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**Étudier le polyusage récréationnel de drogues à travers
une simulation multi-agents ontologique /
Studying Recreational Polydrug use Through an
Ontology Agent-Based Simulation**

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The road is the destination.

Résumé

Cette thèse examine la carrière des polyusagers récréationnels de drogues à travers une perspective pluridisciplinaire. Cette perspective rend compte de la complexité du phénomène en intégrant des éléments de neurologie dans une approche sociologique. Ces éléments théoriques sont intégrés dans un modèle multi-agents visant à tester cette approche et à étendre ses résultats. Afin d'informer ce modèle, trente-huit entretiens compréhensifs ont été réalisés auprès de polyusagers socialement intégrés. Après une première phase où la consommation de drogues est orientée vers l'intégration au groupe de pairs et à l'apprentissage des techniques de consommation, les usagers tendent à instrumentaliser les drogues pour faciliter leur adaptation aux normes contemporaines et gérer les contraintes sociales. La polyconsommation semble être le paroxysme de l'instrumentalisation des psychotropes et peut revêtir quatre formes permettant aux usagers récréationnels de faire varier à dessein leurs états physiques et psychologiques. La dernière phase de la carrière est caractérisée par un accroissement des techniques de contrôle permettant aux individus de concilier leurs usages avec l'accroissement de leurs obligations sociales. Le statut d'usager "contrôleur" est défini en opposition avec le stéréotype de l'usager dépendant, participant à l'étiquetage de ces derniers en tant que déviant. Les résultats de l'enquête empirique ont été formalisés à l'aide de diagrammes visuels avant d'être implémentés dans la plateforme NetLogo. Le modèle créé, baptisé SimUse, fut vérifié à travers plusieurs scénarios évaluant l'adéquation entre les algorithmes implémentés et les données empiriques recueillies.

Mots-clés : polyconsommation, carrière, déviance, usagers récréationnels, modèle multi-agents, simulation sociale.

Abstract

This thesis investigates the career of recreational polydrug users through a pluridisciplinary perspective. This perspective captures the complexity of this phenomenon by integrating data from neurology with a sociological approach. These theoretical elements are integrated into a multi-agent model aiming to test this approach and extend its results. To inform the model, thirty-eight qualitative interviews were conducted with socially-integrated polyusers. After a first phase where drug consumption is oriented toward peers group integration and during which consumption techniques are learnt, the users tend to instrument drugs to facilitate their adaptation to modern social norms and manage social constraints. The polyconsumption appears to be the climax of this psychoactive substances instrumenting and could take four forms permitting the users to make vary their physical and psychological states at will. The last phase of the career is characterized by an increase in control techniques allowing individuals to conciliate their consumptions with the increase of their daily obligations. The status of controller user is defined by opposition to the stereotype of the dependant user, which participates to the labeling of these latter as deviant users. These empirical results have been formalized through visual diagrams before being implemented into the NetLogo platform. The model created, called SimUse, was verified by the means of several scenarios assessing the consistency between the implemented algorithms and collected empirical data.

Mots-clés : polyconsumption, career, deviance, recreational users, multi-agents model, social simulation.

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Abbreviations

5-HT	5-HydroxyTryptamine (Serotonin)
ACC	Australian Crime Commission
CNS	Central Nervous System
DA	Dopamine
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
EnCa	EncoCannabinoid
ESPAD	European School Survey on Alcohol and Others Drugs
GABA	Gamma-AminoButyric Acid
Glu	Glutamate
HOCBC	Health Officer's Council of British Columbia
MDMA	3,4-methylenedioxymethamphetamine (ecstasy)
OCTRIS	Office Central de Répression du Trafic Illicite de Stupéfiants
OFDT	Observatoire Français des Drogues et des Toxicomanies
OP	Opioid Peptides
NDARC	National Drug and Alcohol Research Centre
NDSHS	National Drug Strategy Household Survey
NE	Norepinephrine
SD	Standard deviation
TREND	Tendances Récentes Et Nouvelles Drogues
UML	Unified Modeling Language
UNODC	United Nations Office on Drugs and Crime

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Résumé substantiel

Cette thèse a été réalisée en co-tutelle entre l'Université de Lille 1 (France) et la Charles Sturt University (Australie), entre une unité de recherche socio-économique (Clersé-UMR 8019) et un centre de recherche sur les systèmes complexes (Centre of Research in Complex System). Ce double ancrage administratif s'explique par les deux objectifs de cette thèse : dans un premier temps, cette recherche s'est intéressée aux carrières des usagers récréationnels de drogues et à leurs évolutions à travers un parcours de polyconsommation ; dans un second temps, ces pratiques et leurs transformations ont été formalisées en vue de construire un modèle multi-agents, ce dernier devant servir à incorporer et à faire interagir les différents éléments influençant le polyusage récréationnel de drogue et à élargir la compréhension relative à ce phénomène social décrit comme complexe. En effet, l'usage de drogue a été étudié par une large palette de disciplines allant de la neurobiologie jusqu'aux sciences politiques, chacune de ces disciplines produisant un savoir et des concepts sur un aspect particulier de ce phénomène social. Certains auteurs indiquent cependant qu'il est le résultat de l'ensemble de ces facteurs et appellent à utiliser une approche transdisciplinaire pour mieux cerner cette pratique et saisir sa complexité.

Cette complexité est renforcée par trois traits caractéristiques de l'état actuel de ce phénomène qu'est la consommation des drogues. Malgré des décennies de "war on drugs", certains sociologues n'hésitent pas à parler de "normalisation" et de "démocratisation" de l'usage de stupéfiants. Cette normalisation ne signifie pas que l'usage de drogue est devenu une norme sociale, mais que cette pratique a accédé à un certain degré d'acceptation au sein de la population. Cette normalisation est renforcée par une large disponibilité des substances psychotropes : les substances "classiques" (cannabis, cocaïne, héroïne, ecstasy, amphétamine) restent consommées malgré des fluctuations

dans leurs taux de consommation, alors que de nouvelles substances contournant le cadre légal grâce à une modification de leur structure moléculaire ne cessent d'apparaître sur le marché des drogues. Cette "hyper-disponibilité" est en partie responsable de ce que les institutions nationales et internationales considèrent comme étant la norme contemporaine de consommation : le polyusage. Malgré ce constat, le nombre d'étude portant sur la polyconsommation reste faible et cible principalement des populations jugées à risques. Ces différentes études différencient l'usage concurrent de plusieurs substances au cours de la vie des usagers (CPU : Concurrent Polysubstance Use) et l'usage simultané de plusieurs substances psychotropes (SPU : Simultaneous Polysubstance Use). Cette recherche a considéré que ces deux aspects sont interdépendants et que l'étude de la polyconsommation devait prendre en compte l'impact des différentes sessions de SPU sur la CPU et réciproquement.

L'examen et la compréhension de ces deux dimensions du polyusage, et de sa complexité, a nécessité la constitution d'un cadre théorique original. Celui-ci propose de mettre en relation trois niveaux de compréhension — la drogue, l'individu et le groupe — en combinant des données provenant des neurosciences avec une approche sociologique proche des travaux de la sociologie de l'action et de l'interactionnisme symbolique. La construction de ce cadre théorique partait du présupposé que l'individu use des drogues (et non pas l'inverse) et que la consommation de substances psychotropes est une action issue d'un processus intentionnel inscrite dans un cadre social façonnant et transformant la pratique des usagers. A l'intérieur de ce cadre sociologique, l'adjonction de notions provenant des neurosciences a permis de clarifier les préférences des usagers concernant leurs choix de drogues, mais aussi de rendre compte des comportements et de l'évolution des effets ressentis par les polyusagers. Si ce cadre permet de clarifier les décisions des usagers ainsi que les différents changements dans leurs pratiques de consommation, ce cadre demande

à être réinscrit et contextualisé à l'intérieur de la vie des usagers. S'inspirant des travaux interactionnistes, cette thèse a entrepris de reconstruire la carrière des usagers récréationnels en repérant les différentes phases que peuvent traverser ces usagers à travers le prisme de leur polyconsommation. Cependant, l'approche de type mono-substance généralement employée pour étudier les trajectoires d'usagers de drogue a dû être modifiée pour capturer les changements inhérents à cette pratique : chaque arrêt ou initiation fût considéré comme un point particulier dans la carrière de l'interviewé et fût l'objet d'une investigation plus poussée.

Le recueil des données empiriques relatives à la carrière des polyusagers récréationnels a été réalisé par l'intermédiaire d'entretiens semi-directifs, méthode qui est apparue la plus appropriée afin de recueillir des données de type diachronique et séquentiel. Le double ancrage administratif a permis de réaliser des entretiens dans les deux pays où s'est déroulée cette recherche, favorisant ainsi la généralisation des résultats. L'échantillon se compose de 38 usagers de plus de 18 ans (19 français et 19 australiens), socialement intégrés, n'ayant aucune histoire de traitement et ayant consommé au moins deux substances psychotropes au cours de la même session dans les six mois précédents leur entretien. Trois étapes principales ont pu être découpées dans la carrière des polyusagers récréationnels : « Débuter et Apprendre », « Instrumentaliser et Changer » et « Ralentir et Sélectionner ».

La phase d'*initiation* est principalement marquée par l'aspect social de l'usage de drogue. L'analyse des entretiens a permis de comprendre la manière dont les représentations sociales attachées aux substances sont construites et comment elles se transforment au cours de la période d'initiation des nouveaux usagers. Avant les premières expériences, les substances illicites apparaissent comme étant subsumées sous l'expression « la drogue » et sont, dans la plupart des cas, connotées négativement. Suite aux premières prises, cette

représentation primaire se fragmente, les individus tendant à attribuer une représentation à chaque groupe de substances ou à chacune d'entre elles. Ces représentations se modifient à la suite des expériences des usagers, notamment à travers les différentes interactions que ceux-ci peuvent avoir avec d'autres usagers. Les entretiens indiquent que les premières consommations sont effectuées entre pairs, ce qui a pour conséquence d'accroître la cohésion du groupe en façonnant des expériences communes. L'aspect social est d'autant plus prégnant que ces initiations ne peuvent avoir lieu sans la présence de « pairs expérimentés ». Ces derniers influent directement sur l'initiation des néophytes en fournissant les substances, mais aussi en prodiguant des exemples réels de l'effet des drogues favorisant la modification des représentations sociales. Ces pairs expérimentés servent aussi de « garde-fou » réduisant l'appréhension des nouveaux usagers et facilitant leurs premières expériences malgré les risques perçus par ceux-ci. A ce niveau de leur carrière, les risques liés à l'usage de drogue sont perçus comme immédiats et irrémédiables (i.e. overdose ou psychose irréversible) et nécessitent d'être neutralisés grâce à différentes techniques de « déni du risque ». Finalement, ces pairs expérimentés aident à l'*apprentissage* des techniques relatives à la consommation, l'acquisition des substances et au contrôle des effets. Si les techniques de consommation varient d'une substance à l'autre, les nouveaux usagers doivent répéter leurs prises afin d'apprendre à reconnaître et à maîtriser les effets des substances qu'ils ont jusqu'alors testé.

Une fois ces différentes techniques acquises par l'individu, les polyusagers récréationnels s'orientent vers une phase d'*instrumentalisation* des psychotropes, utilisant ces derniers comme médians neuropharmacologiques en vue de faciliter la réalisation de quatre types de fonctions : faciliter la *sociabilité* ; obtenir plus d'*énergie* pour tenir plus longtemps ; *se relaxer* ; *s'intoxiquer* afin de se déconnecter du monde. Dans la lignée de plusieurs sociologues français, cette thèse considère que ces fonctions sont l'expression de

normes sociales contemporaines (en termes de performance, d'aisance de communication et de gestion des contraintes sociales et économiques) : l'usage de drogues est ici pensé comme une « béquille chimique » participant à la réalisation du projet de vie de l'individu et facilite la réalisation de plusieurs injonctions sociales. Les entretiens ont rendu manifeste un phénomène que l'on trouve décrit dans la littérature : le processus décisionnel à l'œuvre durant cette phase peut être comparé à un raisonnement de type pratique. En effet, le choix des usagers concernant les substances est concordant avec les propriétés neuropharmacologiques des psychotropes sélectionnées, ce qui renforce l'idée que les consommateurs récréationnels usent des drogues intentionnellement en choisissant expressément les substances qui réaliseront la fonction attendue. Si les usagers sélectionnent les psychotropes susceptibles de leur procurer les effets désirés, leur choix est par ailleurs restreint aux substances dont la représentation n'est pas connotée négativement. Il est également apparu que ces usagers établissent une forme de ratio entre effets ressentis et argent à dépenser lorsqu'ils comparent les substances entre elles.

Concernant le polyusage, les résultats de l'enquête empirique indiquent que cette pratique est relativement réglée et qu'il existe des combinaisons et des agencements ordonnés de substances nécessitant une connaissance accrue des substances à combiner, des dosages à respecter et des moments de prises. Quatre formes de polyconsommation ont pu être isolées : *contrôler*, *améliorer*, *changer* et *empiler*. A travers le récit des interviewés, le polyusage apparaît comme le paroxysme de l'instrumentalisation des drogues, le polyusager pouvant augmenter le nombre d'état de conscience et ainsi vivre plusieurs formes d'individualités au cours de la même session d'usage. Du fait que le choix des substances est fortement corrélé aux représentations des usagers et aux effets ressentis par ces derniers, ces choix se modifient tout au long de la carrière des usagers. Ces *changements* interviennent principalement lorsque la représentation

associée à une substance devient connotée négativement : l'apparition d'effets négatifs liés à la tolérance aux substances et l'accumulation des situations problématiques vécues ou observées chez d'autres usagers sont les raisons le plus souvent invoquées par les interviewés pour expliquer ces changements. Les substances dont l'usage se poursuit dans le temps sont contrôlées par l'emploi de sanctions et de rituels visant à réduire les risques encourus par l'individu que ce soit au niveau de sa santé ou de son intégration sociale.

Ces techniques de contrôle, sanctions et rituels se généralisent durant la dernière phase de la carrière des polyusagers récréationnels. En effet, les interviewés indiquent que l'accumulation d'événements négatifs, combiné à l'accroissement du nombre d'obligations quotidiennes (qu'elles soient liées au travail, à une vie de couple ou de nature économique) les a forcés à *ralentir* leur consommation de stupéfiants, à *sélectionner* certaines substances et à encadrer leurs pratiques de manière à garder le contrôle durant leurs sessions. Ce processus de maturation se traduit dans les récits des interviewés par une volonté d'« avancer » et de « faire quelque chose de sa vie », ce qui leur demande d'obéir et de s'adapter aux valeurs et aux règles sociales en vigueur, celles-ci étant perçues comme garant d'une certaine forme d'autonomie et d'intégration. Ces deux notions deviennent encore plus saillantes dans le discours des interviewés lorsque la question du risque est abordée. Si les risques perçus dans les précédentes étapes de la carrière des individus sont des risques liés à la santé physique ou mentale de l'utilisateur, le principal danger reconnu est la perte de contrôle, celle-ci pouvant adopter différents aspects. Les aspects devant être contrôlés sont définis par opposition avec les caractéristiques et pratiques des usagers dépendants. En définissant leur statut d'utilisateur récréationnel capable de contrôler leurs consommations, ces usagers participent à la désignation d'une fraction des usagers à travers un processus d'étiquetage qui, corrélativement, participe à l'ostracisation et d'isolement des usagers étiquetés comme « toxico » ou « addict ». Si le

polyusage est parfois décrit comme facilitant la continuation de pratiques jugées compulsives, les entretiens tendent à indiquer que les polyusagers ne perçoivent pas cette pratique comme dangereuse ou comme pouvant induire des risques sanitaires accrus : les risques sont toujours rattachés à une substance ou à une pratique en particulier. Le manque de données et d'informations relatives à la dangerosité des différentes formes de polyusage constitue certainement le principal risque encouru par les polyusagers.

Le travail de conceptualisation théorique et le résultat des analyses empiriques ont été combinés pour créer une simulation informatique de type multi-agents. Ce modèle fut pensé comme un Complex Adaptive System intégrant cinq niveaux de compréhension, nommément *drogue*, *individu*, *groupe*, *contexte* et *société*, ayant pour objectif principal d'offrir une plateforme favorisant le dialogue multi-disciplinaire nécessaire à la compréhension du polyusage récréationnel. Les différents éléments constituant ce modèle (i.e. caractéristiques et actions des agents virtuels ainsi que différents éléments contextuels) ont été décrits tout au long de la présentation des résultats empiriques comme des prolongements de l'analyse des entretiens. Cette perspective « émique » a cherché à intégrer l'aspect subjectif issu des expériences des usagers dans le modèle afin de générer et de reproduire les différents stages de la carrière des usagers. Si la plupart des interactions entre ces différents niveaux ont pu être informés par les entretiens compréhensifs, l'interaction entre les niveaux *drogue* et *individu* a été formalisée par l'intermédiaire d'un modèle neurologique inédit. Celui-ci visait, sous une forme simplifiée, à reproduire le fonctionnement du cerveau sous influence d'un ou plusieurs psychotropes. En se basant sur les apports théoriques des neurosciences, ce modèle s'est appuyé sur différents niveaux de neuro-transmetteurs pour reproduire les comportements et les conséquences de la consommation de drogues sur le court-terme comme sur le long-terme. Dans la simulation, les comportements générés par l'intermédiaire de ces algorithmes sont

réévalués par les agents virtuels, ainsi que par les membres du réseau de l'agent et les autres interactants. Ces réévaluations peuvent modifier les opinions des agents concernant les substances, et donc impacter leurs futures décisions et actions. Pour rendre compte des différents aspects de la vie des usagers, SimUse a été élaboré pour reproduire le contexte social dans lequel les usagers réels évoluent. Ce pourquoi, SimUse a du intégrer un environnement spatial simplifié et créer pour chaque type d'agent un emploi du temps leur permettant de se rencontrer et d'interagir à l'intérieur de cet environnement virtuel.

La transition entre données qualitatives et formalisation implémentable a été effectuée par l'intermédiaire de diagrammes UML (Unified Modelling Language). L'utilisation de tels diagrammes a permis de présenter visuellement la manière dont les caractéristiques, actions et interactions des agents virtuels ont été pensées et modélisées. Ces diagrammes ont été implémentés dans la plateforme NetLogo pour créer le modèle baptisé SimUse. Celui-ci peut être défini comme une ontologie empiriquement informée ayant pour but principal de faciliter la compréhension du phénomène ciblé et d'étendre les résultats obtenus en pointant les différentes lacunes et limites du modèle : par exemple, certains attributs caractérisant les agents doivent être calibrés de manière plus précise et leur emploi du temps devrait être renseigné afin de rendre le modèle d'autant plus proche de la réalité.

SimUse a été vérifié par l'intermédiaire de plusieurs tests et « *what-if* » scénarios visant à mesurer la réactivité du modèle et des agents en cas de chocs extérieurs et à juger de l'adéquation entre les données empiriques formalisées et les algorithmes implémentés. Du fait de l'absence de statistiques spécifique concernant le polyusage (en termes de pourcentage de population et de combinaison de substances), SimUse n'a pu être validé dans sa forme actuelle. Cet état de fait et la nécessité de calibrer le modèle appelle à la réalisation d'une enquête de

type quantitative qui viserait à renseigner le modèle de manière plus précise et de pouvoir évaluer sa validité.

Malgré cela, le modèle dans sa forme actuelle a permis d'intégrer des données théoriques et empiriques provenant de différentes disciplines en prodiguant un espace de dialogue entre celles-ci. De plus, une fois calibré et validé grâce à des données de type quantitatif, SimUse pourrait se révéler être un outil d'évaluation des politiques publiques auprès des institutions et des décideurs en charge du phénomène de l'usage de drogue.

Part I. Polydrug use
as a Complex
Social
Phenomenon:
Theoretical
Background and
Techniques of
Investigation

Chapter 1.

Introduction: Global and Scientific Contexts of Recreational Polysubstance Use

This work studies and describes the career of polydrug users in the contemporary context. In contrast to most of the studies concerning drug use, this thesis does not aim to investigate the career of dependent users, but the impact of this practice on the life of “unproblematic” and unnoticed individuals that consume drugs recreationally. It also aims to create a social simulation of that phenomenon in order to get a better understanding of the interactions existing between the elements shaping recreational polydrug use.

To achieve these two objectives, this first chapter introduces the state of the art and contextual background of this thesis. The review of the scientific literature will consist of an extensive review of the different disciplines studying drug use (Section 1.1) and of the review of the social simulations related to drug consumption (Section 1.2). It will be followed by the description of the contemporary "drug" phenomenon (Section 1.3). The different terms and notions related to the topic of drug use will be introduced and clarified in Section 1.4. Finally, this chapter concludes by the presentation of this thesis hypotheses and research questions (Section 1.5) and outlines (Section 1.6).

1.1 State of the Art concerning Drug Use, Abuse and Addiction.

This first part of this "state-of-the-art" section will review explanations and concepts from neurology to economics. Once these different explanations describe and inform, a description of the "social simulation" paradigm will be introduced, followed by the description of the different drug use-related computer simulations.

In this review of 43 theoretical frameworks examining drug use and abuse, Lettieri [1] stated that:

"We need to be cognizant of the need to incorporate variables from diverse scientific disciplines in order to fully understand the drug dependence process. No one discipline or viewpoint, alone, has successfully accounted for the multifaceted phenomenon of drug dependence. [...] if one wishes to account for why persons continue in their use of drugs, then biomedical disciplines are probably best; in contrast, however, if one wishes to explain the initiation of drug using behavior, then social psychological explanations seem most pertinent. Sociological elements in combination with biomedical factors may be ideally suited to understanding the escalation of drug use to drug abuse, while psychological and even political and economic elements are essential to an understanding of the cessation of use".¹

According to several researchers [2-4], drug use has to be understood as the complex interplay of several rationales stemming from different levels of reality. This fact calls for a multidisciplinary approach that requires a precise examination of the different elements involved in drug use and abuse.

Thus, (poly)drug consumption, at any level of frequency or quantity, finds its origins in a broad set of factors. Indeed, if social sciences have studied drug use with their own scientific point-of-views, some 'risk

¹ Lettieri D.J. (1985) Drug abuse: a review of explanations and models of explanation, *Advances in alcohol & substances abuse*, 4 (3-4), p.12.

factors' exceed the scope of these disciplines. Biology, and particularly neurosciences, could clarify the origins of behavioral and physiological transformations after repeated use. Although, both social sciences and biology can explain and clarify some specific pieces of the puzzle, the epistemological differences between these two paradigms have created what could be called a "chasm" in the drug use field [5].

Indeed, the 'physicalist' approach (explanations can only come from physical factors) and the 'mentalist' position (explanations can only arise from studies of mental perceptions) have been in contradiction and tension for decades [5, 6]. It is hypothesized in this research that these two positions need to be combined to obtain a clearer understanding of the question.

Therefore, the review of drug use scientific literature will be articulated from micro to macro, or, in other words, from biology to social sciences. This review consists in: (1) a presentation of the different concepts forming the 'physicalist' theories and biological approaches; (2) a description of the 'mentalist' approach, through the various contextual levels of explanation relevant to substances consumption. The distance between physicalist and mentalist approaches has deeply marked the research field of addiction and drug use, and keeping this distinction should help to rebuild the theoretical and epistemological discussion regarding drug use.

1.1.1 Disease Model: the Intra-individual Theories

As Timmreck [7] argued, "Disease is defined as a pattern of responses by a living organism to some form of invasion by a foreign substance or injury, which causes an alteration of the organism's normal functioning."² Considering that drugs produce diverse psychological and physiological pharmaceutical effects on the users, some researchers

² Timmreck, T.C. (1998) *An Introduction to Epidemiology*, Boston, MA: Jones and Bartlett.

have compared drug use to a *disease*. The origins of this "illness" can come from genetic, behavioral or contextual dimensions [8].

1.1.1.1 Biological causes of drug use

Phrenology:

In the 19th century, drug abusers such as alcoholic or opium 'dragon chasers' were judged sinful and amoral persons [9]. One of the first attempt to understand the origins of deviant behaviors such as drug use, "anti-social" comportments, criminal behaviors or alcoholism, was undertaken by Cesare Lombroso. In his book, *The Criminal Man* [10], he attempted to list physiological regularities (designated by the term of *phrenology*) in people who have committed crimes or felonies. From his positivist point-of-view, criminal behaviors find their origins in a particular atavistic *criminal personality*. Contrary to sociological theories, Lombroso found the explanations of crime and drug abuse in inner characteristics. Even though Tarde has refuted the thesis of Lombroso in *La Criminalité compare* [11], the conception of drug use and addiction as inherent in biological factors still finds echoes today, through several perspectives.

Disease Model:

Theorists of the Disease Model consider drug use and addiction as a medical disorder coming from an anomaly in the Central Nervous System (CNS) that can be treated and diagnosed as any other diseases. The principal symptom of this disorder is the loss of control and the compulsiveness of the addicted individual. Because of their disease, these individual are unable to control the urge to satisfy their addiction despite their desire to break the habit [12].

However, the lack of probing explanations concerning addicts who disengaged from their consumption by themselves and the total absence of choice in this model has been generally criticized [13]. Despite these

critics, the neurobiological basis of addiction and the neuropharmacological action of drugs on the brain cannot be denied [14]. However, it is on a genetic and neurological level that can be found the most recent developments.

Genetic Variation:

Progresses in genetics have facilitated the exploration of DNA structure and the isolation of specific gene clusters on chromosomes responsible for specific phenotypes. The brain structure and the related production of neurotransmitters are the result of gene expression. Therefore, genes might contribute to increase the susceptibility to use and/or abuse drugs. For example, the gene coding ADH (Alcohol DeHydrogenase) plays a major role in alcohol metabolizing, while ADLH (ALdehyde DeHydrogenase) takes care of the elimination of alcohol in the stomach. These genetic variations can be found in some Asian group that tends to have fewer alcohol related problems [15]. A comparable example exists for tobacco [16].

Reward Deficiency Syndrome and Dopamine Receptor Hypothesis:

Variations in the production of neurotransmitters can lead to low production of one or some neurotransmitters, altering the functioning of the brain [17]. This *dis-balance* in the normal neurological process may induce trends to drug abuse mediating the lack, or excess, of these specific neurotransmitters. For example, the dopamine neurotransmitter acts on the reward and memory circuits (Section 2.2.1), and as indicated by Volkow et al. [18], a lack of D₂ dopamine receptors increases the chance to consume dopamine agonist substances (such as amphetamine-type or cocaine) that can palliate this low level of dopamine. This point (which is still discussed at the moment) merges with the hypothesis of the *Reward Deficiency Syndrome*. According to Blum et al. [19], some individuals may have a genetic deficient neurochemistry. Therefore, the brain of hypo-

dopaminergic³ people needs a "dopamine fix" in order to feel reward and happiness. Concepts relative to neurobiology will be further developed in Section 2.2.

Twins and adoptive studies:

As one of the illustration of genetic influence, twin studies compare tobacco and alcohol consumptions amongst monozygotic or dizygotic twins. These studies examine the different rate of use according to the level of genetic proximity (100% for monozygotic and 50% for dizygotic) and to the social environment of each of the twin [20-23]. For tobacco, the findings of these studies vary depending on the range of use: considering the category "ever smoking", results oscillate depending on authors, but most studies show a greater importance of environmental factors [21, 24]; conversely, for "regular" and "heavy" smoking categories, genetics seems to dominate contextual factors [25, 26].

Similarly, studies on adopted children have compared the impacts of genetic/environment between parents and their biological and/or adopted offspring. This type of research shows some statistical correlations between genetic and consumption rates [27]. However, Osler et al. [28] have demonstrated that it does not exist such a strong relation between parents' tobacco use and their biological siblings compare to their adoptive offspring.

1.1.1.2 Psychological models: From Disease to Disorder

Personal Disorder:

Putting some distances from these biosocial explanations, modern psychology (such as cognitive psychology or behavioral psychology) considers drug addiction as a *personality disorder* and focuses its efforts on studying behaviors and the impact of perceptions on comportments.

³ This state reflects fewer concentration of dopamine in the brain generally generating low self esteem, anhedonia and depression.

The different personal characteristics considered as increasing the chances for an individual to be involved in drug use have been listed and studied on adolescents during the late 70's and the 80's. Individual characteristics such as *low religiosity* [29, 30], *rebelliousness* [29, 31], *tolerance of deviance* [32], *normlessness* [33], *valuation of drugs* [34] or *thrill seeking* [35] have been related statistically to illicit drug consumption and/or to a high degree of intake once above 18 years old.

Positive/Negative Reinforcement:

By considering that expectancies are constructed by repeated past uses, a form of '*positive/negative reinforcement*' [36] can occur: users learn from their experiences, from the behaviors of their relatives and then await specific effects and/or pleasure/pain from the drugs. This point has been particularly studied in relation to *memory construction*. Indeed, the expectancies related to memories of previous intakes create anticipation for further consumption [37]. Indeed, the neural action of drugs partially alters the brain by transforming the pre-frontal cortex structure (Section 2.2.1). These alterations lead to distortions and misconceptions about the effects or feelings resulting of drug taking, and cause, in turn, the consumption of large amount of drugs or increases of drug intake frequencies.

Cognitive Psychology:

The cognitive branch of psychology considers drug use as a problem of misperception [38, 39]. These misperceptions have for consequences to build false or illusory conceptions of the drug effects, about their dangerousness, and on harmless frequency or quantity of use. Moreover, according to this theory, users can underestimate information relative to their physical/psychological state and/or overestimate the prevalence of drug or the approval of their family/peers.

These cognitive misconceptions and alterations of reality are related to 'Logical Fallacies' theory [38] as well as *Cognitive Dissonance Theory* [40]. These two conceptions suggest that: "the cognitive experiences described [...] may tend to sociologically "normalize" an individual's estimates of drug use frequency or appropriateness, lead one to infer greater pleasure of the outcomes of his behavior that's indicated in repeated experience."⁴

Self-Medication Model:

According to this model, individuals intentionally use drugs to treat themselves of particular psychological symptoms they believe they suffer [41]. A good example is heavy smokers who explain their high rate of consumption by their needs to relieve "stress" [42]; or individuals who declare that drugs help them to control aggressive behaviors or reduce depressed mood [43]. Obviously, this "chemical stand" may become another source of problems, causing tolerance and a "spiraling distress" and so, an increasing consumption [44]. To get a better understanding of the neurological mechanisms influencing recreational drug use, these mechanisms will be further detailed in the subsequent subsection (1.1.1.3).

1.1.1.3 Neurobiological models: Neurotransmitters and Neuroadaptation

Over the last fifty years, neuroscience has advanced the understanding of drug use, abuse and addiction. However, despite the crucial importance of neurobiology concerning drug use, a complete and extensive review of all this literature is beyond the scope of this work. This thesis details several key concepts from neuropharmacology and neurophysiology to clarify the main neurological functions activated by psychoactive substances. This clarification should help to capture the

⁴ Sussman S. & Ames S.L., (2008) *Drug Abuse: Concepts, Prevention and Cessation*, Cambridge University Press, p. 124.

influence of these substances on users' behaviors and decisions. Therefore and in order to link the different neuroscience's key concepts with sociological theories, the neuroscience notions will be directly developed in the theoretical part of this research (Section 2.2).

The review of the disease paradigm literature has underlined the importance of individual characteristics (genetic, neurology, psychology) concerning drug use. In contrast to these notions attached to the individual, the "adaptive" paradigm considers that users' biological or psychological characteristics play a minor role in the choice to use drug, and that these choices should be studied as being the results of social and contextual elements. This paradigm is described in Section 1.1.2.

1.1.2 Adaptive or Choice Model: Interpersonal and Contextual Level

The Adaptive Model sees in the environmental elements surrounding the individuals the real causes of drug consumption. It considers socio-economic situations or the behavioral-psychological state of mind as being the main causes of drug taking. Several socio-economical models have followed these assumptions and have been applied to explain drug use and addiction. The next points aim to present these models.

1.1.2.1 Interactional and Sociological models

Amongst the different social sciences having theorized drug use, sociology and criminology are certainly the most representative of the adaptive model. The following theories are focused on social mechanisms leading individuals to drug taking.

Anomie Theory (Social Strain Theory):

Some particular social situation, such as social *anomie*, can induce deviant behaviors such as drug consumption. Anomie can be seen as the situation where people "become estranged from a society that promises them in principle what they are denied in reality."⁵ This kind of situation can lead people to adopt illegal strategies to achieve what appear to be unattainable socially enhanced goals [45]. Anomie theory considers drug users, and especially drug addicts, as individuals who have abandoned all attempts to achieve "normal" societal goals; inversely, they have entered a "deviant" existence engaging themselves in a life dedicated to "dope" [46]. If this theory can explain some of the reasons inducing people to use drugs, it appears irrelevant when applied to recreational uses, who remain invisible and socially accepted (Section 1.3.2).

Social Learning or Differential Association Theory:

This theory is based on the work of Sutherland [47]. He presented in 1937 a description of professional thieves activities and proposed to study their activities as a social activity with its own codes. According to Sutherland, a professional thief spends most of his time planning and committing larceny with other thieves. By interacting with other professionals, he learns *specific skills* related to his activity (e.g., identify potential victims from "coppers", stock and sell stolen items, "talking ability"...) and abide to "professional" codes and norms that form *consensus* in the profession (e.g., respect appointment with accomplices, do not "rat" or inform the police, do not get involve in violent crime, etc.). These different skills and norms give individuals involved in such activity a particular *status*. This status permits professional thieves to distinguish professional to occasional thieves and to identify themselves as belonging to one specific *organization*:

⁵ Merton R.K., (1968) *Social Theories and Social Structures*, p. 218.

"The group defines its own membership. A person who is received in the group and recognized as a professional thief is a professional thief."⁶

It is this *association* with members sharing a *different* view on societal rules and norms that conditions the status of professional. Sutherland theorized the concept of *differential association* to capture this phenomenon and invalidate the psychopathologist theories dominants during that period. He also pointed out that the entry to this deviant career depends greatly on the frequency, intensity and duration of the association with deviant peers: if the number of deviant associations becomes higher than pro-social acquaintances, actors can drift into a criminal career. However, Sutherland gave only indications concerning the entry into criminality without any detail on the impact of this differential association on the continuation of such career [48].

Differential Reinforcement Association Theory:

Along the same lines as Sutherland, Burgess and Akers [49] have augmented differential association theory to explain this continuation in criminal behavior. According to them: "Because behavior is shaped by positive reinforcement, if lawful behavior does not result in reinforcement, the strength of that lawful behavior is weakened, and a state of reinforcement deprivation results. This deprivation increases the probability that other – deviant - behaviors will be reinforced and strengthened."⁷ Defining one's own identity as a "junkie", "pothead", or "crack head" is generally correlated with the acceptance of the group in a sort of a subcultural acceptance [50], reinforcing this way the phenomenon of Group Identification (see below).

On the question of drug use, deviant socialization induces by differential association (i.e., exposure to deviant behaviors and "bad

⁶ Sutherland E.H. (1937) *The Professional Thief: by a Professional Thief*. University of Chicago Press. Chicago (ed.1989), p. 207.

⁷ Abadinsky H., (2008) *Drug use and abuse: a comprehensive introduction*. Wadsworth Publishing Co, p. 194.

influences") arises from several origins situated at different levels of reality:

I. *Familial model and Peer pressure*: using reference to *social learning* theory, [51, 52] have shown that children, who have witnessed conflict in family, parental or sibling drug consumption have an increased risk of substance misuse [53, 54]. Following the previous point, "*peer pressure*" plays a major role in experimental and regular drug use. On this subject, there is vast literature on the social influence of *friend* [55, 56] affirming that individuals are influenced by their friends, but also, that they can select which peers they have to mix with in order to use drugs [57]. Moreover, rejection by peers can drive individual to marginal life and to deviant behaviors, such as drug taking and delinquency [58].

II. *Subculture/Group Identification*: following the last point, rejecting or be rejected by peers/family could lead persons to identify themselves with "rebel" or "marginal" groups. Sussman et al. [59], have produced a review of the various studies on peer/group affiliation for adolescents. They underscored the consensus of all these studies in differentiating 5 kinds of group identities (Elites, Athletes, Academics, Deviants and Others) concluding that Deviants generally received the worst parenting. On the same topic, Mosbach & Leventhal [60] defined "Dirts" as individuals sharing "sensation-seeking" and "low self-esteem" characteristics and that have a higher drug consumption rate. These authors have noted that drug-use is not related to the same functions: smoking can be differently justified depending upon the groups user belongs to (e.g., get more popularity, get a "macho" image or be sociable).

III. *Mass Media Influences*: studies in communication have shown how the repeated exposure to *media messages* leads to a modification of the preference and conducts [61]; for example, *advertisements* could increase alcohol consumption [62]. Moreover, movies or TV series could

product a positive image of deviant behaviors, such as criminal activities and drug use [63] leading to affiliation with groups carrying such category of image.

Neutralization Theory:

Neutralization theory [64, 65] considers that most people were socialized into conventional environments and exhibit socially accepted behaviors. However, individuals can learn *neutralization techniques* to rationalize deviant acts. These techniques momentarily free people to abide by social rules, and allow them to commit criminal acts without any guilty feelings or moral scruples. These authors describe five main techniques:

- I. *Denial of responsibility*: actors assert that they are victims of forces or circumstances beyond their control that pushed them to act in this way;
- II. *Denial of injury*: delinquents judge that their criminal/deviant actions have not caused any "real" harm or damage. The notion of "real" is relative to the position of the actor, who can, as in the examples given by Sykes & Matza [64], estimate a gang fight as a private problem or an auto theft as a simple borrowing, etc.;
- III. *Denial of the victim*: actors assert that the victim of their acts deserves this treatment or that the prejudice is not real: thefts in a shop because the owner is a crook, vandalism as a vengeance against someone who had transgressed their values, etc.;
- IV. *Condemnation of the condemners*: actors can condemn the main motive of their condemners, who are disguised and hidden criminals;
- V. *Appeal to higher loyalties*: delinquents have acted in a deviant way because they were obeying to stronger commitments inherent in their biographical situation.

Perrethi-Watell [66] has based his "denial of risk" theory on the works of Sykes and Matza and applied it specifically to drug use. This particular theory and its conclusions will be directly described in Section 4.2.4.

Labeling Theory:

Based on the works of researchers from the Chicago School of Sociology, this theory considers that individuals are "labeled" as deviant through the interaction process. This labeling process is based on the inadequacy of user behaviors regarding socially accepted norms. This labeling modifies the identity of the "deviants" and closes the "normal" and conventional routes of society. In return, this closure induces reinforcement of the deviant identity and could lead to a definitive adoption of the deviant label [67, 68]. This theory will be extensively detailed in the theoretical framework (Section 2.5).

"Drugs Choice Theory":

The term "drugs choice theory" is employed in this research to encompass a set of research considering drug use, as oriented by a decision-making process. Generally associated with ethnographic and qualitative work, this research considers users through the process of decision: individuals infer functions to drugs, check their physical and psychical states before deciding to take drugs, and if so, which drugs to take according to their goals and beliefs [43]. These studies have asserted that recreational users develop expectancies regarding the substances they consumed, and, based on substance(s) effect(s) users take for granted, they orient their choice of drug(s) in order to achieve preplanned objectives [69-73].

These objectives vary throughout the life courses of the actors. Longitudinal studies have demonstrated that socioeconomic factors, category of employment, as well as weak or high social role commitments influence drug's choice, and thus, inflect, increase or modify the users drug consumption [72, 74, 75].

Concerning polysubstances use, qualitative researchers have demonstrated that users give specific orders to the substances they use [73, 76-78] and search varying at will their psychic and/or physic

state(s) through these drug's combinations [79-82]. These different points will be further discussed in this chapter (Section 1.4.3).

The social aspect of drug use appears as primary in the decisional process, but psychoactive substances remain an economical good with their own particularities. The economical dimension associated with drug use is described in the next subsection (Section 1.1.2.2).

1.1.2.2 Economic models

From the "Behavioral Economics of Substance Use" point of view, drug use is an economical choice and can be studied as a *consumer* behavior. This assertion could be illustrated by the following quotation: "In general, the value of substance use, and therefore the extent to which it is preferred, is viewed as a function of the benefit/cost ratio of substance consumption in relation to the benefit/cost ratios of other available activities" [83]. The following pages give an overview of these economics developments.

Rational Choice Theory:

Several theories fall within this economic model: the first one, known as *Rational Choice Theory* [13, 84, 85] considered drug users as imperfectly informed agents: users know the risks and consequences of their conduct, have preferences and are fully (Becker) or partially (Skog) rational. Rational Choice economists view drug as a 'good' and therefore use the utility principle to explain how drug users 'calculate' the benefits they will gain from consuming psychoactive substances [84].

Expectancy Theory:

Based on the latter perspective, various sub-models have appeared such as Expectancy Theory. This theory claims that the increasing taking of drugs correspond to the expectancies that users believe they will get once the drug consumed [86, 87]. However, this hypothesis

comes from alcohol studies and has not been applied to other substances.

Melioration Theory:

Opposed to the full rationality details by the Rational Choice Theory, Melioration Theory proposes to understand drug users as having a limited rationality. Drug users are motivated to consume psychoactive substances because they only perceive the present value of taking drug without any thought for their future. This "short-sighted" perspective implies preference for immediate gratification, instead of a rational calculation about long-term effects [88, 89].

Financial Means:

If full rationality could be rejected in regard of previous developments, psychoactive substances still remain economical goods. However, because they are illegal goods, drugs seem to disobey some of the general economic laws. For example, the concept of "*price elasticity*" (decreasing of the consumption ratio relative to increasing prices) has been adapted to psychoactive substance and many studies have shown that, to a large extent, drugs are "inelastic": the augmentations of the price do not generally lead to a diminution of consumption, especially amongst addicts [90]. However, some surveys have demonstrated how increasing price of one drug can have repercussions on the consumption of another drug through what economists call "*cross-price elasticity*" [91]. Concerning legal substances, taxation leads to decreases in alcohol or tobacco consumptions [92].

It needs to be underlined that economic deprivation (e.g., economic crisis, high rate of unemployment) could lead to depressed mood and, correlatively, driving individuals to consume drugs to escape reality.

Legislation and drug market contexts:

Contextual *availability* and *situational laws* affect drug consumption rates. It is obvious that without a drug market distribution inside the geographical area of possible users, there is no possibility for substance abuse. The study of *drug market structure* can give precious information for understanding drug use [93-95]. On the other hand, laws can forbid or allow different drugs and so, influence the use of them.

Conclusion

The field of drug use, abuse and addiction is vast and contains a wide range of risk/protective factors. It can reasonably be argued that five main levels of comprehension need to be studied and interconnected to obtain a global understanding of this social phenomenon. *Drug, individual, network, context* and *society* dimensions constitute these five levels and need to be articulated to fully capture the recreational user's trajectories. One of the purposes of this research is to collect, interconnect and analyze information from these different levels and assess their influence on the life of recreational polydrug users.

However, this large spectrum of influences and the disciplinary differences surrounding these influences ask to answer the following questions: what kind of framework could integrate this large variety of concepts and data and could also reproduce their interactions and co-evolutions? This research proposes to employ an innovative methodology, known as *social simulation*. In the Section 1.2, the basements of this methodology are examined in order to present a global glance on the possibilities offered by this approach.

1.2 Review of the Social Simulations about Drug Use

Over the last twenty years, the use of simulations in science has known a considerable increase. The augmentation of computer capacity combined with the growing interest in Artificial Intelligence and Cybernetics have allowed and facilitated to run computer-based simulations. To present this paradigm and link it to the subject of this thesis, the next subsection (Section 1.2.1) will briefly list the existing different types of simulations. The second subsection will present the types of social simulations related to drug use (Section 1.2.2).

1.2.1. A brief Overview of Social Simulations

In a nutshell, social simulations simplify a fraction of reality to get a better understanding of one social phenomenon [96, 97]. Simulations are either "agent-based" or "equation-based". The first tries to encapsulate the characteristics and behaviors of single entities, called "agents", and generally requires computers; while the second aims to build a set of equations that describes a part of reality and aims to predict changes by solving these equations.

According to Gilbert & Troitzsch [96], there are three majors categories of social simulation: *macrosimulation*, *microsimulation*, and *agent-based models* [98]. These different approaches of social simulation can be linked to three major's sociological paradigms: examining these approaches through their definitions and concepts will provide the opportunity to clarify the nature of these links and to choose the approach for this research.

1.2.1.1. *Top-down Simulation: macro-social influences*

"Top-down" simulations attempt to describe the evolution of macro-level phenomena by using a series of equations. This type of framework aims to reproduce the functioning of a social phenomenon through a holistic perspective. To do so, "top-down" simulations generally use two main techniques: *differential equations* and *system dynamic*.

Evolutionary Game Theory:

In the Game Theory paradigm, each *player* has a set of *information* regarding a particular situation and a set of *actions* to mimic choices for handling the situation. A *payoff* is attributed for each action depending on the actions of the other players. Evolutionary Game Theory has the specificity to iterate games in order to represent evolutions of a population of strategic individuals [99]. These games have been applied to various disciplines and situations: the study of cooperation [100]; economy [101]; ecology [102]; or demography [103].

Dynamic Systems:

Dynamic systems employ a combination of difference and differential equations to accurately reflect dynamic macro phenomenon [104]. Researchers using this kind of systems use computers to solve the set of equations. Dynamic systems are generally composed of several subsystems interrelated by *flows* of information, *energy* or *quantities*. The general principle of these simulations lies in *state equilibrium* and *resilience* between the different subsystems composing the global system. In other words, any change in a subsystem will affect the different other subsystems, which in turn, creates a new stable equilibrium depending on the degree of resilience [105].

In his book *Principles of Systems* [105], Forrester designates the concept of *feedback* as a closed circuit connecting a decision process to the state of the system that provides information about this state. These circuits

or loops could be negative or positive, linear or not. Forrester defined a negative loop as a circuit that can generate the desired goal through gradual steps or wide fluctuations; while, a positive circuit leads to stable cycles of growth or decline.

Examples of such systems can be found in the different "World Models" developed by Forrester: using the DYNAMO software, he has proposed several simulations during the 60's and 70's such as *Industrial Dynamics* (1961), *Urban Dynamics* (1969) and *World Dynamics* (1971). Outputs coming from these systems are most of the time based on a graphical model describing values and the evolution of different micro-elements encapsulated in the system. Users of this type of macro-simulations attempt to predict the outputs of different situations for large periods of time: for example, the *World Dynamics* of Forrester [106] aimed to predict the development of societies and their demography for the next centuries.

Limitations: Gilbert & Troitzsch underline several gaps concerning these systems:

- Entities are generally implemented as homogenous. In other terms, individual differences and specificities cannot be inserted in "top-down" simulations;
- Mathematical macro-level simulations often refer to global characteristics of the system. These global parameters can rarely be observed or assessed in a tangible way;
- Because most of the inputs and outputs of these models come from statistic studies, top-down systems can neither encapsulate the "insider"⁸ point-of-view, nor the reasons of behavioral changes in the "life-time" of the agent.

⁸ Agar M. (1995), Agents in Living Colour: Towards Emic Agent-Based Models, *JASSS*, 8 (1). This concept will be explain and develop in the methodological part.

1.2.1.2. *Bottom-Up System: individualism methodology and emergence.*

As indicated by Gilbert & Troitzsch [96], social scientists may want to study subsystems of reality, such as individual, family or firms. The preceding type of simulations does not allow observing and analyzing accurately these lower strata. The next two approaches are dedicated to that micro-level.

Micro-simulations:

Just a few years before the *Industrial Dynamics* of Forrester, an economist, Guy H. Orcutt [107], criticized the scope and predictive capacities of contemporary economic models, stating that "current models of our socio-economic system have an unduly narrow reach in that they have little to say about such fundamental things as the size and location of the population of individuals, of households, or of firms."⁹ To fill this gap, Orcutt proposed a "new type of model" exhibiting "various sorts of interacting *units* which receive *inputs* and generate *outputs*."¹⁰ Units could be individual, an aggregate of individual or a large group. These units are "decision-making entities" with their own attributes and a set of transition probabilities (which indicate the different possibilities of evolution for the unit). Such a method implies collecting all the "available detailed information about the initial state of micro-units."¹¹

Once the initial state defined, the different units of the model evolve independently generating individual outputs. Different policies or situations are tested and outputs obtained during the simulation. These

⁹ Orcutt G.H. (1957). A new type of socio-economic system, *Review of Economics and Statistics*, 39(2), p. 116.

¹⁰ *Ibid.*, p.117.

¹¹ Orcutt G.H. (1986). Views on microanalytic simulation modelling. In G.H. Orcutt, J. Merz and H. Quinke (eds), *Microanalytic Simulation Models to Support Social and Financial Policy, Information Research and resource Reports*, vol. 7, p.16.

outputs are compared to establish which strategies or policies are the most efficient [104].

Several studies and simulations have been conducted with this technique: impacts of different tax reforms [108], effect on the changes of retirement age or evolution of demography [109].

Cellular Automata:

This approach attempts to generate social emergence by local interactions of virtual atomic entities [110]. A grid (2D or 3D) represents a spatial environment where each cell could represent an agent, a territory or an empty space. Generally, agents evolve each step time in two possible ways: following "internal" rules or due to their external interactions with direct neighbors. These rules of interaction or transformation are uniform to all cells creating a homogeneous model.

CAs are generally best used to study the evolution of phenomena containing a spatial dimension. Studies on segregation of population (such as model of urban segregation [111, 112]) and the diffusion of information, innovation or disease have used this kind of model.

Limitations: Bottom-up methods generally do not consider effects coming from the context: transformations in the macro-level have no explicit impact on the units or cells. Similarly, units have a limited influence on the global environment. In the case of Cellular Automata, interactions are only possible in a local context. However, group influences exceed the simple spatial dimension and social networks are too complex to be encapsulated in a homogenous set of interaction rules. Simulations able to capture this interaction level are presented in the next subsection.

1.2.1.3. Meso-level Analysis: network theory.

Considering the previous limitation, two types of social simulations focus on agent interactions and/or network structures. This subsection presents these two types of model, namely, Network Systems and Agent-based Models (ABM).

Network Systems:

Scientists employing this category of model consider interactions between the system components as fundamental. Basically, Network Systems are composed of *nodes* and *links* (or *edges*) represented in a graph. A *graph* is generally noted G and is composed of two pairs of set (V, E) . V is a set of nodes or vertices; E is a collection of subset gathering all the ordered edges between two nodes: edges are noted $e(x, y)$, where x and y represent nodes. Graph could be *directed*: in this case $e(x, y)$, the edge e is directed from x to y ; *undirected*: edges have no direction; or *mixed*: the graph contains directed and undirected edges.

The layout of the network depends on the number of nodes (size), the number of *links* (connectivity), the *strength* of the ties (strong ties are family and close friends; weak ties are acquaintances and colleagues) and several other attributes such as *radiality*, *centrality*, *closeness* or *prestige*. These models aim to determine the impact of network structures on its components. Hence, collective social behaviors are the principal object of study: research about individual cooperation, group cohesion and appearance of norms is current example of how network systems can provide valuable insights.

Limitations: Reducing an individual to a node in a network limits the integration of personal characteristics and so, the impact of these characteristics on actions/interactions of individuals. Furthermore, Network Systems do not take into consideration contextual/cultural particularities and, therefore, the influences of environment.

Still at the meso-level, agent-based model will be the object of a particular presentation in the theoretical chapter (Section 2.7). It could already be said that agent-based modeling is "a *computational* method that enables a researcher to create, analyze, and *experiment* with *models* composed of *agents* that interact within an *environment*."¹²

1.2.2. Social Simulation on Drug Use

The following subsections give a description of the social simulations concerning drug use. It presents the method and components constituting these simulations and their conceptual limitations.

1.2.2.1. *DrugMart*¹³/*DrugTalk*¹⁴

Michael Agar [113-116] is the pioneer of social simulations concerning drug use. He was the first to develop an agent-based simulation of a heroin epidemic by considering drug epidemics as complex adaptive systems (Section 2.6.1). His simulations, *DrugMart* and its later version, *DrugTalk* have been developed based on ethnographic investigations conducted amongst young heroin users in Baltimore during the 90's. Initially implemented in SWARM[®] [117] with the title Drugmart, this simulation has been programmed through the Netlogo[®] [118] platform. In these simulations, Agar and Wilson [119] reproduced the life and communications of heroin users, by focusing on their interactions concerning the quality of the drug purchased in a given environment.

¹² Gilbert N. (2008) *Agent-based Models*, Sage Publications, Series: Quantitative Applications in the Social Sciences, p. 2.

¹³ Agar M. & Wilson D. (2002). Drugmart: Heroin Epidemics as Complex Adaptive Systems. *Complexity*. 7(5).

¹⁴ Agar M. (2005). Agents in Living Color: Towards Emic Agent-Based Models. *Journal of Artificial Societies and Social Simulation*. 8(1).

Heroin users are represented by a set of characteristics — *attitude* toward drug; *risk* attending; *experience* (good and bad) relative to the drug, and; a *stage* representing the level of addiction — and by a personal network composed of a definite number (in DrugMart) or a random normal number (in DrugTalk) of other heroin users. Heroin doses are disposed randomly on the "grid" (the spatial dimension in NetLogo®). In Drugtalk, agents act every step accordingly to the following processes:

Routine and Decision process:

Virtual users move randomly on the grid each step of the simulation. Each of them "check-the-buzz" by "interacting" with other agents: they count bad/good *experiences* of other agents in their neighborhood and add these numbers to their own *attitude* attribute. If they move to a patch (one cell of the grid) that contains heroin, they compare their *attitude* to their *risk* attribute: if *risk* is inferior to *attitude*, they consume heroin and increase their number of use by one.

Evolution rules:

- DrugTalk displays 5 types of agents: *clean*, *experimenters*, *users*, *addicts*, and *ex-addicts*. *Clean* agents have never used heroin; *experimenters* have used at least once; *users* are regular consumers (the frequency of use is handled by two counters); *addicts* are *users* or *ex-addicts* that have reached a certain threshold of consumption, and; *ex-addicts* are *addicts* who have decreased their frequency of consumption, but could relapse according to specific conditions;
- After each intake, an agent produces a random number between 0 and 100 that represents their feeling after drug use (call ∂ here). Consumption could lead to agreeable (if $\partial < \text{goodstuff?}$) or disagreeable (if $\partial < \text{badstuff?}$) experiences. Agent adds one point to its good and/or

bad experiences¹⁵ and increases its attitude toward heroin¹⁶ according to the result ∂ ;

- To mirror the *tolerance* to heroin and the gradual loss of primary sensation, the number of experiences will reduced the quality parameter, which, in turn, forces the agent to convey a bad perception about the product;
- If the number of uses is greater or equal to 5, agent becomes an "addict".

Interactions rules:

Rules concerning interactions aim to reproduce the communication about the quality of the drug between agents.

- If the agent is not an "addict" but has just used drug, it will affect the rest of its network by moving the attitude of these agents towards its own attitude. Furthermore, an agent that just consumed offers heroin to its entire network (agents check if they want to consume or not, but will not offer drug back to avoid recursive loops).
- If the agent is an *addict*, agents in its network decrease their *attitude* by 20. Contrary to non-addict agents, its attitude will not be impacted by its network.

DrugMart/DrugTalk constitute the first attempt to model an "epidemic" of heroin without resorting to the "S-curve" differential equation¹⁷ and by focusing on the individual and interactional levels (local and network communications between drug users cannot be represented via a differential equation).

¹⁵ As indicated by Agar, the experience of using could be considered *good* and *bad* at the same time, due to the high and comedown affecting every intake.

¹⁶ The risk characteristic does not change for the whole simulation.

¹⁷ This equation is a first order non-linear differential equation. Primarily used to study population growth in the 19th century, this equation has been since employed in chemistry (to characterise catalytic reaction), in epidemiology (to characterise the spreading of a disease) or to study the diffusion of innovation [Rogers, 2007].

Limitations:

- Biochemical properties of the heroin are omitted. This leads to a straightforward conception of addiction (agent becomes an addict once they have used 5 time heroin);
- The financial dimension, drug price and possible drug sharing are not represented;
- Users move randomly in a homogenous grid, where heroin doses are randomly dispatched;
- Virtual users communicate with any agent situated in their immediate neighborhood, which in one hand represents a form of interaction (through gossiping) but omits the network dimension and peer's influence;
- Parameters "goodstuff?" and "badstuff?" do not permit considering the variation of purity from one dealer to another or from one importation lot to another;
- Agent class is only composed of users: there are no other social actors in this simulation (such as, dealer or policeman).

1.2.2.2. DrugChat¹⁸: an agent-based model approach to injecting drug use

In their paper, Chattoe, Hickman & Vickerman [67] have reimplemented DrugTalk in LISP [120]. This version of DrugTalk is constituted by three types of agents (*non-users*, *users*, and *addicts*) and incorporates several new characteristics:

- Agents belong to a virtual network influencing decisions and opinions of both non-users and users. Addicted agents have little chance to be influenced in their decisions to consume drugs, but could potentially affect the attitude toward drugs of their peers;
- Drug accessibility depends mainly on the category of agent: *addicts* have a higher chance to find drug but will buy small quantities; *users*

¹⁸ Chattoe E., Hickman M. & Vickerman P. (2005) *Drugs Futures 2025?: Modelling Drug Use*, Foresight, Office of Science and Technology.

have a moderate probability to find the drug but they could obtain it in larger amount, while *non-users* have low chance to encounter drugs;

- "Users" can "share" their drug with agents of their networks that are willing to try (this sharing method constitutes the major way for non-users to be initiated to drug use).

DrugChat presents the same main characteristics of DrugTalk despite the absence of *clean* and *ex-addict* types of agents in the simulation. Agents consume and evolve in the same manner than in the initial simulation, but the interactional process is not limited to the immediate and adjacent neighborhood of the agent. Peers play a key role in the modification of "attitude to drugs" by encouraging or discouraging non-users and users to consume the drug.

Limitations:

- Except for the addictive potential of the drug, no other neurobiological effects are represented in this simulation;
- Networks remain stable even if their members see their "attitude to drugs" varies greatly;
- The economic dimension is not incorporated in this simulation (except by considering the difference of amount purchased by the different types of agents).

1.2.2.3. Agent-Based Modelling of Drinking Behaviour: system dynamic & agent-based model

This agent-based simulation could be described as a hybridization of agent-based-model and systems dynamic. This model aims to analyze agent-environment interactions as a key factor encouraging the development and the continuation of alcohol consumption inside general population. To do so, Gorman and colleagues [121] have developed a model based on set of agents at different stages of alcohol consumption interacting in a heterogeneous spatial environment.

Social entities:

Agents could be *abstainers*, *susceptible non-drinkers*, *current drinkers* or *former drinkers*. These agents move on a one-dimension "lattice" composed of several blocks. Movements and direction of the agents are determined by a *velocity* coefficient that indicates the number of sites an agent can visit in a time step. This *velocity* is based on $1-2p$, where p is the probability to move in one direction or another. As explained by the authors, depending on p , agents will move more or less often during the 1000 iterations of a simulation.

Interaction and evolution rules:

These rules are based on probabilistic laws that mimic "social influence":

- *Abstainers* form a fixed population, they have no dynamic laws and cannot evolve during the simulation;
- *Susceptible non-drinkers* have a probability of becoming *current-drinkers*: this probability is calculated on the basis of the number of *current-drinkers* divided by the total number of agents on the site;
- *Current-drinkers* can switch to *former-drinkers* based on the number of *former-drinkers* presents at the site plus μ that represents the probability current-drinkers stop by themselves;
- *Former-drinkers* have the probability of changing their minds and resuming drinking. This probability is based on the number of *current-drinkers* at the site added to the probability of relapse, ∂ .

Gorman et al. indicated that the equilibrium of the simulation depends greatly on the ratio μ/∂ ¹⁹. The entire set of *susceptible-non-drinkers* goes through different stages. Speed of transition depends on p (probability to move): with a large p , agents move more frequently and are more susceptible meeting *current-drinkers*, and vice-versa. One of the developments of this model consists of inserting a bar on the lattice. This specific location attracts current-drinkers by increasing their

¹⁹ A probability of $\mu/\partial = 1$ gives 50% of current-drinkers and 50% of former-drinkers.

probability of moving to that location. Principal effects result in an isolation of the current-drinkers, who get less chance to stop their consumption, and in a rapid conversion of susceptible non-drinkers that move to that location.

Limitations:

- There are no interaction between abstainers and the rest of the population; there is no network influence on the agents;
- No physiological or health changes are implemented in this simulation;
- Economic matters are not developed;
- Probability p of movement does not represent accurately the daily-life routine of social individual;
- Absence of intermediary stages for current-drinkers: alcoholics should represent a risk for the susceptible non-drinkers;
- There is no statistical data to verify and validate the different probabilities used in this work.

1.2.2.4. SimDrug: an "environmental" agent-based model.

In the continuity of DrugTalk, SimDrug [122] searches to describe a heroin epidemic based on a real case: the Melbourne heroin drought of 1999, by using an agent-based software, Cormas© [123]. SimDrug proposes an increased complexity of the components present in DrugTalk by adding an evolving spatial environment. Furthermore, SimDrug integrates several types of agents with different patterns of actions. Its different elements and articulations between these elements are presented below.

Environment:

There are 3 different types of locations in SimDrug: *street block*, *police station* and *treatment center*.

- *Street blocks* belong to one of the five *suburbs* implemented in the simulation. Each of these street blocks is a cell of the spatial grid. It is

characterized by a *wealth* indicating the capital of local populations as well as the expected profit by committing a crime. Street blocks also contain information relative to the number of crimes, overdoses and fatal overdoses committed there. The *risk* attribute corresponds to an equation composed of the different previous elements to what the number of users present on the block is added.

- *Suburbs* are composed of several street blocks. An average risk is calculated over its blocks to reflect the level of crime in the area. If this score reaches a certain level, police will intervene reducing criminality.
- *Police station* is the starting places of the *constables*. It also represents the location where all different agents arrested are "stored" until the end of the simulation.
- Finally, *treatment center* is the starting point of *outreach workers*. It proposes three types of treatment: "detoxification", "therapeutic community" or "methadone maintenance". These different possibilities have various duration and chance of success. All users engaging in a treatment move to this location.

Social entities:

This simulation aimed to represent the heroin user population (at least a portion of it) interacting with different social actors during their daily life. Conversely to DrugTalk, agents are not only *users*, but can also be *dealers*, *wholesalers*, *constables* or *outreach workers*, all of them having different attributes and routines.

- *Users*: 3000 *users* are created with different levels of addiction (30% with "light addiction", 54% with "moderate addiction" and 16% with "severe addiction") depending of their level, *users* need to get a certain amount of drug to guarantee their daily consumption without feeling any withdrawal. Therefore, *users* remember when their last fix was; have attributes *drugNeed*/*drugShortage* to define their state, and; keep in mind the last drug they used (*myDrug*), as well as the address of a dealer. Each turn (a 24h representation), *users* have a chance (0.50%) to declare an overdose depending on specific conditions (i.e., greater

purity, larger dose or if they have injected another drug than heroin). Added to these physiologic characteristics, *users* earn \$200 every fortnight. If their consumption is larger than their cash they can commit a crime to obtain more money (*crimeIntention*). Finally, *users* have a *readinessForTreatment* attribute randomly picked between 10 and 50. Depending on their interactions with *outreach workers* or if they are witness of an overdose or are victim of an overdose, this score will decrease. Once it gets to zero, users have a percentage to go in one of the 3 types of treatment and maybe cure their addiction.

- *Dealers/Wholesalers*: 150 *dealers* and 10 *wholesalers* at the beginning of each simulation. Their attributes are purely economic. However, if the risk of a street block becomes too large, a dealer can choose to stop dealing for a while or go to a hidden place. *Wholesaler* restocks every 30 rounds and *dealers* supply when needed. In the case of the arrest of a *wholesaler*, all *dealers* "attached" to it are busted; and conversely, if a *dealer* is arrested there is 0.25% of chance that it gives information on its *wholesaler*.
- *Constables*: 10 constables move randomly in the *streets*, if not called in a specific suburb. A particular *missionType* can be added if a dealer denounces its wholesaler or if a wholesaler is arrested.
- *Outreach Workers*: 10 of them start the simulation at the Treatment Centre. They are sent to street blocks with the highest overdose rate. Their actions consist asking users to go into treatment (by decreasing the *readinessForTreatment* of users).

SimDrug simulations are run over a 5 years period. The model aims to reproduce situations before, during, and after the heroin drought. It uses a combination of statistical data and ethnographical work to get a better understanding of the user environment and verify the credibility of outputs. Once implemented, agents act according to a pre-

programmed routine consisting in a series of actions. Finally, the Cormas[®] software allows researchers to obtain graphical results and mathematical data throughout the simulations. Several SimDrug outputs have closely matched the statistics.

Overall, SimDrug was employed to test different policies regarding treatment/law enforcement scenarios around this heroin drought. Economic output, especially on dealer outcomes and money spent by users have closely matched Australian estimations.

Limitations:

- Interactions do exist between the different types of agents, but not between agents of same category (contrary to DrugTalk): there are no "network" effects such as "peer pressure" or peer judgment.
- Only one substance is considered: the variable "other drugs" represents the whole set of other psychoactive substances. Because it was oriented on the study of heroin epidemic, SimDrug does not address the question of recreational polydrug use.

1.2.2.5. Researching a local heroin market as a complex adaptive system: a heroin Illicit Drug Market Simulation (IDMS)

This research used an agent-based model to study the structure of a local heroin market [124]. The construction of this model is based on ethnographic observations conducted in the 90's in a suburb of Denver. The model was used as an "explicative" rather than a forecasting one. It tries to "reproduce the essential behaviors of market participants in an ABM what was discovered in the ethnography."²⁰ The authors considered heroin drug market as a Complex Adaptive System and have used data from the observed micro-interactions to reproduce macro-patterns.

²⁰ Hoffer L., Bobashev G. & Morris R.J. (2009) Researching a Local Heroin Market as a Complex Adaptive System, *American Journal of Community Psychology*, 44, p.274.

Social Entities:

The IDMS model contains six types of agents:

- *Customers*: they are the main agent of the simulation. They have pharmacodynamics characteristics to mimic their level of addiction, a list of where to purchase heroin, an attribute that represents their heroin stash, and a money attribute that they perceive more or less frequently. Their addiction is based on their frequency of use and is used to calculate the amount of drugs a customer try to buy;
- *Brokers*: these agents are half-user half-dealer. They serve as intermediary between customers and private dealers and buy their heroin based on a "tax" perceived on the customer drug;
- *Sellers*: these agents have an inventory of drug to sell. They sell in the public space (see below) at the full retail price. They stop selling once they have no more drugs, when their shift is finished or when they get caught (see The Police);
- *Private Dealers*: these agents act in the same way as *Sellers* but they remain in the private space. *Private dealers* sell only to brokers or to customers that have their address in their list of places where to buy;
- *The Police*: police agents patrol randomly in the public space and inspect randomly agents within 100 feet radius. They arrest agents who possess heroin. Agents arrested return in the market after a duration proportional to the amount of drug they were possessing. In a normal simulation, there is only one police agent;
- *The Homeless*: these agents do not play any role in the simulation, but the police agents considered them as potential brokers, sellers or customers.

Environment:

IDMS was designed to represent the Larimer suburb of Denver (a square of half a mile by half a mile). This square is divided into two types of locations:

- *Public space*: all agents can move freely in this space and can buy/interact with brokers, sellers or sometimes with police agents.
- *Private space*: only occupied by *private dealers* and *customers*.

The IDMS was used to test *what-if* scenarios. It tests the influence of the number of brokers on the number of transactions of both sellers and private dealers. With no brokers, the street sellers make more transactions than the private dealers and, conversely, private dealers make more transactions if the number of brokers is high. Also, increasing the number of brokers increases the number of transactions. IDMS also tests the impact of police intervention on the drug market. To reproduce a "police bust", 29 police agents are added into the public space. The results of this scenario show that, during the bust, the number of *sellers'* transactions decreases drastically, while the number of transactions of *private dealers* increases. The number and type of transactions return to their normal values after the jail-time of *sellers* finished.

IDMS proposed a framework enabling the comparison between drug markets and can assess the relevance of police interventions on the drug market (in other words, what kind of agents should be targeted by police intervention) by creating *what-if* scenarios.

IDMS does not constitute a "drug use", but a "drug selling" model. Nevertheless, its review gives an idea of how ethnographic works could be used to build an agent-based model, and the type of *what-if* scenarios that can be tested with this type of model.

1.2.2.6. *SimAmph: An agent-based simulation model for exploring the use of psychostimulants and related harm amongst young Australians: integrating risk and interactional judgment to study psychostimulant use.*

SimAmph [125] used a unique feature in the world of drug-use simulation: it integrates both qualitative material and epidemiologic data in an agent-based model. This model examines the role of individual perceptions, peers influences and type of settings on the consumption of psychostimulants and their related-harms.

There is only one type of agent in SimAmph: young users of psychostimulant. SimAmph *agents* display several attributes: socio-demographic attributes (gender, age), physical and mental health status, motivations toward drugs and a number of peer relationships. They are also characterized by a "stage of social engagement" in psychostimulant use, which reproduce the different stages of a psychostimulant user's career (these stages were based on ethnographic data). Agents could be situated in one of the five following stages:

- Novice (Stage 1) use exclusively alcohol and cannabis in weekend parties;
- Occasional Users (Stage 2) consume monthly or less psychostimulant in addition to their consumption of alcohol and cannabis during weekend parties;
- Regular Users (Stage 3) consume psychostimulants weekly as well as alcohol and cannabis during weekend parties;
- Hardcore Users (Stage 4) have 'binge' uses of one to three days involving use of alcohol, cannabis and psychostimulants;
- Marginal Users (Stage 5) consume psychostimulant on a daily basis with alcohol and cannabis.

The evolution between stages is not a one-sense trajectory: agents can move between stages accordingly to "rules of transition". These rules are

based on two independent variables: *Peer Influence* and *Health-Related Experience*. The former represents a chance for the agent to increase his stage, while the latter represents a probability for the agent to decrease his stage. Furthermore, SimAmph integrates short and long-term harm associated with psychostimulant uses. The risks of agents to experience harms are based on a probabilistic rule based on epidemiologic data. SimAmph also includes different type of settings where agents can access and consume different types of drugs. These settings are characterized by two attributes, *Tolerance* and *Accessibility*, which represent the possibility of using illicit drugs in the setting and the type of drugs that an agent can purchase in the venue.

The validation of SimAmph tests the ability of the model to reproduce the proportions of agents for each stage based on different statistical sources. This model was able to reasonably match these statistics despite the fact that all agents start Novice.

SimAmph draws its strength from its combination of epidemiologic and ethnographic data. The representation of both self-evaluation and peers influence is unique in the world of modeling. Moreover, SimAmph includes several drugs and differentiates stage of consumption to embed the concept of career.

Limitations:

Nevertheless, the economic dimension is omitted and the two reevaluations processes are "one-way": peers cannot sanction agents for their behaviors or for their mental/physical states and agents cannot decide by themselves to consume more drugs. Finally, if several drugs are represented, polydrug use is not encompassed in its neurologic dimension.

This brief review of the different social simulations related to drug use helps us to understand the possibilities offered by each of them. As aforementioned and depending on the phenomenon studied, some techniques are more adapted than others to capture the targeted phenomenon and, conversely, particular types of agents are better fitted to mimic the social phenomenon targeted. Here, the choice of the simulation framework has to take into account the complexity inherent in drug use, and, therefore, the necessity to model drug use as the result of interrelations between components of several subsystems. Reviewing the different elements influencing drug use reinforces the necessity of a multidisciplinary perspective. Such a perspective calls for the utilization of a framework allowing embedding several strata of reality. Social simulations offer the possibility of letting interact these different strata and, therefore, embedding information coming from several disciplines into a dynamic structure.

According to Chattoe, Hickman & Vickerman [126], "agent-based models attempt to tackle the 'explanation gap' [...] by explicitly modeling the internal states, decision processes and social interactions of individuals. Instead of variables and parameters or 'types' and transitions, these models deal with simulated populations and their interactions".²¹ Considering the previous remark and the multidisciplinary perspective of this project, the social simulation related to the evolution of recreational polydrug users will take the form of an agent-based model to encompass both actions and interactions shaping the drug career of these users.

²¹ Chattoe E., Hickman M. & Vickerman P. (2005) *op.cit.*, p.7.

1.3. Contextual Elements

For more than forty years, illicit drugs consumption has been considered a major social and health issue. After the different drug "epidemics" (heroin, crack and more recently methamphetamine) and the large consumption of related "dance scene" drugs (MDMA-like and amphetamine-type drugs) in the 90's, the last decade has seen western societies considering polydrug use as the main problematic trend. However, poly-consumption is accompanied by two main phenomena — "hyper-availability" and normalization — that need to be introduced before detailing polysubstance use.

1.3.1. Hyper-availability

The first of these phenomena is related to the drug market structure and its recent trends. According to UNODC²² [127], the global drug market and substance consumption are mainly characterized by the following two aspects:

(1) The quasi-constant presence and stable consumption of "classic" psychotropic substances on the drug market: amphetamine-type drugs (speed and methamphetamine powder or crystal), cannabis (hashish and marijuana), cocaine (powder, free-base and crack), MDMA-type (ecstasy pills, MDMA liquid or crystal), heroin, hallucinogenic (LSD or magic mushrooms) have seen their statistics (consumption or seizures) fluctuate through time without ever disappearing²³ as indicated by the report from OCTRIS²⁴; NDARC²⁵ [128]; OFDT²⁶ [129]; EMCDDA²⁷ [130] and the UNODC;

²² United Nations Office on Drugs and Crimes.

²³ Consumption of cannabis and ecstasy pills have decreased in these last 5 years. However, due to the appearance of other consumable forms of MDMA (crystal or ecstasy liquid) attributed diminution of ecstasy depends mainly on its chemical forms.

²⁴ Office Central pour la Répression du Trafic Illicite des Stupéfiants.

²⁵ National Drug and Alcohol Research Centre.

²⁶ Observatoire Français des Drogues et des Toxicomanies.

²⁷ European Monitoring Centre for Drugs and Drug Addiction.

(2) The last few years have seen frequent appearances of "new" substances obtained by the modification of illicit drugs molecular structure. These substances known as "legal high" or "designer drugs" have a legal status considering the contemporary legislation at the moment of their appearance on the drug market. Their number has greatly increased since 2005: in the UE, 24 new legal highs have appeared on the drug market in 2009 and 41 in 2010 [131, 132].

In this research, the combination of these two phenomena is called "hyper-availability": this term underscores the quasi-constant presence and the large range of psychotropic substances inside western modern societies. This hyper-availability furnishes an important panel of pharmacological substances to users, who can shape and modify at will their physical and mental states. According to Fontaine [76], this "hyper-availability" may play a major role in the intensification of polyuse practices.

1.3.2. Normalization

Concomitant with the "hyper-availability" of psychotropic substances, several researchers have observed a "normalization" of illicit substance use since the 90's [72, 74, 75, 133]. According to Parker [134], this normalization of drug use practice is characterized by (at least) 5 social phenomena:

(1) *Significant drug trying rate*: the last 20 years have seen the level of experimentation (e.g., used at least once in the life time) of the different drugs grown before getting stabilized in the beginning of 2000s [128-130];

(2) *Constant regular drug use rate*: if some substances have seen their consumption rate fluctuate over the last 20 years, their use persists. On this basis, Parker argued that illicit drugs consumption has

known an epidemic phase in the 80's before becoming endemic since the 90's [72]. Similarly, Kokoreff and Faugeron [135] speak of "society with drugs" confirming the endemic presence of drug use inside western modern societies;

(3) *Social accommodation of 'sensible' recreational drug use*: this point reflects an extended acceptance of recreational consumption by both abstinent and former users. It does not mean that drug use has accomplished a completed normative integration, but that abstainers accept drug use and could maintain social activities with drug user's peers. It also means that non-users distinguish between controlled and dependent use of substances [134];

(4) *Cultural accommodation*: drugs are largely mediated by media press, movies or television series showing recreational drug use and users in a non-manichaeist perspective favoring the visibility of this type of practice (on this topic, the examples are numerous: *The Wire*, *Transpotting*, *Ali G*, *Human Traffic*, *Weeds*, *Doctor House*, etc...);

(5) *Availability and accessibility*: these two terms represent the relative easiness/difficulty to acquire different substances in a specific geographical area (availability) and the relative capacity for individual to buy substances (accessibility). Parker [134] seemed to consider that psychoactive substances are more readily available than in the 80's.

This normalization does not mean that drug use becomes a norm of actions socially well accepted. It means that illicit drug use becomes banalized and does not necessarily induce a strong social sanction from abstainers and ex-users.

1.3.3. Poly-Consumption

The term poly-consumption appears in the 70's as "multiple drug use" [136] or "concurrent multiple drugs use" [137]. It was defined as the consumption of an illicit substance in combination with another licit/illicit drug. During that period, polysubstance use has been principally investigated through statistical surveys. These surveys aimed to characterize the phenomenon by identifying the different types of populations' polyusing; the substances consumed during polysubstance sessions, and; the health risks inherent in this practice.

Polysubstance was already observed in the statistics concerning users entering treatment. However, the appearance of the "dance drugs" in the 90's and the relative normalization that has followed, have contributed to orient the research about polyuse toward nightlife environments. A first branch of polysubstances studies have investigated, through ethnographic surveys, the habits and norms of psycho-stimulant users in settings, such as, raves, clubs, and music festivals [72, 77, 138-140]. These studies have underlined the frequent and normative aspect of polyuse practices, as well as the instrumenting of polyconsumption during and after night sessions.

A second branch of polysubstance-related researches was investigating the health risks inherent in polyusage. These surveys have described the increased health and psychological harms induced by the combination of different psychoactive substances and have listed the different substances most commonly combined. Lately, epidemiological surveys have examined the consumption of prescribed substances in combination with licit/illicit drugs and have pointed out the potential dangers of such practices, mainly due to the lack of scientific knowledge and empirical information regarding the physiological and neurological effects of such combinations [141, 142]. Furthermore, the entry in the drug market of the "legal highs" has complicated the work of this

research by introducing unknown substances in the possible combinations. This modification of the drug market, combined to the increasing use of prescribed substances, tend to confirm that the "hyper-availability" plays a major role in the statistical increase of polyuse practices [76, 143].

Despite this increase and the fact that EMCDDA considers polysubstance use as the "dominant pattern of drug use in Europe"²⁸, there is very little statistical data targeting polysubstance use at the general population level. The European School Survey Project on Alcohol and Other Drugs (ESPAD) shows that between 22.5% and 40% of 15 to 16 years old student are polyconsumers, and that within that proportion, 27% use one illicit drug in combination with at least one or several licit/illicit substances. Again, little is known about older groups inside the general population: most of the data on young adult's remains based on mono-substance use or subpopulation approaches. The recent French report concerning cocaine [144] indicates that recreational cocaine users are "more surely polydrug users than simple cocaine users [free translation]" without mentioning the precise percentage of polyconsumption inside this population. This is partially confirmed by EMCDDA statistics concerning people entering treatment: 62% of cocaine users and 85% of cannabis users appear as being polyconsumers [145]. Nevertheless, there is no data concerning users consuming other drugs.

In Australia, the National Drug Strategy Household Survey (NDSHS) presents results concerning the general population. This report gives the percentage of recent users (above 14 years old) having combined one kind of substance with at least another illicit substance in the last 12 months. Results of this report show that:

²⁸ EMCDDA (2012) *Annual Report 2012*, p .13.

- 39% of cannabis recent users have consumed at least one other illicit substance;
- Approximately 90% of stimulant recent users (ecstasy, cocaine and amphetamine-type) have taken another illicit drug with their primary stimulant (mainly another stimulant or a hallucinogenic drug);
- 97.3% of recent hallucinogen users have used other illicit drugs in combination with hallucinogen;
- 94.2% of recent heroin users have mixed heroin with at least one other illegal drug in the last 12 months;
- Although 80.5% of the Australian general population (above 14 years old) has consumed alcohol in the last 12 months, these statistics do not consider licit substances (i.e., alcohol, tobacco, energy drinks) as possible combinatory drugs.

This last point illustrates the difficulty of obtaining consistent statistics concerning polysubstance use. This difficulty is mainly due to the absence of a single and common definition regarding this practice. As explained in Section 1.4.3, polysubstance use characterization varies accordingly to the temporality of usage (i.e., lapse of time between two intakes) and on the type of substances used (i.e., licit and illicit drugs, only illicit substances). These differences lead to different interpretations concerning polydrug use depending on the local legislation. Therefore and to avoid any further misconceptions, the next section (Section 1.4) will review and clarify the different terms and notions related to the subject of this research.

1.4. Defining Recreational Polysubstances Use

If "recreational polysubstances use" seems to constitute a well-defined and well-delimited type of use, the institutional and scientific definitions related to this form of psychoactive substances remain imprecise and

vague [127, 145]. Thus, an examination, term by term, is essential before going further and specifies research hypotheses.

1.4.1. Use, Misuse, Abuse, and Addiction: Consumption-related definitions

This subsection examines the different expressions characterizing psychoactive substances consumption. Some of these expressions are subject to controversies inside the drug use field. This research does not pretend to give exact definitions concerning these terms, but instead, specify the way these notions will be employed herein.

Use corresponds etymologically to the Latin verb *usus*²⁹, which literally means "to avail" or "to employ." As argued by Peretti-Watel et al. [146], employing the terms use and user "[...] reflect a sociological standpoint supposing that individuals *use* drug or, in other words, that users have a certain mastery of drugs. This standpoint breaks with the widespread opinion that drug "uses" drug users and not conversely [free translation]."³⁰ This conception of drug use attributes to individual the capacity of choice³¹ and control over the substances they consume. For this work, substance use will be considered as *an instrumental consumption operated by users toward specific effect(s)*. The terms use, usage and consumption will be used to characterize the same concepts, except if another qualification precedes the term consumption (i.e., addictive consumption).

Misuse corresponds to the improper consumption of prescribed drugs: it consists in the diverted use of medications for recreational non-medical or non-therapeutic uses.

²⁹ Etymology of the different terms examined here are issued from Dubois J., Mitterand H. & Dauzat A. (2011) *Grand Dictionnaire d'étymologie & historique du français*, Larousse, Paris.

³⁰ Peretti-Watel P., Beck F. & Legleye S. (2007) *Les usage sociaux des drogues*, Le Lien Social, PUF, p.2.

³¹ These decisions are conditioned by a set of risk and protective factors that will be detailed in the scientific literature review.

Abuse or *problematic use* designates harmful form of substance use. Substance(s) problematic use is not necessarily related to dependence and/or addiction, and it is not directly associated with the notion of need and craving.

Substance dependence or *addiction* indicates the state where an individual experiment physical withdrawal from drug weaning and/or the psychological feeling of "craving." Addiction comes from the Latin *ad-dicere*, which literally means "says at". This expression was employed during Roman antiquity to designate the owner of a slave. This conception of addiction removes the "mastery" component from the previous definition of use. In this research, addicted individuals are not considered as users, but as dependent or addicted "consumers" (which comes from *cum-suus-emere*, literally "take for oneself", "waste", "destroy" or "eat").

Abuse and addiction are less related to the question of quantities or frequency than to the consequences drug(s) taking has on the user's life. Signs and symptoms of addiction are defined as follows:

- Drug tolerance e.g., need more drug to achieve same effects;
- Feeling of withdrawal;
- Ill-considered risks taking during drug use session;
- Social and professional activities neglected;
- Substances consumption maintains despite negative effects;
- Daily life revolves around drug use. [147]

This last point must not occult the faculty of dependent individuals to build plans and develop skills, such as searching for money, finding a dealer, purchasing a certain quantity of drug and consuming in a specific setting [46]. This research considers that the actions of dependent individuals are mostly oriented toward substance(s) consumption at the cost of their social day-to-day activities. These

different notions have been summarized in Figure 1.1, representing a dangerousness diagram³².

The evolution of individual drug use is not as linear: "beneficial use" does not necessarily entail "chronic dependence." However, this scale has the advantage of presenting the function attributed to each type of use and their related harmfulness.

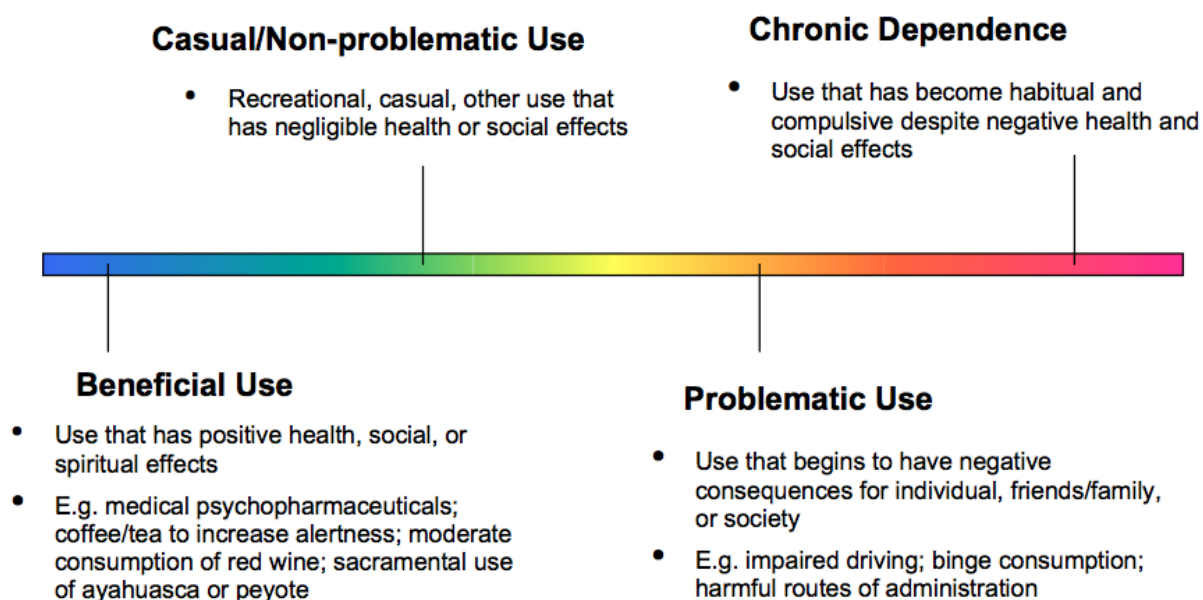


Figure 1.1. Spectrum of Psychoactive Substance Use (HOCBC, 2005)

Concerning the overall statistical representations of these different types of drug consumers, the UNODC considers three classes of consumers characterized by the "potential harmfulness" of their usage:

- 3.3% to 6.1% (155 to 250 million individuals) of the 15-64 years old world population have consumed at least one illicit drug in 2008;
- 0.3% to 0.9% (16-38 million persons) are considered as "problematic" (i.e. are dependent or facing physical/social issues), and;
- 0.25% to 0.47% (11-21 million persons) is users who inject intravenously substances (mostly, cocaine, heroin, and amphetamine-type) [148].

³² Health Officers Council of British Columbia (2005) *A Public Health Approach to Drug Control in Canada*.

These two last categories represent 10% to 15% of the global population of illicit drug consumers, which tend to indicate that 85% to 90% of the individuals consuming drugs are *users*. The present research focuses on this last category. The next section (Section 1.4.2) presents an extended description of this non-problematic and recreational class of users.

1.4.2. Recreational user characteristics

According to the UNODC: "The term "recreational use of drugs" is an imprecise term used to describe a pattern of drug use that usually takes place in the context of leisure activities, such as parties or dance events, and that is alleged to be non-dependent or non-compulsive."³³ Indeed, sociologists consider that (1) "recreational drugs are those used for non-medicinal purposes, in particular, for fun or leisure"³⁴ (*recreatio* in Latin designated periods of restoring or recovering subsequent to wounds or diseases). This type of use seems to possess, for the users, a social utility and could be interpreted (2) as "[...] the intentional utilization of a pharmaceutical in order to get high, have fun and/or socialize with friends and peers."³⁵ More importantly, recreational drug use consists of the (3) "[...] occasional use of certain substances in certain settings and in a controlled way."³⁶ Based on these three main characteristics extracted from the scientific literature, recreational use could be defined as *the intentional and occasional consumption of psychoactive substances oriented toward specific pharmaceutical effect(s) and undertaken in particular settings*. Correlatively, recreational users are *non-compulsive users, who remain in control of their consumption*.

³³ UNODC (2002) *Prevention of the recreational and leisure use of drugs amongst young people*, Forty-fifth session, Vienna, p. 2.

³⁴ Sussman S., Ames S.L. (2008) *Drug Abuse: concepts, prevention, and cessation*. Cambridge University Press.

³⁵ Quintero G. (2009) Rx for a Party: A Qualitative Analysis of Recreational Pharmaceutical Use in a Collegiate Setting. *Journal of American College Health*, 58(1), p. 67.

³⁶ Parker H. (2005) Normalisation as a barometer: Recreational drug use and the consumption of leisure by younger Britons, *Addiction Research and Theory*, 13(3), p. 205.

Concerning the notion of control, the term "controlled users" has been primarily developed and conceptualized by Norman E. Zinberg & Wayne Harding, while they were realizing a survey on drug users. Looking for a proper way to differentiate categories of users, Zinberg & Harding [149] defined the quantitative and qualitative traits of controlled and compulsive users. According to these authors, controlled users should "not be such frequent users that their use would interfere with family life, friendship, work or school and health."³⁷ Thus, controller users are individuals who abide by social rules in order to continue their "ordinary social obligations"³⁸ and should have, therefore, no history of treatment. Consequently, these users "are acknowledged as unremarkable and within normative boundaries."³⁹

The question of whether recreational users are controller users and vice-versa mainly depends on the practices that are encompassed in these concepts. If recreational users need to remain in control of their consumption for them to stay recreational, the inverse — controller users are recreational user's — is not valid. Several studies have pointed out that dependent users could still fulfill their "ordinary social obligations" and abide by social rules [150, 151]. In other words, the dependent users could be in control of their consumption, although these consumptions are not recreational; and, the recreational users, as non-dependent, must control their usage in order to not become abusers and/or dependent users.

According to Zinberg [152], the continuation of drug use in a controlled way involves *social controls*. Indeed, this author postulates that controller users have internalized informal rules of conduct, named *social sanctions* and *rituals*, in order to auto-regulate their consumption.

³⁷ Parker H. (2005), *op.cit.*, p. 47.

³⁸ Zinberg N.E. (1984) *Drug, Set, and Setting: The Basis for Controlled Intoxicant Use*, Yale University Press, New-York, p. 55.

³⁹ Parker H. (2005) *op.cit.*, p. 3.

Sanctions prescribe the "whether and how a particular drug should be used"⁴⁰, while *rituals* are "the stylized, prescribed behavior patterns surrounding the use of a drug and may apply to the methods of procuring and administering the drug; the selection of the physical and social setting for use; the activities undertaken after the drug has been administered; and the ways of preventing untoward drug effects."⁴¹ In other words, *sanctions* are the injunctions fixed by the individual to control her consumption, while *rituals* are the techniques and practices that permit the user to achieve her sanctions.

In their 1977 article, Harding and Zinberg described and enumerated the different sanctions and rituals in the following terms:

- "1. They define and approve controlled use and condemn compulsive use.
2. They limit use to physical and social settings conducive to a positive drug experience.
3. They incorporate the principle that use should be kept infrequent enough to avoid dependence/addiction and to maximize the desired drug effect.
4. They identify potential untoward drug effects and prescribe relevant precautions to be taken before and during use.
5. They assist the user in interpreting and controlling his drug high.
6. They operate to compartmentalize drug use and support the user's non-drug-related obligation and relationship (this point was added in *Drug, Set, and Setting*)."⁴²

These mechanisms of control are acquired and modified through personal experiences or through a social learning process intervening throughout individual interactions. Confirming the last point, Decorte [153] explains that the social environment plays an essential role in the

⁴⁰ Zinberg N.E. (1984) *op.cit.*, p. 9.

⁴¹ *Ibid.*, p. 9.

⁴² Harding W. & Zinberg N.E. (1977) The Effectiveness of the Subculture in Developing Rituals and Social Sanctions for Controlled Drug Use, in *Drugs, Rituals and Altered States of Consciousness*, DuToit B.M.

production of "informal control mechanisms" allowing users to "protect inner borders" regarding their uses. These control mechanisms are also reinforced with the different negative experiences that users could experience during their drug user 'careers'. To summarize, controlled users develop *sanctions, rules and rituals to manage their uses to stay socially integrated and functional. These control techniques are built and modified throughout the user consumptions.*

The question of whether recreational users are controlled users has already been positively answered. Several questions arise then: what is the impact of polysubstance use on the control capacity of users? Do specific polysubstances-related social control techniques exist and if they do exist, what are they? In order to address these questions, a proper definition of polysubstances use is needed. The next subsection (Section 1.4.3) examines this topic.

1.4.3. Definitions regarding substances and polysubstances

The number of substances that could potentially be used to achieve "beneficial" pharmaceutical effects is undoubtedly large (this number remains unknown) and in constant evolution. It is reasonable to assume that the number of possible combinations exceeds largely the number of psychoactive substances existing (for example, in Europe, ESPAD has listed 91 different potential combinations [145]). Therefore, studying particular combinations appear to be irrelevant and non-adapted to capture polysubstance use in its entirety. However, it needs to be categorized and delineated in order to be grasped, analyzed, and defined.

Drugs, as single substances, are legally classified according to three subsets: licit (e.g. alcohol and tobacco); prescription (e.g. benzodiazepine or methylphenidate); and illicit (e.g. methamphetamine,

LSD or heroin). These substances are pharmaceutically classified depending on their actions upon the brain into three main categories: depressant (e.g., alcohol, opiates, GHB); stimulant (e.g., amphetamine-type drugs, ecstasy, cocaine); and hallucinogen (e.g., cannabis, LSD, peyote).

Added to these classifications, the *timeframe* of intake and *effects* obtained through polydrug use allow narrowing the categorization of polysubstance use [154]. Indeed, based on the timeframe of consumption, polysubstance use could be described as *simultaneous* (SPU), i.e., consume during the same occasion; or as *concurrent* (CPU), i.e., take over the drug user's life. Concerning the effects, three categories seem to encompass the totality of the researched effects [155]:

- (1) *Agonist or additive*: one substance is added to one or several others in order to increase the actual effect. In the case of agonist use, drugs ingested often belong to the same pharmaceutical group, e.g., cocaine and speed to increase the energy effect, or alcohol and cannabis to augment the relaxing feeling;
- (2) *Antagonist*: one substance is added to counterbalance the effect of one or several other drugs. Here, the drugs combined belong to oppose pharmaceutical groups, e.g., heroin after amphetamine to ease sleeping, or cocaine after alcohol to reduce the drunkenness sensation;
- (3) *Synergetic or supra-additive*: the combination of drugs creates a new effect or adds another effect to the primary one. Drugs mixed come from different non-antagonist pharmaceutical group, which generally implies the use of hallucinogens or other substances, e.g., LSD and speed, or ecstasy and Viagra.

Despite these categories, attributing a precise definition to polysubstance use still appears to be a difficult task. If "consumption of more than one psychoactive substance" is the obvious and basic definition of polydrug use, institutional definitions vary from a period to

another and from one country to another [145]. These variations arise from the different acceptations regarding the temporality attached to poly-consumption (i.e., from a few hours to the entire life) and regarding the legal status of drugs mixed (only illicit drugs, one illicit plus one licit/illicit drug, or two licit drugs). The largest definition would consider the use of two licit drugs during the whole life of individuals and the narrowest one would consider as polyuse, the consumption of a minimum of two illicit substances in less than 6 hours [156].

For this work, the following definition will be considered: *polysubstances use consists in the consumption of at least one illicit drug with at least one licit or illicit other substance in order to achieve a specific effect during the same session*⁴³. Session being defined as a period of intentional use delimited by the lapse of time separating the first intake and the end of all pharmacological effects. Considering the statistics presented in Section 1.3.3, this research argues that the large majority, if not all, of individuals consuming illicit drugs are polyusers.

Moreover, this thesis argues that simultaneous and concurrent polydrug uses should be considered together because each SPU is part of the global CPU and that CPU, understood in the sense of ‘career’, will impact further decisions regarding polydrug use (SPU), a reasonable stance would be to consider both forms of polyuse in order to capture both short-term and long-term consequences of polydrug use. This point is extensively developed in Section 2.5.

⁴³ For this research, are excluded the following substances: tobacco, caffeine and any energetic drinks. This choice is based on two main reasons: (1) except energy drinks, the relation between "recreational" use and these drugs is, for the least, unclear and difficult to establish; (2) integrating these drugs as part of polysubstances use would mean including the quasi-complete general population creating this way an inoperative definition.

1.5. Research Assumptions and Questions

Outlines

Polysubstances consumption, as a pattern of use, has seemingly become the norm amongst drug users in a context where drug use has been qualified by several researchers as “normalized”. Despite this fact, knowledge concerning patterns, contexts and social risks of polysubstances use remain fragmentary and calls for further investigations. Paradoxically and despite the "aggravating" factor associated with polydrug use, the number of problematic users (i.e., dependent and injecting users) remains stable through time [127]. This last point reinforces the necessity to deepen the knowledge of polysubstance use to assess the dangerousness of this practice.

Considering the scientific literature and the institutional reports, the following notions were clarified and the four following assumptions of work were built:

- (1) To understand polysubstance use, both simultaneous and concurrent polysubstances dimensions have to be investigated and put into perspective;
- (2) In this thesis, simultaneous polysubstance use is defined as the consumption of an illicit drug in combination with at least one licit/illicit substance;
- (3) Recreational users are non-compulsive and *controller* users, who use substances in order to *intentionally* achieve a particular goal (which needs to be defined and described). Recreational users remains socially integrated and manage their intake by developing several *control techniques*, which need to be examined and detailed in the particular case of polyconsumption;
- (4) To capture the complexity inherent to drug use, a multidisciplinary framework is required. This framework should be able to encompass five different levels of reality: *drug, individual, network, context* and

society. The first level (i.e. psychoactive substances) requires examining the neurological aspect of drug use.

Based on these hypotheses and on the literature review, the current research:

1. Investigates the decision-making process and patterns of Simultaneous Polydrug Use amongst an Australian and a French samples of socially-integrated young adults;
2. Clarifies the precedent point by integrating neurosciences notions in the explanations of SPU;
3. Investigates the impact of this practice on the life of recreational users and examines the strategies developed by these latter to delineate their consumption;
4. Captures the complexity of polydrug use by using a generative modeling process that leads to the construction of an agent-based model, named SimUse.

1.6. Thesis Outlines

In order to present the way these different objectives have been achieved, the thesis has been organized as follows:

Chapter 2 presents the theories employed to study and analyze recreational polydrug use as a social phenomenon, as well as the concepts and methods employed to build the social simulation. The neurobiological and sociological notions and concepts are developed and combined to form an original theoretical framework able to capture the dynamical changes shaping the drug career of the recreational polydrug users.

Chapter 3 describes the choice of the methodology used to collect empirical data on which is based the construction of the algorithms.

This chapter presents the way the data collection has been shaped and how these data have been treated and information extracted. It also contains a quick description of the context and settings of this research, as well as precisions regarding the demographics of the participants.

The second part of this thesis describes the overall career of recreational polydrug users by detailing three main steps in their evolution:

Chapter 4 presents the "Starting and Learning" phase. This chapter details the main reasons for individuals to engage into drug uses and the conditions of this consumption. It describes the conditions of first substances use and the evolutions of the initial drug's opinions of users before and after their first experiences.

Chapter 5 describes the "Instrumenting and Switching" phases of recreational users. This chapter examines the different roles and expectations polyusers imputed to psychoactive substances. It analyzes and details the decision process leading to drugs selection and consumption. It also presents the reasons users have to change their drug habits and the main role of polyconsumption in the life of recreational users.

Chapter 6 details the "Selecting and Slowing" steps of recreational polyusers trajectory. It focuses on the importance of control techniques in the social integration of this particular type of users. This chapter also investigates the construction of the recreational user "identity" based on the characterization and labeling of non-controller users.

The third part of this research is dedicated to the description of the multi-agent based model developed to mimic the life of recreational polydrug users and its evolution in the actual context.

Chapter 7 presents the global functioning of SimUse, the agent-based simulation, by describing the UML class diagram and sequence diagram, as well as some of the activity diagrams that were not detailed in Part II. It describes the verification of SimUse. The verification will be executed through different tests and by running several scenarios assessing the model accuracy against qualitative trends.

Chapter 8 is an overarching discussion of the findings concerning the consequences of recreational polysubstance use on the life and drug career of individuals. The second part of this discussion examines the role of agent-based simulations as a tool for social.

Chapter 2. Theories and Concepts

As aforementioned, the purpose of this work is twofold: (a) examine and "interpret" the life course of recreational polydrug users in a context of "normalization" and "hyper-availability"; and (b) create an agent-based model integrating theoretical data and empirical findings to simulate the evolution and interactions of virtual recreational users. The present chapter aims to provide the theoretical and conceptual framework employed to achieve these two purposes.

The first objective — understanding the impact of polyuse on the life of recreational users — requires capturing several causal elements that are, as described in the precedent chapter (Section 1.1), co-evolving dynamically. Given the fact that the (poly)use practices are gradually modified throughout the life course of the individuals, this work needs to be able to capture the different rationales shaping the practices of these users. It also needs to integrate the consequences of these practices considering the fact that these latter could become rationales for further changes. The theoretical framework developed in the next sections aims to capture the complexity of this phenomenon by employing four theoretic notions that can be dynamically combined: neurology (Section 2.2), action (Section 2.3), interaction (Section 2.4), and drug career (Section 2.5).

Considering the second objective of this thesis — to create an artificial society that mimic polysubstances users in their social environment — a "common language" needs to be found in order to make both disciplines and theories mutually accessible. This "platform"

should be able to integrate into a simulation software, both data coming from the scientific literature and results produced by the empirical arm of this work. As already stated by several authors, drug use, and even more polydrug use could be considered as a Complex Adaptive System [116, 157]. This kind of complex systems consist of systems exhibiting non-linear interactions amongst their components that co-evolve producing sub-optimal equilibriums [158]. In social sciences, Complex Adaptive Systems (CAS) are closely related to Multi-Agents Systems and to the *Generative Sociology* and the concepts developed by Epstein. The Sections 2.6 and 2.7 examine these different notions in order to justify this thesis approach.

As already stated, models are simplifications of a fraction of reality that enable a deepened investigation about that particular fraction. Models can contribute to clarify relations between components, and more interestingly, they allow researchers to understand which points of their conceptual scheme are invalid, incomplete or just missing. To construct such a model, the theoretical notions and empirical findings of this research will be "translated" into formal schemes. These schemes will represent the way algorithms have been conceived as well as the logic behind their formalization. Before getting to the different concepts that composed the theoretical approach of this research, the following section (2.1) will describe the modeling techniques employed to achieve such a "translation".

2.1. Modeling Techniques

"All models are wrong (but some are useful)."

Georges E.P. Box & Norman R. Draper

This thesis proposes to formally "transcribe" empirical and theoretical data into algorithm⁴⁴ by using the Unified Modeling Language (UML). After a brief description of the purpose and functioning of this modeling framework, the different type of visual "diagrams" employed for the construction of this research model are described and exemplified.

2.1.1. Creating a social simulation by using a qualitative data

This thesis used theoretical and qualitative data to design the operations and attributes of the agents populating the model. These operations and attributes require number to be implemented and run through a computer. One should underline that numbers and mathematical functions cannot capture the complexity of social phenomenon, especially in the case of drug use. Nevertheless, the formalization proposed in this thesis is not based on specific preexisting mathematical functions; instead, it consists of sociological findings translated in a computational language or as argued by Agar "to express qualities learned through anthropological research, using functions instead of words as the language for that expression."⁴⁵ But, doing so, brings the next criticism: what make these formalizations accurate or even needed to the model? First, the different agents, their characteristics and their actions are propositions and could be modified if they are judged irrelevant to the phenomenon modeled. Second, and as argued by Agar: "A function grounded in differences that make a

⁴⁴ An algorithm is the enunciation in a well-defined language of a series of mathematical operation allowing to answer a given problem. Algorithms function as a machine that treat inputs and deliver outputs.

⁴⁵ M. Agar (2001) Another complex step: A model of heroin experimentation. *Field Methods*, 3(13), p.364.

difference, drawn from experience and user accounts, is probably in the right area of validity."⁴⁶ The process consists of interpreting the qualitative findings, then formalizing these latter by using a computational language and finally in observing if the outputs of the algorithms fit with the initial interpretations.

The next step consists in finding a way to formalize the "experience and user accounts" in a comprehensible shape for both social scientists and modelers to be able to examine and judge how these empirical data are transformed into operations. The following subsection (2.1.2) presents the type of formalization used in this thesis.

2.1.2. Modeling with Unified Modeling Language

As previously discussed (Section 1.2), social simulations consist of a simplification of a real social phenomenon. To create such simulations, conceptual models are designed to formally represent the way one researcher understands the targeted phenomenon. In the case of agent-based social simulation, models are implemented in software using a specific programming language. In order to facilitate the transposition of empirical data toward logic statements and to ease the transposition from one implementation to another, the Unified Modeling Language (UML) [159] proposes, through different categories of diagrams, to graphically represent the logic shaping the whole model and its algorithms. UML enables modelers to share their conceptions about the different elements composing the model: it therefore provides a common space for scientists to discuss the different algorithms constituting the simulation. In some senses, using UML allows the modeler to reshape his conceptions of actions/interactions/structure and, therefore, participate in the abductive logic inherent in the modeling and simulation processes.

⁴⁶ M. Agar (2003) *My Kingdom for a Function: Modeling Misadventures of the Innumerate*, JASSS, 6 (3), p. 9.

In the subsequent parts, the different theoretical concepts and empirical findings will be first described and discussed, before being graphically transposed into specific diagrams. Diagrams in part II and III present the final version of the way that actions, decisions, interactions, physiological changes and environmental contexts have been structured and shaped to build the agent-based simulation of this thesis. UML disposes of three main types of diagrams (*structural*, *behavioral* and *interactional*). These diagrams allow modeling at different levels the components of the system and their evolution, actions, and interactions. The following sections will present the overall logic and connections of the different diagrams employed in this work.

2.1.3. Structural Diagrams

Structural diagrams depict the model architecture in its static dimension. The class diagram describes the different type of passive and active objects, named 'classes', constituting the model and their interconnections. Each class diagram contains three boxes. The first one contains the *name* of the class. The second box contains the set of characteristics (named *attributes* in UML) of its agents. Each attribute is associated with a type of variable, which represents the type of value exhibited by this particular attribute. The third box lists the different actions (*operations*) that each instance of a class can undertake. Each operation is linked to a specific behavioral diagram and is activated as a routine or called by other operations.

To clarify this description, consider the example of a researcher who wants to model patterns and responses of individuals having a drink at the pub after work. Amongst all the different characteristics of this population, this modeler may only be interested in a few elements, such as gender, weight, BAC (Blood Alcohol Concentration), alcohol unit(s), money, favorite bars, acquaintances, maximum number of drinks,

travel mode. The modeler may also consider that these pub goers have five main actions relevant to his subject that he names: 'drink', 'consume-alcohol', 'check-drunkenness', 'move-to-favorite-pub' and 'go-back-home'. The individual class is represented in Figure 2.1.

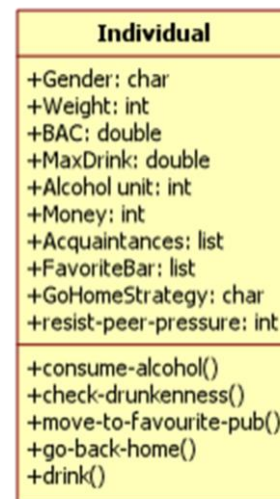


Figure 2.1. Example of Class Diagram

These classes constitute the patterns that allow researchers to create numerous objects sharing the class attributes and operations. These objects are specifications, named 'instances', of their class and are described by their state (set of values related to their attributes), identity (specific name) and behaviors (corresponding to their class operations). If some simulations could be realized with one unique class of agents, social phenomena generally require the interaction of several types of agents and/or objects, and a specification of the environment. In the case of the previous example, modeler could create a "constable" and "pub" classes to complete her model. In that case, modeler specifies in the class diagram the different relations existing between these entities. This structural diagram of this example could be illustrated as below (Figure 2.2):

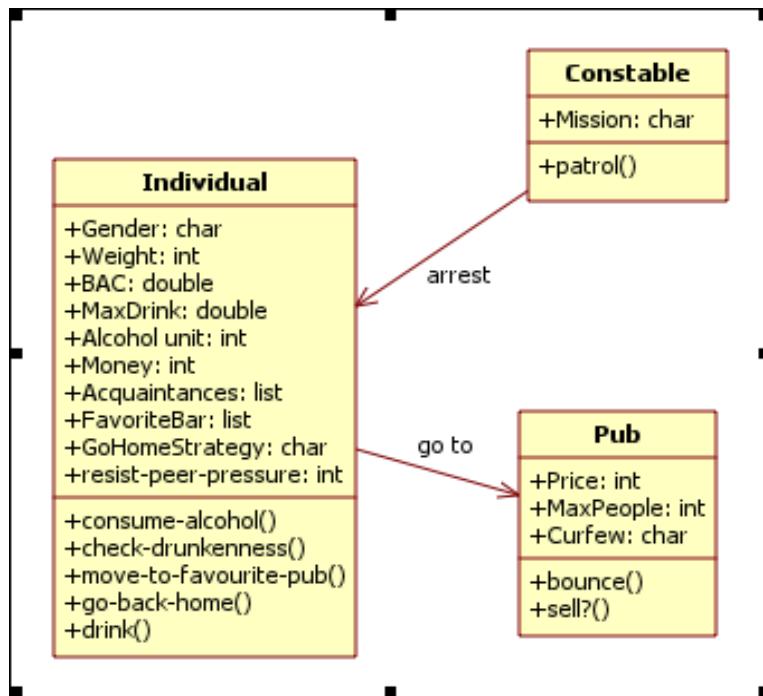


Figure 2.2. Example of relation in a Class Diagram.

The links between classes could have different shapes stipulating the type of relations existing between the two classes. Most of the links used in this research are simple 'associations' (a trait with no arrow) or actions (a trait with an arrow). Any other relations will be introduced directly with the diagrams. It is important to precise that the number or symbols on both parts of the links define the number of agents of each class that can participate to the action or are part of the association.

If class diagrams give a global vision of the different components and interrelations structuring the model, the different actions, interactions and evolutions of classes' agents are generally represented by either state-transitions or activity diagrams, which are presented in the next subsection.

2.1.4. Behavioral Diagrams

This type of diagram consists in abstractions of possible agent's behaviors by describing the different steps of the algorithm's execution. Each agent moves through one or several activities (represented by a

rounded rectangle) linked by transitions (arrows). Each activity could potentially modify one or many attribute's values and/or lead to the execution of other operations. A decision (represented by a diamond) is introduced in the case where the next step of the operation is conditioned by an external parameter and/or on the value of one or several agent's attributes. The following example illustrates what could look like the "check-drunkenness" operation of an individual's agent (Figure 2.3).

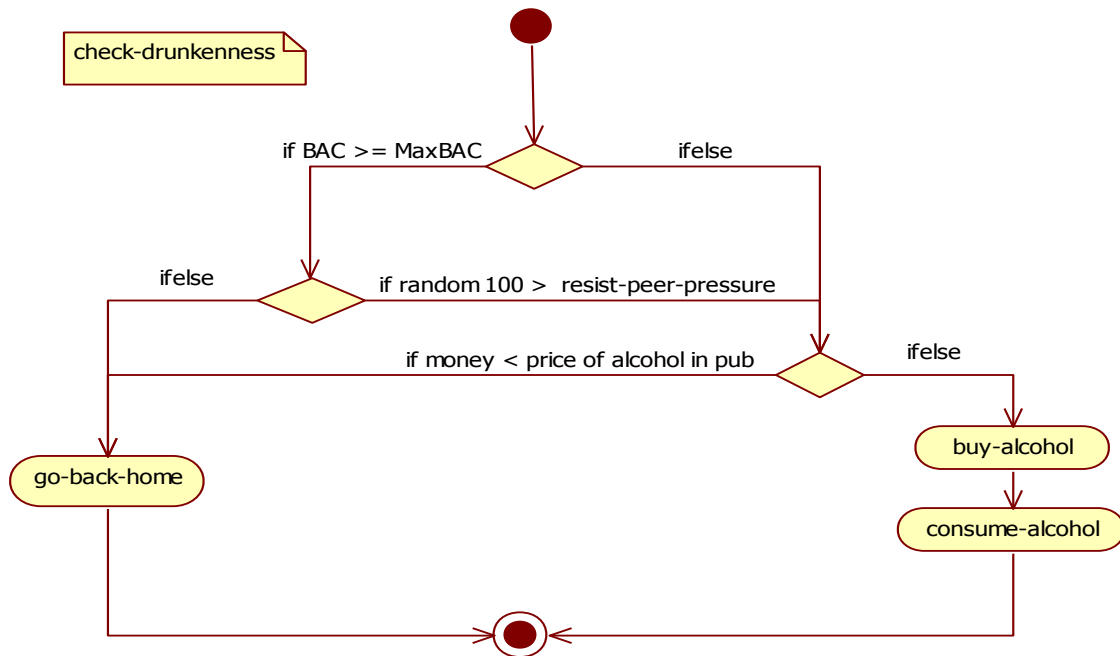


Figure 2.3. Check-drunkenness Activity Diagram.

In this thesis, only activity diagrams will be used. The preference between these two behavioral diagrams lays on the nature of the component affected: state-transitions diagrams describe modifications affecting the state of a particular object, following routinized operations or external events; while activity diagrams organize actions and activities possibly related to many different objects.

2.1.5. Interactional Diagrams

While precedent graphical representations depict the state of the system at a particular point in time, the interactional diagrams aim to create the sequence in which operations of the different types of agents are modeled and executed. *Sequence* diagram are generally designed to achieve this task. This particular diagram represents with vertical lines (called *lifelines*) the interactions between different categories of agents and uses arrows to indicate the direction of the interaction. A rectangular band placed on the lifelines represents the beginning and the end of an activity period and specifies the duration of activity. The sequence diagram of the precedent example could be represented in Figure 2.4.

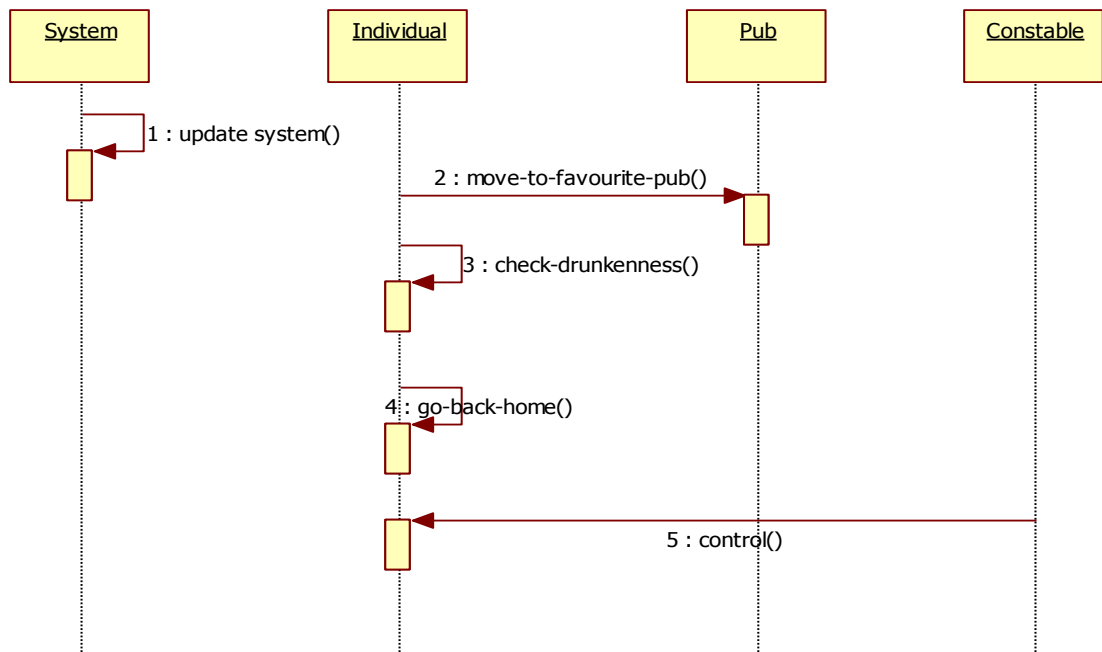


Figure 2.4. Example of Sequence Diagram.

This section (2.1) has examined the modeling method employed in this research to capture the drug career of recreational polyusers and to inform the agent-based model aiming to simulate the behaviors and evolutions of these users. Nevertheless, this proto-model remains

theoretical and needs to be fed, for almost all its parts⁴⁷, with empirical information coming from the users' point of views. Thus, the second part of this research will be dedicated to the empirical investigation and will present the findings to provide a clearer picture on the trajectories of polydrug users. These empirical findings presenting the actions and evolutions of the recreational polyusers will be modeled by using such diagrams. This will permit (1) "filling the blank" of the proto-model in terms of classes' attributes and operations; (2) creating relevant and empirical-based activity diagrams, and (3); ordering, in the logic of the recreational polyusers, these different activity diagrams. The next sections (2.2, 2.3, 2.4, and 2.5) will present the interrelation existing between the drug and the individual levels, or considering the proto-model between the Drug class and the Individual Class.

Throughout the descriptions and analyses of the theoretical basements and recreational polyuser's drug careers, the characteristics essential to the agent-based simulation will be underlined and the user's different practices "translated" into algorithms. This process will favor the dialog between the empirical sociological data and the abductive process of modeling. This will also allow directly justifying the construction of the different algorithms employed in the agent-based simulation. To present the different attributes of the classes' agents, these will be detailed inside a text box as shown by the following example:

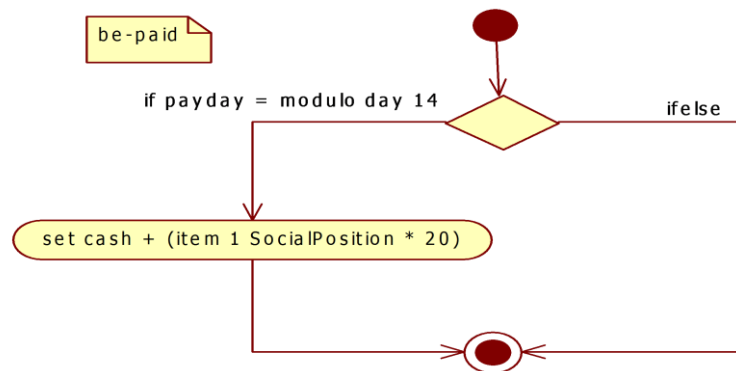
⁴⁷ The "neurologic component" of the model is, unfortunately, not based on empirical data collected in the course of this research.

Example Class X Attribute 1: attribute of the Class X of SimUse
 Type of values: number (integer), characters (char), list, boolean (bool)
 Value: 1...n
 "Attributes"
 (item 0, item 1...item n)
 true/false
 Employed in: describe the different algorithms in which this attribute is employed.

N.B: if the attribute is composed of several elements inserted in a list, each of them appears as "item" followed by a number designating its rank in the list. To be consistent with the NetLogo language used to implement the simulation, the first element will be noted "item 0", the second "item 1", and so on.

In a similar manner, the related algorithms are described via activity diagrams inserted inside a boxed text and are accompanied by short descriptions of the different characteristics involved and of their global functioning, as follows:

Individual Operation 1: be-paid



1. *User* checks if its attribute 'Payday' is equal to the modulo of the actual day of the simulation (in number) divided by fourteen.
2. If yes, the cash attribute of this *user* is increased by twenty times the value of the item 1 of the attribute 'SocialPosition'.
3. If no, the *user* goes to the next step of its routine.

To avoid misconceptions in the following chapters, agents of the different *classes* will be put in italic; the name of the different attributes will be underlined; while the name of **operations** will be put in bold. Therefore, "*users*" refer to real individual, while "*users*" will be used to characterize virtual agents.

These modeling notions are illustrated in the following section (Section 2.2) to formalize the first level of understanding: drug in its neurological aspect. This formalization is based on a description of the different notions of neurosciences inherent in polydrug use.

2.2. Neurological Components:

Neurophysiology, Neurotransmitters and Addiction.

The literature indicates that drug use is the result of the interaction of numerous factors and requires a multidisciplinary approach (Section 1.1). Despite these points, the adjunction of neurosciences to social sciences has rarely been attempted, certainly due to the "paradigmatic distance" between those disciplines. Nevertheless, as claimed by Albert Ogien, the social scientists may draw large benefits from studying and integrating neurosciences to their research:

" [...] sociologist can make a huge profit from neurosciences: allow him to lighten his workload. When the descriptions of the mechanisms of cognition explain phenomena that the body or the brain process independently, it becomes unnecessary to invent [for these phenomena] some social causes. We can certainly assume that these descriptions have little interest to sociologists who are orienting their research toward the global level of society, socialization processes or forms of organizational or institutional activity. I tried to show that the case is different when the sociological analysis considers knowledge as a practical activity engaged in the coordination of joint action, because then knowing precisely what the brain does (and what it does not) allows the researcher to define relevant objects of investigation and to formulate realistic work assumptions. Which is not the thinnest service that cognitive neuroscience may provide [to social sciences]."⁴⁸

⁴⁸ Ogien A., (2010) Normativité sociale et normativité neuronale: la découverte des «neurones miroirs» et ses usage en sociologie, *Revue française de sociologie*, 51-3, p. 688. Translation by the author.

One of the hypotheses of this thesis is that the consumption of psychoactive substances induces specific behaviors and that the repeated consumption changes in the long-term both behaviors and practices of the polyusers (cf. Section 1.4.3). To investigate this hypothesis, several important concepts from neurophysiology and neuropharmacology need to be understood in order to capture the impacts of drugs on the individuals' behaviors. First, this presentation describes the pharmacokinetics of substances, in other words the way drugs are ingested, transported, metabolized, and excreted (2.2.1). Second, the pharmacodynamics (i.e., the action of the active principle on the brain) of the most widely consumed substances will be described (2.2.2). This subsection will also briefly describe the neuropharmacological properties of these substances (2.2.3), as well as the long-term effects of drug use (e.g., *tolerance* and *behavioral sensitization*). Finally, the section 2.2.4 presents the formalization of these different concepts and the neurological “engine” of SimUse.

2.2.1. Neurophysiology and pharmacokinetics

The pharmacokinetics of psychoactive substances involves four basic processes: absorption, distribution, metabolism, and elimination. *Absorption* refers to the way one substance enters the bloodstream. Depending on the route of administration, its chemical form (powder, liquid or solid) and dosage, the drug will reach the bloodstream more or less rapidly and effectively. Drugs of abuse are most commonly administered in four ways: orally (taken by mouth), through mucous membranes (through the nasal mucosa while snorting or sniffing a drug in a powder form), inhaled (absorbed through the lungs as a gaseous form or as particles contained in smoke or aerosol) or parenterally (liquid form injected intravenously, intramuscularly or subcutaneously).

After absorption, drugs are rapidly *distributed* by the circulatory system eventually reaching the brain. However, before influencing neuronal

function drugs must first penetrate the brain by passing through the blood-brain-barrier. Finally, drugs are *metabolized* into smaller molecules, and *eliminated* from the organism through a number of routes. Lungs and kidneys are primary routes of excretion, but bile, sweat, saliva and breast milk can contribute to drug elimination [160].

The pharmacokinetics of each drug depends on the route of absorption and on its chemical properties. An injected drug will reach its maximum plasma concentration immediately, while substances orally absorbed will raise plasma concentrations only after having crossed the lining of the stomach or intestine. Approximately 75% of an orally administered drug will have entered the bloodstream within two hours. Further, the psychoactive drug *half-life* (which is the time for the blood concentration of the drug to halve) is different for every psychoactive compound. At the sixth half-life, 98.4 percent of the drug is eliminated and the organism is considered to be drug free. Therefore, if the half-life of a psychoactive substance, for example morphine, is approximately 4 hours, a morphine user needs 24 hours (i.e., 6 half-lives) to be considered drug free. It is worth stressing here that ethanol is an exception, since it is metabolized at a constant rate every hour. The half-life values of drugs and their neurological characteristics will be discussed directly with the description of user's choices.

2.2.2. Neuropharmacology of substance use: neurons and neurotransmitters

In simple terms, drugs alter the chemical messages sent between neurons in the brain. In order to produce their pharmacological effects, most psychoactive substances bind with specific receptors situated on the surface of neurons. The strength of this binding is determined by the structural similarity, at the molecular level, between the substance and the receptor. The chemical structure of the drug acts as a chemical key. This key needs to fit in the lock formed by the structure of the

receptor: the closer the molecular structure of the drug is to the shape of the receptor, the stronger will be the binding. In neuropharmacology, the *potency* of a substance "is determined by the accessibility of the drug to the receptor and the affinity of the drug to the receptor, as well as the efficacy of the drug at the receptor."⁴⁹ High affinity drugs require fewer molecules to elicit changes in neuron function. The *efficacy* refers to the strength of the effect the substances elicit. Each drug acts on one or several specific receptor types and has a different efficacy, which is expressed as a proportionality constant related to the drug's ability to elicit a response once bound with a neuroreceptor [161]. A drug could be *potent* (kicks in rapidly) but with a limited efficacy over time.

Drugs can be either agonists or antagonists. Agonists activate receptors, leading to changes in neuron function. Antagonists prevent the receptors from being activated by other molecules [161]. How a drug influences brain function depends on the neurotransmitter systems that it influences. Considering the large number of the neurotransmitters, this section will only review and describe the neurotransmitters and the pharmacodynamics of the psychoactive drugs the most commonly used. These are: alcohol, cannabis, cocaine, MDMA-type, heroin, amphetamine-type and serotonin-like psychedelic drugs (LSD and "magic mushrooms").

Dopamine (DA) belongs to the catecholamine class of neurotransmitters. It is involved in feelings of reward, self-confidence, talkativeness and happiness [162]. However, it is also considered one of the key-factors that trigger craving, addiction [163, 164] and schizophrenia [165]. Low levels of dopamine are generally accompanied by dysphoria, anhedonia, attention disorders [166] and aggressive behaviors [167]. Damage to the dopaminergic system causes cognitive and psychomotor impairments, Parkinson's disease, and loss of control [18].

⁴⁹ Feldman R.S., Meyer J.S. & Quenzer L.F. (1997) *Principles of Neuropsychopharmacology*, Sinauer Associates, Massachusetts, p.14.

Endocannabinoids (**EnCa**) are the main neurotransmitters impacted by cannabis. These neurotransmitters induce an analgesic effect, sensation of well-being, decreases in body temperature and potentiates opioid effects [168]. Once activated, EnCa inhibits the release of other neurotransmitters (mostly norepinephrine, GABA and glutamate) [169]. Long-term exposure can disrupt the consolidation of short-term memory [170].

Opioid Peptides (**OP**) are small peptides (enkephalins, endorphins and dynorphins) involved in the pain perception system. Opioids act through three different receptors: μ , δ , and κ [161]. Normal doses of endorphins generate a feeling of analgesia and deep relaxation [171], while high doses reduce respiratory functions [172]. The activation of μ receptors induces feelings of analgesia and depression of the respiration function than both δ and κ receptors. The antagonist action of opiates on inhibitory GABAergic neurons receptor disinhibits the release of dopamine in the brain inducing a feeling of reward and happiness. Indeed, Koob [173] suggests that these opioid peptides are potentially responsible for the hedonic sensations, and thus, may be involved in the reward-learning process. Conversely, the depletion of these opioid peptides leads to the absence of normal pain regulation and thus, to intense ache sensations. Opioid withdrawal increases the GABA level and provokes a decrease of glutamate in the ventral tegmental area, a reduction of the dopamine release, and feelings of depression and dysphoria [174].

Gamma-Amino-Butyric Acid (**GABA**) is an amino acid neurotransmitter present in most of the neurons constituting the brain. GABA is involved in all aspects of brain function: it is the principal inhibitory neurotransmitter in the brain reducing and regulates the activity of other neurons and neurotransmitters [175]. At normal levels GABA has

a relaxant and anxiolytic effects [176], but higher doses cause drowsiness and motor impairments [177].

Glutamate (**Glu**) is also an amino acid, the main excitatory neurotransmitter in the brain. It is involved in all aspect of brain function, including movement, language, learning, and memorization [178, 179]. At higher concentrations, glutamate can induce "excitotoxicity", impairing or killing neurons [180].

Norepinephrine (**NE** or *noradrenaline*) belongs to the catecholamine class of neurotransmitters acting through specific receptors (α and β adreno-receptors). It produces a host of changes including increasing arousal and attention, increasing body temperature, motor activity [181], respiration rate, blood pressure [160]. It also activates glucose release from the liver [182]. This transmitter is also implicated in the decision-making process. A large dose or long-term activation of NE receptors in the brain is frequently followed by acute insomnia.

Serotonin (5-HydroxyTryptamine, **5-HT**) is a monoamine neurotransmitter involved in mood regulation, sleeping cycles and thermoregulation. There are seven subfamilies of receptors (from 5-HT₁ to 5-HT₇) in the brain, each of them is declined into several subtype (such as 5-HT_{2C} or 5-HT_{1D}). Drugs the most widely consumed affect several of these receptors subtypes, but two of them concentrate the essential of the effects imputed to psychoactive drugs: **5-HT_{1A}** and **5-HT_{2A}**. Mild enhancement of 5-HT_{1A} receptors brings euphoria and a sentiment of happiness. 5-HT_{1A} is also implicated in prosocial behavior [183]. Conversely, depleted serotonin levels are generally correlated with feelings of depression and aggressive behaviors [184-186]. Psychedelic drugs (e.g. LSD, mescaline, "magic mushrooms") are strong agonists of the 5-HT_{2A} levels. Large concentrations of 5-HT_{2A} lead to disorientation, confusion, and visual hallucinations [187]. More importantly, the "serotonin syndrome" or "serotonin toxicity" due to excess of

serotonergic agonist in the CNS induces delirium, neuromuscular rigidity, and hyperthermia that could be lethal [188, 189].

In Table 2.1, the most used psychoactive substances are described both in terms of the neurotransmitter systems they influence and half-life of each compound [160, 161].

Table 2.1. Half-life and impacted neurotransmitters for psychoactive substances.

<i>Substance</i>	<i>Neurotransmitters impacted</i>	<i>Half-life</i>
Alcohol	Dopamine++; Cannabinoid+; OpioidPep+; GABA++; Glutamate--; Norepinephrine+; 5-HT _{1A} +	0.15g/hour
Cannabis	Dopamine+; Cannabinoid++; GABA _A -; Glutamate-; Norepinephrine-	1 hour
Cocaine	Dopamine+++; Glutamate+; Norepinephrine+; 5-HT _{1A} ++	30-90 minutes
MDMA-type	Dopamine+; Norepinephrine+; 5-HT _{1A} +++; 5-HT _{2A} +	8 hours
Heroin	Dopamine++; OpioidPep+++; GABA-; Norepinephrine--, 5-HT _{1A} +	< 10min.
Methamphetamine	Dopamine++; Norepinephrine+++; 5-HT _{1A} +	12 hours
Amphetamine	Dopamine+; Norepinephrine++; 5-HT _{1A} +	12 hours
LSD	5-HT _{2A} +++	4 hours
Psilocybin	5-HT _{2A} ++	4 hours

The + and - attached to the neurotransmitters indicate if the substance has an agonist or antagonist action on the targeted neurotransmitters. The number of these indicators gives a qualitative indication concerning the intensity of the substance action on the neurotransmitter's receptors. However, the exact quantitative intensities are unknown and appear difficult to calculate.

2.2.3. Neurophysiological concepts: synaptic plasticity and behavioral sensitization

In the long-term, drugs act as "behavioral reinforcers" progressively altering the normal function of the brain. Indeed, psychoactive substances elicit the release of supra-physiological amounts or inhibit the normal functioning of neurotransmitters in several brain regions. These amounts promote a form of "over-learning" altering the normal responses of the brain that gradually adapt to such repeated stimuli [160].

Robinson and Berridge [190] through their *incentive-sensitization theory* assert that repetitive and intermittent administration of drugs leads to a "sensitization" of the psychomotor functions, which in turn renders the brain reward systems hypersensitive to drugs and drug-associated stimuli. Once this hypersensitivity is established, the brain reward systems mediate what these authors call an "incentive-salience". This is resulting in a transition from a subjective form of pleasure (drug "liking") to a compulsive form of consumption (drug "wanting"). This incentive-salience can lead individuals to exhibit unconscious drug-oriented behaviors and compulsive drug use [9, 191-193]. However, drugs that do not stimulate the psychomotor system (such as, alcohol or opiates) remain highly addictive substances, which impair the generalizability of the incentive-sensitization theory. But these drugs will influence reward systems and produce "hypersensitivity" in them.

The role of dopamine in the development of addiction was first examined and conceptualized by Wise, who proposed a *mesolimbic dopamine reward* hypothesis of addiction [163]. Based on the fact that dopamine antagonists block the sensation of reward associated with drugs, it was proposed that reward is inextricably linked to the activation of dopamine neurons in the midbrain. Moreover, research by Schultz and Ljunberg have demonstrated that dopamine neurons are

more activated by stimuli predicting reward than by receiving the reward [194, 195]. Based on these results, Wise concluded that midbrain dopamine system is both involved in reward function and in anticipation of reward ("craving"), reinforcing the role of dopamine in addiction [164]. In other words, the action of dopamine is twofold: it provokes hedonic feelings and participates in the formation memories of these sensations. Kalivas & Volkow [196] specify that the glutaminergic system takes part in the construction of memory and could, therefore be cause for relapse in the long-term. Hence, dopamine initiates the reward feeling and participates to the learning process of these sensations through "neuroplasticity".

This *synaptic plasticity* involves three mechanisms: (1) modifying the strength or efficacy of synaptic transmission, (2) eliciting the growth of new synaptic interconnections, and (3) modulating the excitability of individual neurons [197]. These changes are central to development of drug *tolerance* [198]. Tolerance refers to a progressive decrease in the neural responsiveness to a substance. Individuals who have developed a tolerance need to consume larger doses of the drug to obtain the same effect. Tolerance is seen as the result of (1) more enzyme are created to metabolize the substance and (2) neurons adapt by reducing the number of receptors available and/or their sensitivity to the drug. The regulation of receptors in response to repeated drug administration means that tolerance to one drug could produce neural responses to other substances acting on similar receptors. This *cross-tolerance* can explain the lack of effects perceived by polyusers while trying new drug or during the medical treatment of drug abusers [199, 200].

Augmentation of doses due to tolerance is accompanied by an increase of side effects. This evolution of positive effects/negative side-effects has been conceptualized by Solomon as the "Opponent-Process" theory [201, 202]. The opponent-process has been for a long time the main explanation for tolerance and withdrawal. This theory is based on the

hypothesis that the brain disposes of many affect control mechanisms. These mechanisms counterbalance any stimulation by sending an inverse message reducing the intensity of hedonic feelings in order to maintain *homeostasis*⁵⁰. On a single use time scale, opponent-process could be described as a succession of two processes: (1) an *a-process* that corresponds to the neurobiological response to an arousing stimulus and, (2) a *b-process* that, when the effect of the *a-process* wears off, sends a negative signal equaling the intensity of the *a-process*. In the case of addiction, Solomon [201] claimed that tolerance and dependence are inextricably linked. They asserted that over the course of stimulation, the hedonic intensity of the *a-process* slowly declines while the *b-process* becomes larger and longer. Finally, the *b-process* masks the positive effects and benefits of the *a-process* (Figure 2.5). At an advanced stage of dependence, the *b-process* constitutes a negative affective state with large side-effect symptoms impairing the normal life of users.

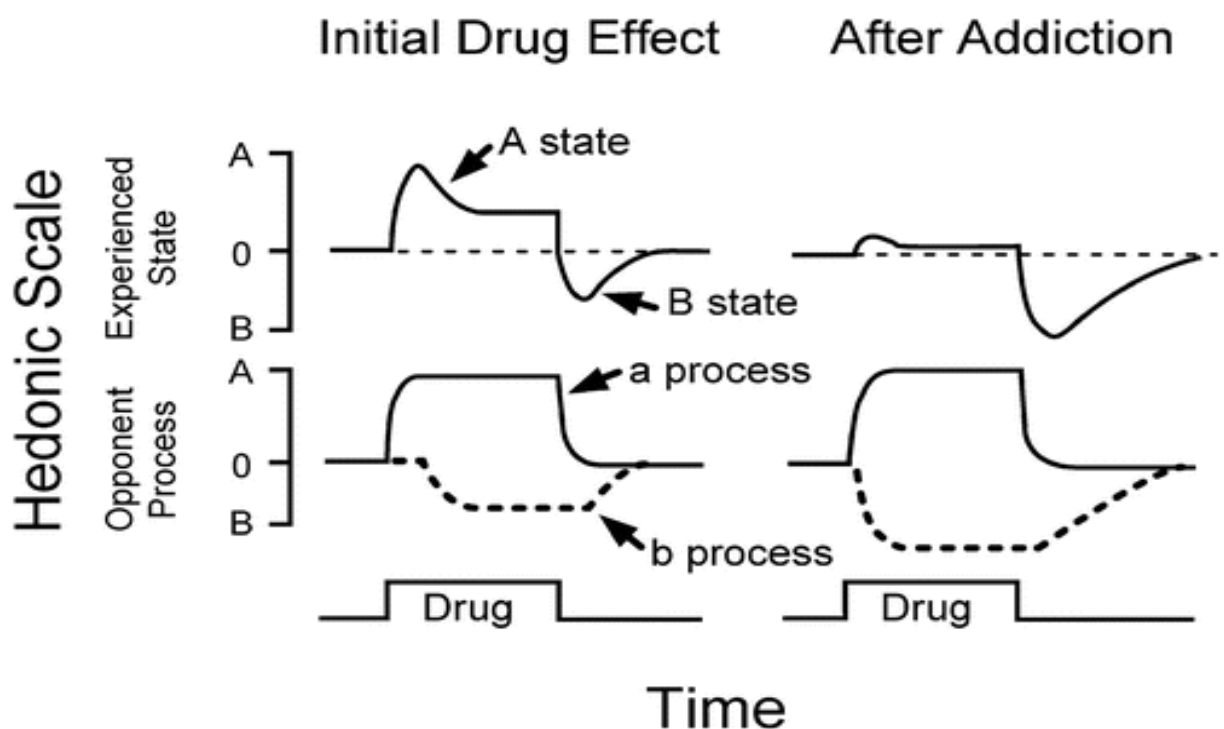


Figure 2.5. The evolution of the standard responses to repeated intake of drugs through Opponent-Process theory.

⁵⁰ Homeostasis is the property of a system or an organism to maintain its interior environment into stable and constant conditions despite external stimuli.

Further, Koob and LeMoal [203] have stated that following iterative and prolonged administrations of substances (resulting in a series of *a* and *b*-processes) reward thresholds fail to return to their baseline levels. This elevation of reward set point results in a chronic change in the global reward system named *allostatic view of neurotransmitter neuroadaptation*. According to this one, the *b*-process not only gets longer and larger with substance intakes, but the reward baseline from which both *a*-process and *b*-process are anchored shift downward. This produces a permanent change in neurotransmission homeostasis, or "allostatis" (Figure 2.6) [203, 204]. Koob & LeMoal hypothesized that allostatic neuro-adaptation is common to all drugs of abuse and affects the different neurotransmitters involved in the effects of psychoactive substances. Indeed, several neurotransmitters (GABA, opioid peptides, dopamine, but also Corticotropin Releasing Factor (CRF), and neuro-modulators NeuroPeptides Y (NPY)) see their normal baseline affected by the same allostatic mechanism [203].

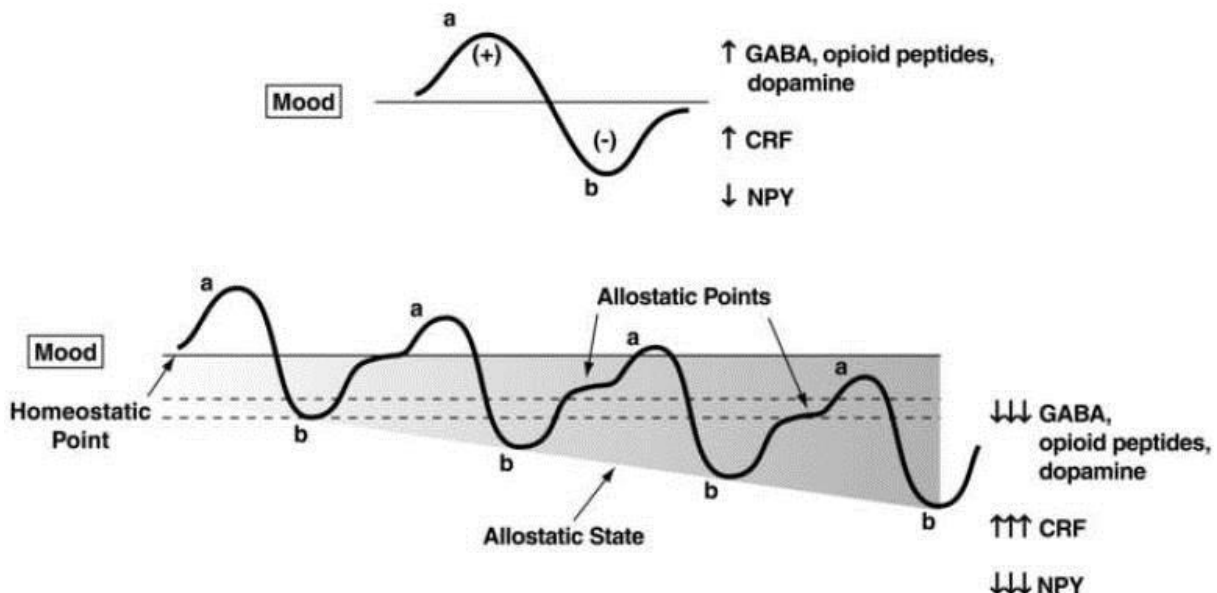


Figure 2.6. Evolution of the homeostatic point of neurotransmitters according to the Allostatic Neuroadaptation of Neurotransmitters Theory [203].

Overall, each psychoactive substance impacts one or several neurotransmitters receptors, inducing specific effects. The positive effects felt

are followed by inverse effects equal in intensity. The duration of these effects mainly depends on the half-life of the substance(s) administered. Prolonged intake leads to an increase in the "reward threshold" asking increased dosage for the user to feel positive effects. These higher dosages also induce larger comedowns with acute negative effects, which in return can impact the daily life of users. These different neurological mechanisms need to be integrated in the simulation in order to capture the impacts of the different psychoactive substances on the actions and trajectories of the recreational polyusers.

2.2.4. Modeling the neurology of recreational polydrug usage: SimUse's "NeuralBox" and 'Drug' class

This last sub-section describes the virtual "brain" of *individuals* that aims to model and simulate the actions of psychoactive substances on the brain of users or, considering the proto-model, the interactions between the *drugs* and *individuals*. This drastic simplification of the human brain's functioning during drug intoxication is based on theoretical data and not based on any existing experiments. Indeed, despite the significative progress achieved in the last few decades, most of the neuro-pharmacological and neurophysiological literature concerning drug use targets the effect of a single substance on the brain and the neuroscience literature regarding the effect of polysubstances use remains scarce. The verification of this neurological model, which will be extensively discussed in Section 7.3.4, has been effectuated by comparing expected outputs (i.e., generated by the simulation) with theoretical data (i.e., that correspond to scientific information).

The main objective of the neurological "engine" is to account for the behavior exhibited by *users* while under the influence of one or several of these substances. This simplification aims to partially reproduce the functioning of the human *prefrontal cortex*. This particular region of the Central Nervous System (CNS) and several of its surrounded areas is

implied in a large variety of cognitive functions. Indeed, the different regions of the prefrontal cortex are the siege of behaviors control, motivational and affective processes, decision takings, social behaviors, autonomous functions, mood control, memory, inhibition, language, or reward oriented actions [205, 206].

Amongst the large panel of drugs available on the drug market, SimUse will integrate the nine psychoactive substances the most commonly consumed in "western" societies (Section 2.2.2). To model the interactions between these drugs and recreational polyusers, the two classes in charge of representing both *drugs* and *users* need to exhibit common attributes. Considering that drugs act on the human brain through neurotransmitters, both *drug* and *individual* will have a list of the main eight neurotransmitters' receptors. These latter have already been presented in Section 2.2.2, in combination with the different behavioral changes that can be induced by the consumption of one or several of substances. Therefore, the functioning of the NeuralBox consists in treating the *drug*, the inputs, and producing Behaviors, the outputs as depicted in Figure 2.7.

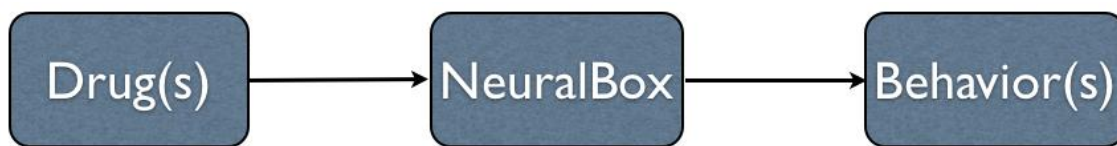


Figure 2.7. NeuralBox functioning

To do so, the model must be able (1) to quantify effects of drugs on each neurotransmitter's receptors, and; (2) to "produce" behaviors induced by substances and exhibited by the *users*.

Concerning (1), this asks to characterize the action of each virtual *drug*. To do so, each of these ones will carry a set of eight indicators characterizing the way they impact the corresponding eight neurotransmitter's receptors.

Drug Attribute 1: NeuralAction
 Type of values: list of eight elements (DA_{2A}, CB, OP, GABA_A, Glu, NE, 5-HT_{1A}, 5-HT_{2A})
 Value: decimal value from 0.9 to 1.2
 Employed in: define-NeuralAction

The items' values for each of the *drugs* modeled are indicated in Table 2.2.

Table 2.2. Drugs corresponding Neurotransmitters values.

Substance /Receptor	DA _{2A}	CB	OP	GABA _A	Glu	NE	5-HT _{1A}	5-HT _{2A}
Alcohol	1.08	1.02	1.02	1.07	0.94	1	1.03	1
Cannabis	1.05	1.07	1.02	1.08	0.95	1	1.02	1.01
Cocaine	1.18	1	1	1	1.1	1.08	1.1	1
Ecstasy	1.12	1	1	1	1.06	1.09	1.12	1.02
Heroin	1.16	1	1.2	1	1	1	1.03	1
Methamp.	1.12	1	1	1	1.08	1.16	1.12	1
Speed	1.06	1	1	1	1.1	1.14	1.04	1
LSD	1	1	1	1	1.06	1	1	1.14
MagMush	1	1	1	1	1.04	1	1	1.1

These values reproduce the actions of *drugs* accordingly to their neuropharmacology (cf. Table 2.1). Nevertheless, the intensity of their actions is unknown to the best of our knowledge (there are no numerical neurological data comparing these intensities). Therefore, these values have been set arbitrarily, but in consideration of the information related to each substance [160, 161]. For example, the value 1.08 for the DA_{2A} reflects how alcohol could produce a mild happiness and euphoria; while, the same neurotransmitter value for

cocaine is set to 1.16 because this drug has a greater affinity to the Dopamine neurotransmitter's receptors.

It has to be noted that all these drugs (except the hallucinogens) participate to the release of dopamine in the prefrontal cortex. Dopamine release induces a sensation of pleasure and reward, but is also a vector for tolerance and addiction (Section 2.2.2). The repeated consumption of substances will have a cross impact on the dopaminergic system, which could lead to an increase risk of addiction, as in the case of the combined use of alcohol and cocaine [207], and the willingness to consume. This particularity of the dopaminergic system has been reproduced in the simulation by the creation of the Global-Stage attribute. This was initially designed as a reinforcer increasing the frequency and quantity of consumption.

Individual Attribute 1: Global-Stage

Type of value: integer

Values: from 1 to 7

Employed in: update-stage
check-days

The Global-Stage is fixed depending on the difference between the value of Dopamine at the creation of the agent minus the actual value of Dopamine in the brain of the agent (cf. below).

Drug's half-life is the second main attribute of substances that could directly impact the drug's action duration and, therefore, the neurologic components of *users* in the simulation.

Drug Attribute 2: Half-life

Type of values: decimal

Value: from 0 to 1

Employed in: all "comedown" algorithms

The value is based on the equation $D_t = D_0 - (1/2)^{t/h}$, where D_t is the remaining dosage, D_0 is the initial dosage before the period t and h is the half-life of the substance.

Concerning (2), to mimic the impact of these neuro-transmitters on the behavior of agents, the *individuals* require a specific attribute:

Behaviors. This attribute bears a set of four groups of four different possible behaviors that agents could display in the simulation.

Individual Attribute 2: Behaviors

Type of value: list of character

Values: "Normal"; "Sedated"; "Aggressive"; "Anxious"; "Erratic"; "Depress"; "Energetic"; "Hallucinate"; "Happy"; "Psychotic"; "Prosocial"; "Relax"; and "Slow".

Employed in: check-Brain-Intake

check-Brain-ComeDown

check-Others-Behaviors

check-Self-Behaviors

all consume-drug algorithms

get-back-home

come-down

As indicated during the description of the different neurotransmitters (Section 2.2.2), the amount of the different neurotransmitters in the brain will produce one or more behavioral responses and will engage several neurophysiological and physiological reactions. It is proposed here to model the behaviors display by the virtual *individuals* as being outputs of these different neurotransmitters' levels. Before getting to the description of these various behaviors, the formal functioning of the virtual brain and its evolution throughout the "trajectory" of agents need to be discussed and detailed.

According to the *Allostatic Neuroadaptation of Neurotransmitters* theory of Koob and LeMoal (cf. Section 2.2.3), the recurrent exposure to similar psychoactive substances induces tolerance, consisting of an augmentation of the "reward threshold" that users need to attain through their consumption in order to obtain expected effects. Tolerance is generally followed by an increase in the frequency or dosage of intakes, and, conversely, by an increase of the comedown negative feelings and neurophysiologic impacts. Hence, to be as realistic as possible, SimUse needs to reflect:

- (1) The effects (behavioral changes and physiological reactions) of drugs during the intake;
- (2) The inverse effects generated by the comedown;
- (3) The evolution of the "reward threshold", and;
- (4) The global evolution of the different levels of modeled neurotransmitters.

To model these four points, the agent's neurophysiology is represented by five different neurotransmitters' indicators. These sets of indicators represent the state of *individual's* eight neurotransmitter levels at different moments of their consumption and daily-life:

- 1) Initial-NeuralBox (INB): this set of values indicates the different levels of neurotransmitters agents are created with;
- 2) Normal-NeuralBox (NNB): this indicator corresponds to the level of neurotransmitter at the beginning of the virtual time step;
- 3) NeuralBox (NB): this level represents the updated level of neurotransmitters during intake;
- 4) Tolerance-Threshold (TT): this threshold indicates the quantity of neurotransmitters required to achieve drug's positive effects;
- 5) NeuralBox-ComeDown (NBCD): this indicator designates the magnitude of the inverse reaction that the *users* will face once the effects of the drug(s) have worn off. This level also aims to represent the time needed for the different neurotransmitters' receptors to recover their normal levels.

Individual Attribute 3: Initial-NeuralBox (INB), Normal-NeuralBox (NNB), NeuralBox (NB), Tolerance-Threshold (TT), and NeuralBox-ComeDown (NBCD)

Type of value: list of eight items (DA_{2A}, CB, OP, GABA_A, GLU, NE, 5-HT_{1A}, 5-HT_{2A})

Values: decimal numbers with a range from -10 to 10

Employed in: check-brain-Intake

check-brain-ComeDown

rest

all "consume" algorithms

all "come-down" algorithms

The value of Initial-NeuralBox will not change throughout the simulation. This value is based on a Normal law with a mean of 1 and a standard deviation of 0.25. The Normal-NeuralBox, NeuralBox and NeuralBox-ComeDown are initially set with the values of the Initial-NeuralBox.

The Tolerance-Threshold corresponds to the value of the Normal-NeuralBox plus 1%, to represent the margin that needs to be reach in order to trigger behavioral response(s).

The value serving to define the Global-Stage (cf. above) of the *user* corresponds to:

$X = \text{item 0 InitialNeuralBox} - \text{item 0 NeuralBox}$.

These values are as followed:

Global-Stage 1: $X < 0.2$

Global-Stage 2: $0.2 \leq X < 0.4$

Global-Stage 3: $0.4 \leq X < 0.6$

Global-Stage 4: $0.6 \leq X < 0.8$

Global-Stage 5: $0.8 \leq X < 1$

Global-Stage 6: $1 \leq X < 1.3$

Global-Stage 7: $X \geq 1.3$

The Figure 2.8 represents the modeling of one neurotransmitter level at different moments of a substance administration. The violet curve represents the impacts of a large dose of substance; while the blue curve describes the changes generated by a small dose of the same substance.

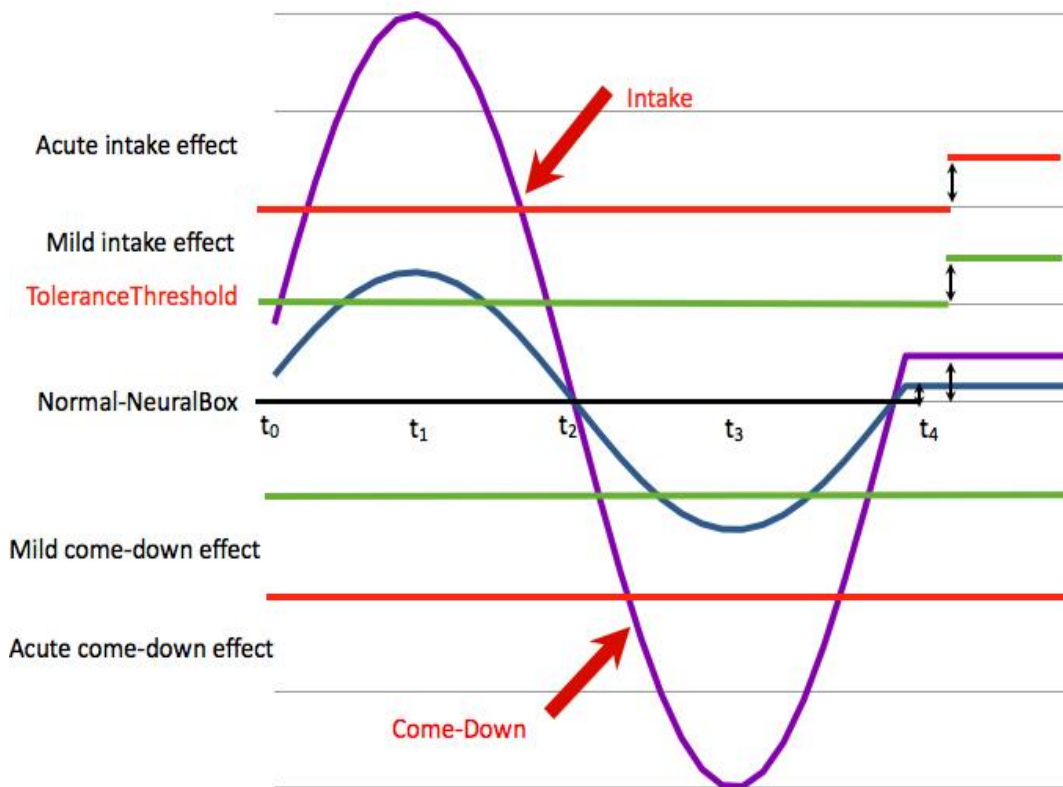


Figure 2.8. Evolution of the Neurotransmitters' Levels.

At initiation (t_0), the Normal-NeuralBox level presents the level of the neurotransmitter just before drug' absorption. The point t_1 corresponds to the moment where the drug reaches the maximum plasma concentration in the brain. In the case of a small amount of substances (blue curve), this dosage stimulates the release of enough neurotransmitters for the Tolerance-Threshold to be attained.

In SimUse, one unit of substance corresponds to the average "street" dose weights as presented in the institutional reports [129, 208] and in the empirical material collected for this research.

These values are displayed as follows:

- Alcohol: one Standard Drink (SD) equivalent to 10 grams of pure ethanol;

- Cannabis: one gram, but the empirical data show that one gram represents between three to six cannabis cigarettes. Therefore, one unit of Cannabis in SimUse corresponds to a fifth of a gram;
- Cocaine: one gram, which constitutes approximately 3 to 6 lines [78]. In the model, one unit represents 0.2g;
- Ecstasy: one pill, however, the purity of MDMA in pill varies too importantly to specify the exact dosage of the active ingredient ingested by user with each intake. In SimUse, one unit of ecstasy represents one pill;
- Heroin: on "cap" equivalent of 0.2 gram, which corresponds to the one of Heroin in the model;
- Methamphetamine: one "street deal" or 0.1 gram (same value in the model);
- Speed: one "street deal" or 0.1 gram (same value in SimUse);

Concerning LSD and psilocybin, the quantity and potency of what is considered as one dose varies too widely for being precisely determined. Users generally refer to half a tab or one tab of LSD and half a portion (5 grams) of a full portion (10 grams) of magic mushrooms when describing their intake.

It is difficult to grasp the exact purity of illicit substances. SimUse does not integrate the purity as an attribute of the *drug*, mainly because the exact process of adulteration operated by real drug dealers, and the exact quantity of active ingredient in the substances, remains unknown. However, the purity of the substance could be modified in the model by the means of the NeuralAction of the *drug* class (cf. Table 2.2). Indeed, by increasing or decreasing proportionally the items of this attribute, changes in the purity can be reproduced: a drug would be more potent, so purer, if the elements of NeuralAction are increased and, conversely.

Nevertheless, the quantity or the purity of drug absorbed is not the only factor influencing behavioral and physiological reactions. As pointed

above (Section 2.1.3), the neuro-adaptation induced by repeated and prolonged consumption reduces the capacity of neurons to release neurotransmitters, generating physiological reactions and behavioral responses. To reflect this neuro-adaptation, the Tolerance-Threshold is increased proportionally to the Normal-NeuralBox. In other words, the higher the Normal-NeuralBox, the higher will be the Tolerance-Threshold. This, in turn, asks the *user* to increase their intake in order to obtain similar effects. These increases of dosage are transposed in the model by a set of "Stages" that characterizes the adaptation of the agent's brain to the different substances. The different elements of the Stage indicate the minimal dosages that the *user* needs to consume in order to obtain positive effects. These Stages are based on the weekly frequency of consumption: the more a *user* consumes of a particular substance during the virtual week, the higher will be its neuro-adaptation, and so, its future drug consumption.

Individual Attribute 4: Stages

Type of value: list of 9 integers

Values: from 1 to 7

Employed in: update-stage

check-preferences

all "consume" algorithms

all "come-down" algorithms

all "buy" algorithms

There is a value for each *drug*. The Stage values appear as follow: [Alcohol, Cannabis, Cocaine, Ecstasy, Heroin, Meth, Speed, LSD, MagMush]. The attribution of the Stage values has been fixed accordingly to the week-base frequency of consumption and is described in 7.1.2. It has to be noted that *user* with a low SocialStatus value (SocialStatus < 8) and a Cocaine, Heroin or Meth Stage greater to 5 will display the "Injector" Archetype. This archetype has a main impact on the **consume** operation and potentially on the Health and

In Figure 2.8, the *user* consuming a small quantity of the substance will feel the different "Mild-Intake" effects induced by the pharmacology of the drug (these effects are described in Table 2.2. The higher dosage (violet curve) largely exceeds the Tolerance-Threshold leading to adverse over dosage related effects, named "Acute-Intake" effects. The

calculation of each value of the NeuralBox increases at t_1 is based on the following equation:

$$(1) \text{NB}_{t1} = \text{NNB}_{t0} + (\ln X * (S_x + 1)^\mu)$$

- X corresponds to the NeuralAction value of the substance ingested (cf. Table 2.2). These values are set to their natural logarithm to create a value small enough to match the difference between the NeuralBox and the ToleranceThreshold (which is generally equal to 0.01);
- S_x is the substance's stage of the agent;
- and, μ is a constant with a value of -1.35.

This μ constant aims to mimic the exponential quantities *users* need to ingest in order to palliate the tolerance they develop as a result of their repeated intakes. The μ constant allows reducing the drug's behavioral changes on *users* with a high substance Stage, while *users* with low Stage will experience larger effects. By using this process, *users* having a long history of consumption on a particular drug will need more of this substance to reach the Tolerance-Threshold, and, conversely, a single dose of the same drug will induce important effects for occasional or beginner *users*. The value of this constant has been chosen based on the generated behaviors *users* of different Stages should experience with a single unit of the substance. For example, a *user* of Stage 1 should feel the effect of unit of Alcohol (mild euphoria and relaxation feeling) while a *user* of Stage 3 should not (cf. Section 7.3.4).

It has to be noted that substances with half-life exceeding two hours (Cannabis, Ecstasy, Meth, Speed, LSD and Magic mushrooms) continue to impact the levels of the NeuralBox until they get completely metabolized. To mimic the impacts of these specific substances on the different level of the NeuralBox, an attribute "memuse-intake" is created for *users*. This attribute represents one of the several memory counters

of these agents. Memuse-intake lists the quantities of each substance consumed by the *user* in the precedent step of the simulation.

Individual Attribute 5: memuse-intake
Type of value: list of nine items
Values: integer
Employed in: check-brain-intake
 all "consume" algorithms
 all "come-down" algorithms

The values of each item of the list is updated every steps and mainly depend on the "metabolize" value of the related-Drug.

Furthermore and as pointed above (Section 2.2.2), high amounts of neurotransmitters in the brain could entail physiological and psychological damages. This is especially the case for excess of Glutamate, but also in the case of excessive amounts of Serotonin [209] and Dopamine [210]. To model such impact, two sets of values, regrouped under the name of Health and Sanity, will represent the *users*' "physiology" and "psychology" in the simulation.

Individual Attribute 6: Initial-Health, Normal-Health, and Health
Type of value: integer
Values: from 0 to 100
Employed in: check-health
 check-brain-intake
 check-brain-ComeDown
 hazardous-acts
 treat
 rest
 brawl
 check-means

The Initial-Health value represents the value of the attribute at the creation of the *user*, which is randomly chosen in the range of a Normal law with a mean of 70 and a standard deviation of 5. The Normal-Health corresponds to the value of that attribute at the beginning of the virtual day, and; Health represents the physiological characteristic of the *user*. As it could be expected, *user* with a Health value of 0 dies, runs the **deceased** operation, and moves to a specific location ("Morgue").

Individual Attribute 7: Initial-Sanity, Normal-Sanity, and Sanity

Type of value: integer

Values: from 0 to 100

Employed in: check-Sanity

hazardous-acts

treat

rest

check-means

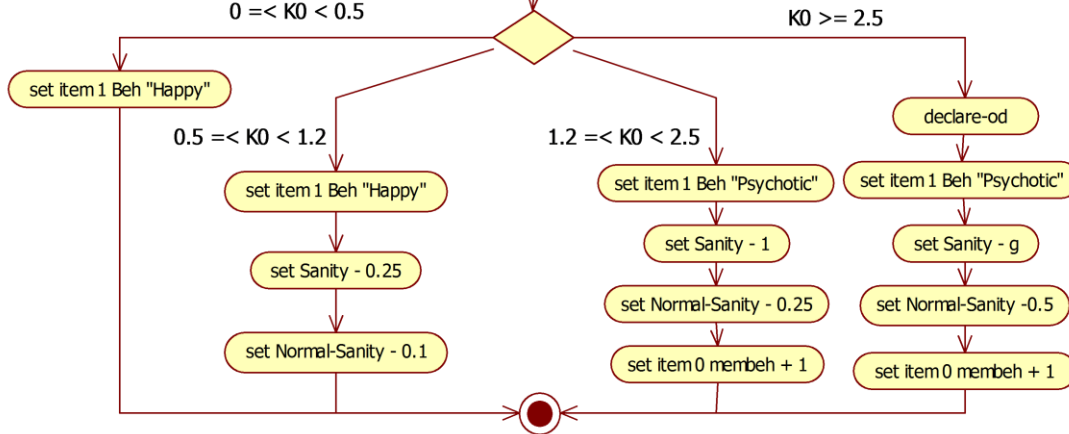
This attribute represents the psychological equivalent of Health and follows the same pattern. The Initial-Sanity value is also randomly chosen in the range of a Normal law with a mean of 70 and a standard deviation of 5. Normal-Sanity defines the Sanity value at the beginning of the virtual day, and; Sanity corresponds to the evolving psychological attribute value. If the Sanity of a *user* falls to 0, this agent suffers from a permanent mental trouble, runs the **commit** operation and moves to a specific location ("Sanitarium").

Once the different values of the NeuralBox at t_1 are calculated, these values are imputed in the **check-brain-Intake** method. Based on the values of the NeuralBox, Normal-NeuralBox and Tolerance-Threshold, this operation will determine which kind of Behaviors *users* exhibit and in which extent their consumption(s) could affect their Health and Sanity. The Behaviors values have been implemented based on the neuroscience literature and on the empirical material collected (cf. Part II). This **check-brain-Intake** operation goes through all the NeuralBox items to evaluate the effects of *user* intake(s). The following activity diagram displays the outcomes of the **check-brain-Intake** for the Dopamine neurotransmitter:

Individual Operation 2: check-brain-Intake (Dopamine)

Check-Dopamine-Intake

NNB: NormalNeuralBox attribute
 NB: NeuralBox attribute
 TT: Tolerance-Threshold attribute
 Beh: Behavior attribute
 MemBeh: membehavior attribute
 Kx: item X NB - item X TT
 g: item X NB - (item X TT + 1.2)



The value Kx represents the intensity of the intake effects. The higher the intensity, the more likely the *user* will experience detrimental effects.

The activity diagrams concerning the other neurotransmitters are presented in the Annex 1.

Note that when the value of one neurotransmitter level exceeds greatly the Tolerance-Threshold level, *users* are exposed to important adverse effects, which could lead agent to display undesired behaviors (Section 5.3). *Users* remember the consequences of these neurological excesses through the different items of the membehaviors attribute. This attribute serves as memory for the *users*, who may modify their drug consumptions in order to not repeat these adverse effects (Section 6.2.3). The membehaviors attribute could be presented as follows:

Individual Attribute 8: mem-behaviors

Type of value: list of 6 items

Values: integer

Employed in: check-rules

detoxify

check-believes

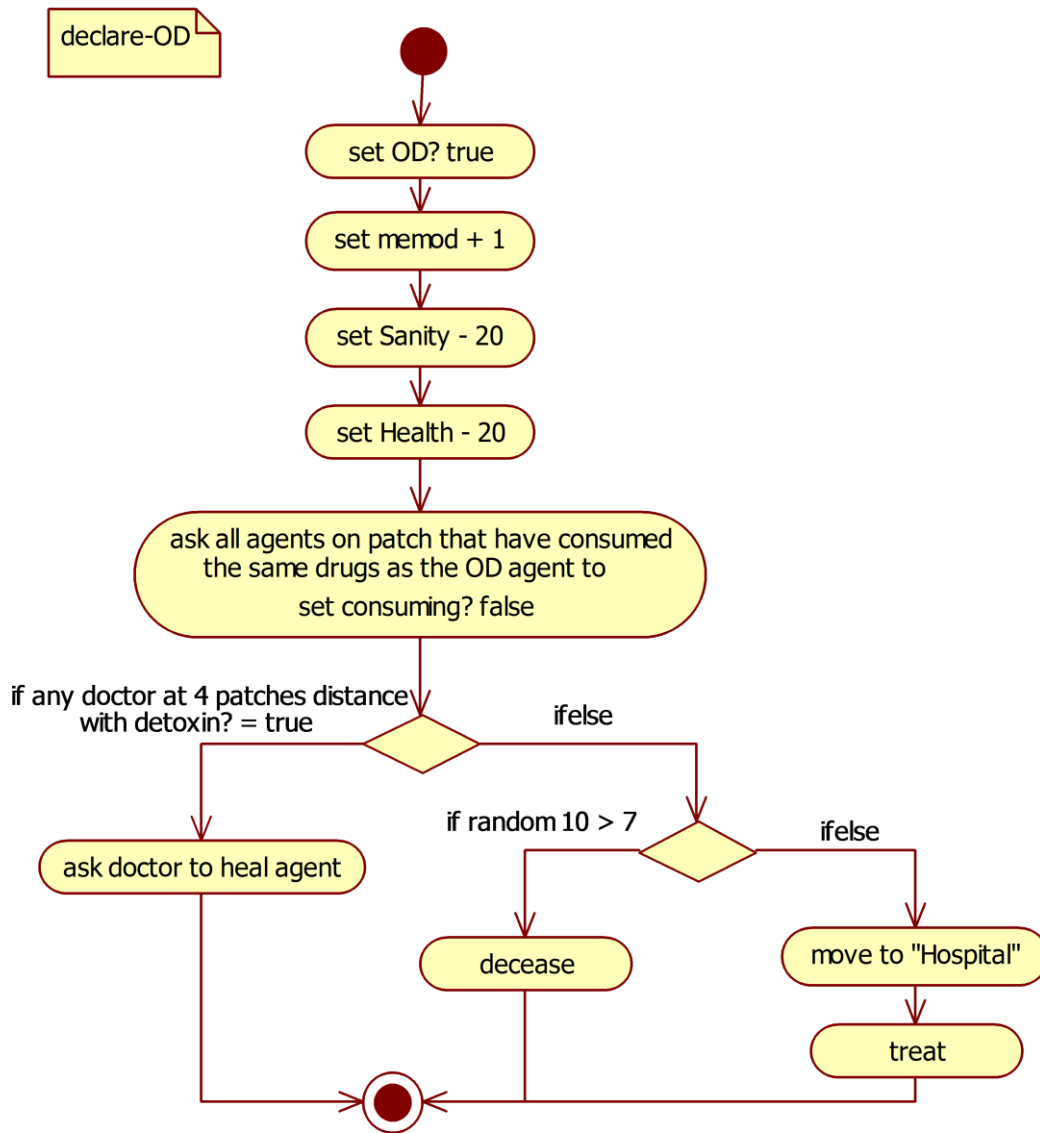
This attribute represents the memory of the *user* concerning the negative outputs inherent to their recreational consumptions. These items function as counters: once a certain threshold exceeded, *users* can modify their perceptions regarding drugs, or generate rules of behaviors (cf. Chapters 5 or 6).

Each item corresponds to specific events experienced or negative states felt by the *user*:

- 1) The first item corresponds to the occasion where the *users* displays "Erratic" or "Psychotic" behaviors due to large doses of either Dopamine or Serotonin levels in the "brain";
- 2) The second item represents the number of occasions the *user* has the values "Depress" or "Anxious" for its Behavior attribute in the morning (10:00-12:00);
- 3) The third item is increased by one, each time the *user* is in a state where it can react to external threats or immediate dangers, in other words when its Behaviors attribute displays the "Sedated" value;
- 4) The fourth counts the number of fights in which the *user* was involved;
- 5) The fifth item represents the occasions in which the *user* put its life in danger, the number of time the *user* has called the **hazardous-acts** operation (p. 314);
- 6) The last item corresponds to the number of time an "Employed" *users* exhibits the "Sedated", "Slow", "Erratic", "Psychotic", "Hallucinate" or "Aggressive" Behaviors during the morning of working days (10:00-12:00) and is noticed by others (agent has 30% chance of being noticed if they exhibit the "Slow" or "Sedated" Behaviors and 70% if they display "Erratic", "Psychotic", "Hallucinate" or "Aggressive" Behaviors). It aims to mimic a form of social sanction.

During the consumption phase, overdoses could happen if the level of Dopamine or the level of Opioid peptides reaches a critical amount in the NeuralBox (almost the double of the NeuralBox value). *Users* overdosing run the **declare-OD** operation functioning as follows:

Individual Operation 3: declare-OD



The probability of 70% for *users* to die from an overdose has been arbitrarily set. The action of the *doctor* agent will be extensively described in Section 7.1.2 but it could already be said that *doctors* have for main purpose to **heal** *users* in case of emergency.

Going back to the Figure 2.8, at t_2 , the positive effects wear off and the comedown starts. In the model, the level of neurotransmitters decreases (or increases if the drug has an antagonist action on the neurotransmitter) to reach the inverse levels attained at t_1 . At t_3 , the comedown phase is at its maximum, this one being represented by the NeuralBox-ComeDown.

To calculate the value of this attribute, each dose ingested at t_0 modifies the value of the NeuralBox-ComeDown as indicated by the equation (2):

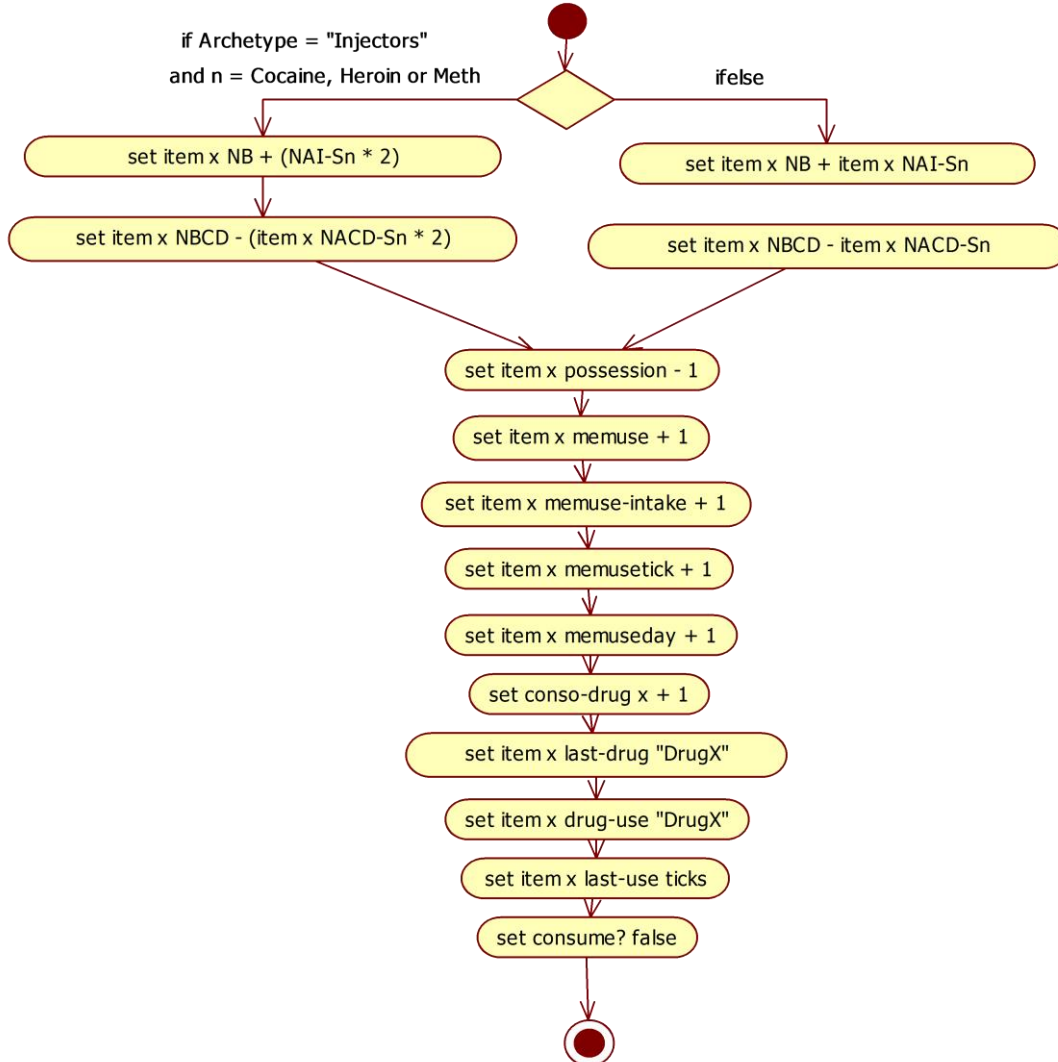
$$(2) \text{NBCD}_{t3} = \text{NNB}_{t0} - (\ln x * (9 - S_x)^\mu)$$

Here, the influences of the Stage are inverted: the higher the stage, the higher the side effects. It has to be noted that modifications of both NeuralBox and NeuralBox-ComeDown values are effectuated at the same time through the different "consume" algorithms:

Individual Operation 4: consume-DrugX

Consume-DrugX

NAI-Sn: Neural Action (NA) of the drug during the Intake (I) phase for an agent at Stage n (Sn) for the Neurotransmitter x.
 NACD-Sn: Neural Action (NA) of the drug during the ComeDown (CD) phase for an agent at Stage n (Sn) for the Neurotransmitter x.



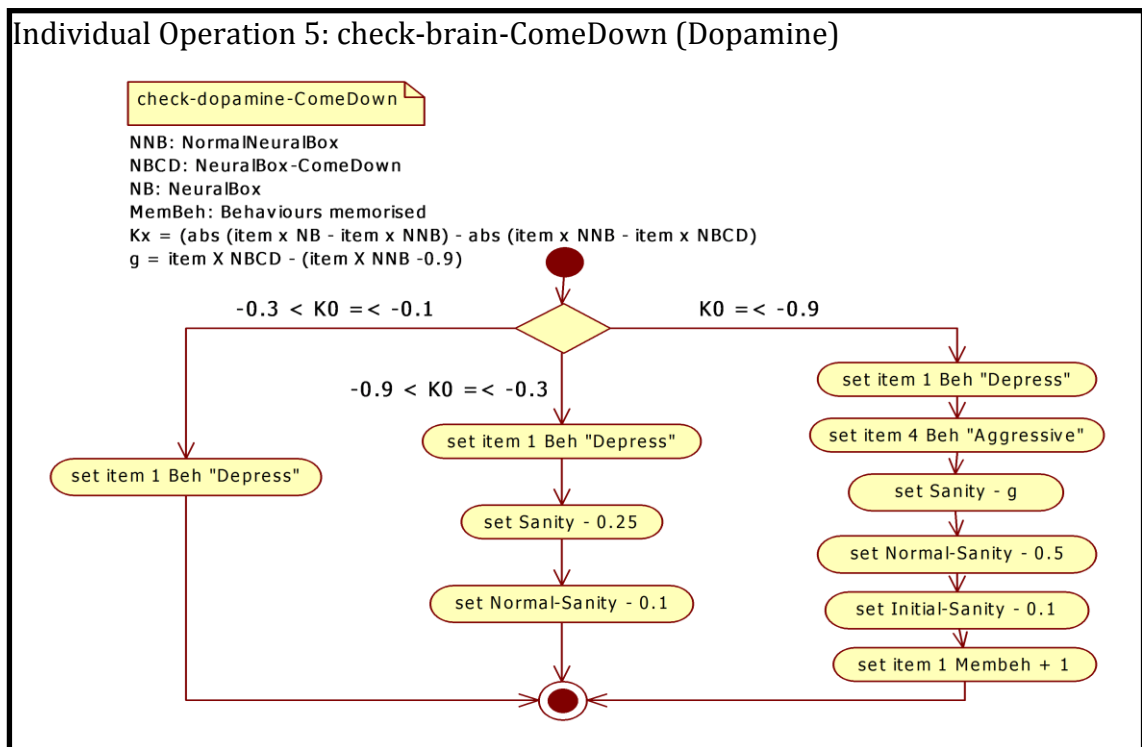
In addition to modify both NeuralBox and NeuralBox-ComeDown levels, the different counters of use – memUse-tick, memUse-intake and memUse-day – are updated, as well as several other counters (possession, drug used, last-drug and global substance's consumption (these different counters will be described in Section 7.1.1).

Looking at the Figure 2.8, the small dosage induces "Mild-ComeDown" effects, while larger amount will generate "Acute-ComeDown" reactions. By inverting the influence of stage, the *users* with a low Stage value (i.e.,

with a low frequency of use) will experience a short come-down of weak intensity, while, conversely, *users* using frequently that drug will undergo through a long and intense comedown.

This last point is reinforced by the high dosages that these *users* need to consume in order to reach the Tolerance-Threshold. *Users* getting to elevated Stages of consumption will experience increasing comedown adverse effects and generally exhibit dangerous or inappropriate behaviors associated with the Acute-ComeDown effects. The consequences of these exhibited behaviors on the *user* and other surrounding *users* are in Section 2.4 and are detailed throughout the second part of this thesis.

Once the different values of the NeuralBox-ComeDown are calculated, the model runs the **check-brain-ComeDown** algorithm that determines the behavioral responses and neurophysiological impacts caused by the depletion (or excess) of neurotransmitters in the brain. The following diagram displays the **check-brain-ComeDown** of Dopamine:



The activity diagrams concerning the other neurotransmitters could be found in Annex 2.

Again the behaviors exhibited by the *users* are based on the neurological literature as well as on the empirical material collected. This algorithm considers the margin (named Kx) between the values of each item of both NeuralBox and NeuralBox-ComeDown to determine what kind of behaviors are exhibited and what are the negative physiological consequences of the comedown phase. Kx is calculating by taking the Normal-NeuralBox for reference, as indicated in the equation (3):

$$(3) Kx = (\text{abs}(\text{item} \times \text{NB} - \text{item} \times \text{NNB}) - \text{abs}(\text{item} \times \text{NNB} - \text{item} \times \text{NBCD}))$$

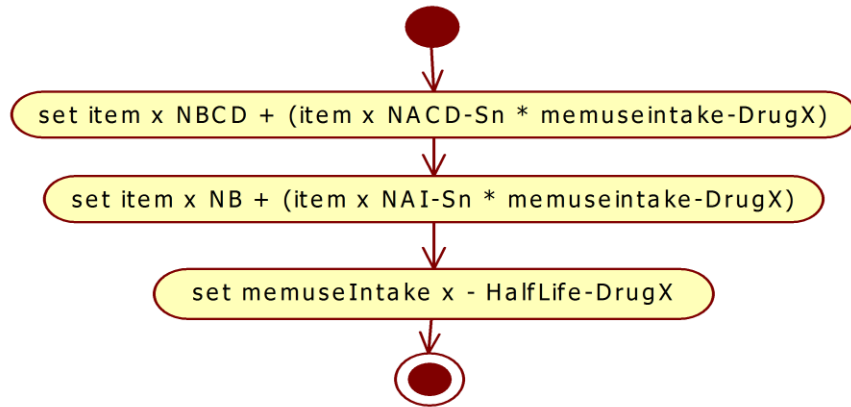
The lower Kx , the more the *user* will experience intense comedown effects. By comparing the difference between the NeuralBox and the NeuralBox-ComeDown values, the comedown effects are only expressed once the Intake effects start to fade. The substances with a "Half-life" attribute higher than 0 see their actions continue over the subsequent steps of the simulation by increasing the values of both NeuralBox and NeuralBox-ComeDown. Moreover, the "memuse-intake" value decreases accordingly to the value of the *drug's* Half-Life. Once this value gets below 0.1, the substance intake is considered as completely metabolized (this takes four half-lives to be achieved). These different points are presented in the **ComeDown-DrugX** activity diagram:

Individual Operation 6: comedown-"DrugX"

ComeDown-DrugX

NAI-Sn: Neural Action (NA) of the drug during the Intake (I) phase for an agent at Stage n (Sn) for the Neurotransmitter x.

NACD-Sn: Neural Action (NA) of the drug during the ComeDown (CD) phase for an agent at Stage n (Sn) for the Neurotransmitter x.



The **comedown-drugX** algorithm affects both NeuralBox-Intake and NeuralBox-ComeDown levels. These two levels are increased by the *drug NeuralAction* value multiplied by the quantity of the substance remaining in the brain (that corresponds to the memuse-intake attribute). This quantity decreases each time step accordingly to the Half-life value of the substance, this to reflect the action of drugs with long term action.

As already stipulated, the effects experience by *users* depend on the levels of both NeuralBox and NeuralBox-ComeDown. These effects are summarized in Table 2.3.

Table 2.3. Behavioural responses associated with the level of neurotransmitters.

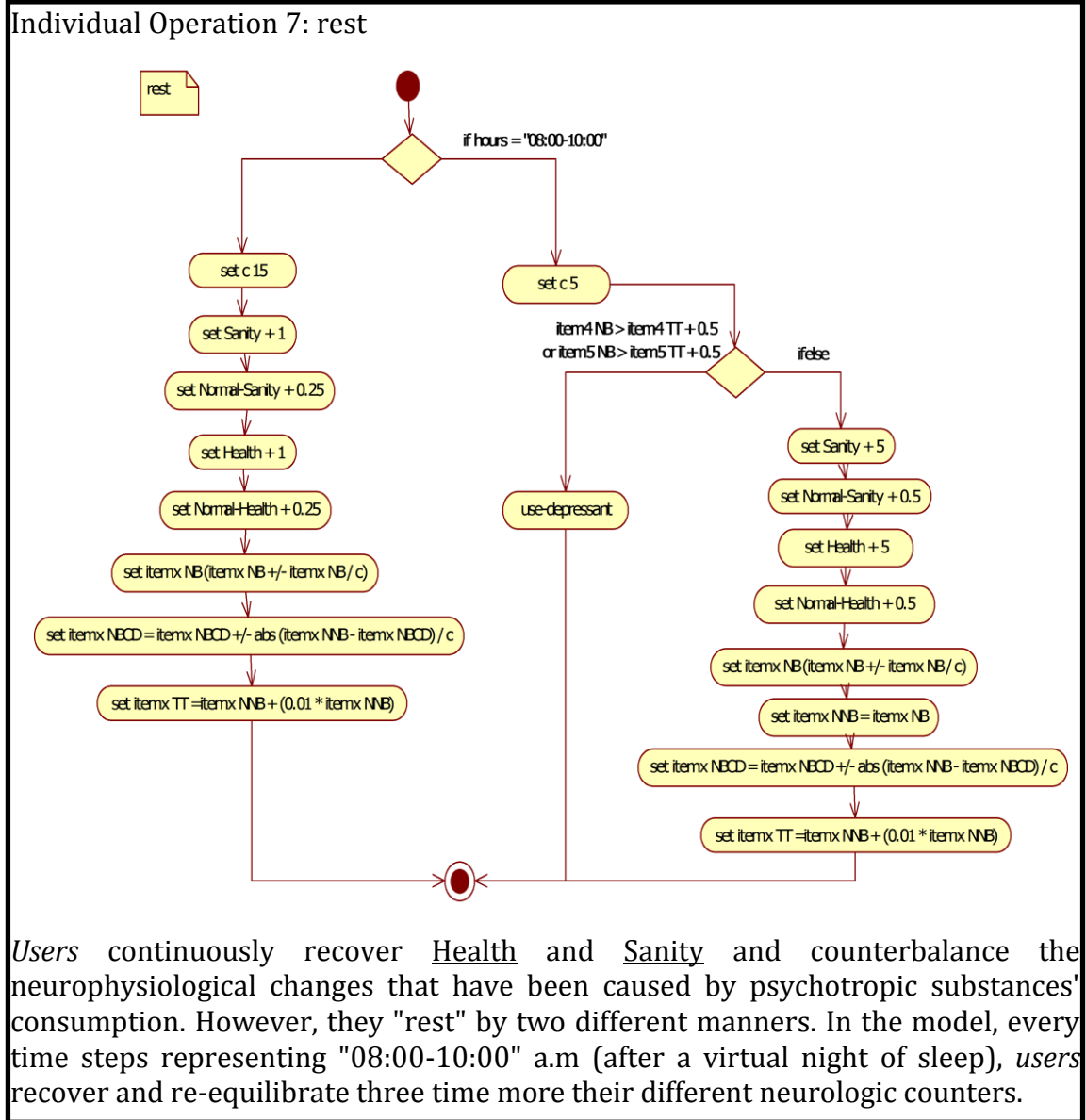
Neuro-transmitter	Acute ComeDown	Mild ComeDown	Mild Intake	Acute Intake
Dopamine	Aggressive	Depress	Happy	Psychotic
Cannabinoid	Anxious	Slow	Relax	Sedated
Opioid Peptide	InPain	Anxious	Relax	Sedated
GABA	Erratic	Anxious	Relax	Sedated
Glutamate	Sedated	Slow	Energetic	Erratic

Neuro-transmitter	Acute ComeDown	Mild ComeDown	Mild Intake	Acute Intake
Norepinephrine	Slow	Slow	Energetic	Erratic
5-HT_{1A}	Aggressive	Depress	Prosocial/ Happy	Erratic/Psychotic
5-HT_{2A}	Anxious/ Depress	Depress	Hallucinations	Hallucinations/ Psychotic

These values are used by several actions/interactions operations in the course of the simulation (these different algorithms are described in Part II). Most of these values reflect clearly the type of behavior produce by the agents, but some needs to be clarified: *users* exhibiting the "Sedated" behavior are drowsy, with motor impairments and will not be able to decide or act as required, typically agents that have consumed large doses of alcohol will display this Behavior value. "Erratic" encompasses involuntary movements, repetitive behaviors, or uncoordinated speech: grinding teeth as a result of amphetamine consumption is an example of what is attached to this value. "InPain" is exclusive to the withdrawal of heroin: the depletion of endorphins leads to the incapacity of the individual to suppress pains caused by any normal daily activities. "Psychotic" regroups a set of reactions such as paranoiac or dissociative episodes: for example, long-term, high-dose use of cocaine could induce *toxic paranoid psychosis* [160] with altered perception of reality and entail aggressive behaviors. These different values of the Behavior attribute are set back to "Normal" if the NeuralBox and NeuralBox-ComeDown values become close (at +/- 0.01) to the Normal-NeuralBox.

Between t_3 and t_4 , the level of neurotransmitter slowly returns back to the Normal-NeuralBox level to mimic neurotransmitters' repletion and marks the progressive regression of the adverse effects inherent in the comedown phase. This filling up is ended by an augmentation of the

Normal-NeuralBox level reflecting the mechanism of neuro-adaptation and tolerance. In the model, this augmentation corresponds to a fraction added (or withdrawn) to the NeuralBox level at t_4 . This neuro-adaptation is accompanied by a constant recovering process modeled in the **rest** activity diagram:



The following example will clarify and illustrate the functioning of SimUse neurologic component. Consider the example in which a *user* consumes one unit of alcohol. To shorten the explanation, only the Dopamine level will be considered. Following the previous developments, the functioning can be summarized as follows: assume

that the *user* has an alcohol Stage of 2, a Dopamine NormalNeuralBox level of 1 and a ToleranceThreshold regarding this neurotransmitter of 1.03. After a shot of alcohol, the NeuralBox level of Dopamine will reach $1 + (\ln 1.08^{51}) * 3^{-1.35}$, which gives a dopamine NB of 1.018. This level is below the agent's ToleranceThreshold; therefore, this *user* will not experience any effect from this single intake of alcohol. A few virtual minutes later, the same agent decides to have another alcoholic beverage, which brings its dopamine level to 1.035. This value is higher than the agent's ToleranceThreshold. As indicated by the **check-brain-Intake** algorithm, this agent will exhibit the "Mild-Intake" behavioral effect related to dopamine, i.e., "Happy" (in terms of attribute, the item 1 of the Behaviors will change from "Normal" to "Happy"). At the same time, the Dopamine NeuralBox-ComeDown value will change from the NormalNeuralBox value (3) to $2 - (\ln 1.08) * 7^{-1.35}$, which brings the level of Dopamine NeuralBox-ComeDown at 0.988.

Continuing with our example, imagine that the same agent had two more drinks in the same virtual time step. This agent will experience a comedown for a total of four drinks. Four drinks of alcohol will bring the Dopamine NeuralBox to 1.069 and the NeuralBox-ComeDown to 0.978 (result of $1 - 4 * (\ln 1.08) * 7^{-1.35}$). Referring to the **check-brain-ComeDown** diagram, this Stage 2 agent will behave "normally" because the Kx (0.047) remains above the first threshold entailing comedown effects (cf. Annex 2). In the case of an agent with an Alcohol Stage of 6 having six alcohol dosages, the Dopamine NeuralBox would have been of 1.022 and the NeuralBox-ComeDown of 0.93, which would make this agent's behavior switches to "Depress" (here, $Kx = -0.071$).

Note that in this example only once substance and one neurotransmitter were involved. Polysubstance use entails complex situations in terms of neurophysiologic interactions and behavioral

⁵¹ This value corresponds to the NeuralAction of Alcohol on the Dopamine neurotransmitters.

results. This model proposes, in a simplified way, to capture formally these complex interactions and to produce "behavioral outputs". As explained in Part II, these Behaviors will be interpreted and judged by the *user* itself and by other *users* belonging to its *network* or to its social environment.

The review of the previous neurological theories facilitates the comprehension regarding neuropharmacology and pharmacodynamics of psychoactive substances, as well as the mechanisms leading to addiction. The crucial role of neurotransmitters in behavioral response to drug's administration and the neurophysiological evolutions of the different neurotransmitter's levels contribute to clarify the relation between drugs consumed and effects "expected" by drug users. Nevertheless, if neurosciences could clarify the psychoactive substance's effects and the development of both addiction and tolerance, they remain unable to capture the rationales that brought an individual to experiment a particular drug and later on, to choose and consume a particular range of substances on a more or less regular basis. To capture these causes, the following sections examine the other levels of reality that could influence drug use (Section 1.1) from a sociological perspective. The Section 2.3 examines the sociological theories of actions in order to explain the different processes that precede and accompany psychoactive substance's intakes.

2.3. Action and Decision in the context of Drug use: a sociological perspective

The Section 2.2 detailed the different physiological and psychological responses entailed by psychoactive substances consumption as well as one of the several ways to model such neurophysiologic mechanisms. The findings from the "Drug choice theory" (Section 1.2.1) tend to

indicate that drug users have expectations concerning the different substances they already used. These expectations are based on the perceived effects induce by the neuro-pharmacologic properties of the substances taken. This theory also emphasized that users base, partially at least, their decisions on these expectations. Following these developments, one assumption of this thesis is to consider recreational polydrug use as an *instrumental* use. It means that recreational polyusers consume psychoactive substances to achieve one goal related to a social cause. The term "social cause" reflects the fact that individual's actions are encapsulated in a particular historical, economic and cultural context. The individuals act in consideration of their particular idiosyncratic situation inside that particular context.

As discussed above, this research supports the point-of-view that the individual, (as a biographical and physiologic being), his actions and interactions are embedded and strongly interrelated. In other words, any of these three elements — individual, actions and interactions — cannot be interpreted without referring to the other two. Considering these hypotheses, theories originate from sociology of action and symbolic interactionist theories, especially the one developed by Anselm L. Strauss seem to be the best suited to tally the objectives of this research.

Member of the Second Chicago School of Sociology, Strauss was one of the founders of the "grounded theory" and drew inspiration from the works of pragmatists such as C.S. Pierce, J. Dewey and G.H. Mead; symbolic interactionists such as H. Blumer and E. Hughes; and social phenomenologist such as A. Schütz, P.L. Berger and T. Luckmann. Based on this theoretical background and his empirical research on the medical field, Strauss developed what he called an "interactionist theory of action". This latter proposes a *pragmatist* vision of actions, which remain constantly embedded in *meaningful interactional contexts* and

will be modified, in terms of processes and objectives, throughout the *biography* of actors.

To achieve his purpose, Strauss accumulated and developed operative concepts in his attempt to build a theory of action able to capture a complex world constantly changing [211]. His theory took the form of a framework integrating the relevant elements (actors, actions, interactions, and context) and their interrelations susceptible to influence the studied phenomenon. Consequently, his conceptual framework has been built to capture dynamic transformations inside the studied phenomena. This dynamic theory will be described through its concepts and use as a basement for this study. Several theoretical components from other authors (especially, coming from social phenomenology, philosophy of action and social psychology) will be incorporated in order to deepen and increase some operative concepts.

Despite the nested configuration of the following concepts, this theoretical conceptualization distinguishes four couples of notions corresponding to the next four subsections of this chapter: neurophysiology/behaviors (Section 2.2); action/decisions (Section 2.3); interaction/representation (Section 2.4), and; career/biography (Section 2.5).

2.3.1. Action and Decision Theory

In the sociological literature, there are three ways of understanding individual action: (1) as the result of determinations that shape and orient individual choices through interiorized norms; (2) as a process without pre-established ends, which is elaborated throughout social interactions; and (3) as the result of a rational deliberation and planned process [212]. As discussed previously, this research aims to combine elements from these three conceptions to capture the complex and

dynamic characteristics of drug use. To achieve this, the perspective developed by Strauss on action will be used as basis.

Before getting into the Straussian perspective of action, a well-known and useful distinction has to be introduced here: actions are distinguished in *overt* and *covert* actions. *Overt* actions have an incidence on the physical and social world (i.e., buying bread or playing a football game) while *covert* actions are internal and mental (i.e., solving a scientific problem mentally or remembering chess rules). This difference has a primary importance into the sociological context especially when coming to the notion of judgment, symbolization and meanings. It also becomes important considering the previous developments (Section 2.2): behavioral responses induced by drug uses are both *overt* and *covert* actions that will impact the individual and its social environment.

2.3.1.1. *Actors, Time and Externalities: the Basis of Action*

The following four Straussian assumptions⁵² could be perceived as straightforward, but they constitute the fundamental and logic basis for any theory of action and interaction, and have major importance in the context of drug use.

The first necessity for individual to act is a physical medium to interact with the social world. As Strauss argued with his first assumption: "*No action is possible without a body*"; stating that: "body is the condition for means of interaction since none can occur without a body or bodies. With these, actors can perform, present themselves, and their interactions can be judged with respect to performance and appearance, during and after the interaction"⁵³. These last two assumptions are even more relevant for the topic of polydrug use

⁵² In his book *Continual Permutations of Action* (2008), Strauss detailed his theory of action through 19 assumptions.

⁵³ Strauss A.L. (2008) *Continual Permutations of Action*. p.23.

considering that psychoactive substances have an impact on both physiology and psychology of the user (Section 2.2).

Second, body cannot be separated from a *self*. With this concept, Strauss referred to a concept developed by Georges Herbert Mead [213], who defined the self as a "social process, which implies interaction of individuals in the group"⁵⁴. The self is considered as being both a *social object (Me)* and a *reflexive subject (I)*. The "*me*" is the social entity perceived by others as significant; whereas the "*I*" is the idiosyncratic component of the self. It carries actor's accumulated and sedimented knowledge and forms the center of self-reflection. In other words and as explained by Mead: "The "*I*" is the response of the organism to the attitudes of the others; the "*me*" is the organized set of attitudes of others which one himself assumes. The attitudes of the others constitute the organized "*me*", and then one reacts toward that as an "*I*"."⁵⁵ Self is in constant construction and reconstruction due to dynamic feedback between the "*I*" and the "*Me*". Based on Mead conception of the self, Strauss infers that the *self* of actors is constantly part of their actions:

*"During early childhood and continuing all through life, humans develop selves that enter into virtually all their actions and in a variety of ways. [...] This assumption is necessary for all the remaining assumptions although most obviously for these such as pertain to self-evaluation, meaning/symbol, and perspective [...] except in our reflex reactions, we have to take our selves and these of others into account, both in everyday action as well as in research when interpreting or analyzing data."*⁵⁶

Actor's "*I*" participate to actions by making accessible to actors their own representation of reality and "others" expectations memorized. During and after actions, their acting "*me*" are judged and evaluated by others. These judgments will be remembered, treated and integrated by their "*I*", and so on.

⁵⁴ Mead G. H. (1934) *Mind, Self, and Society: from the Standpoint of a Social Behaviorist*, University of Chicago Press, p.164.

⁵⁵ *Ibid*, p.175.

⁵⁶ Strauss A.L. (1993) *op.cit.* pp.25-26.

Third, if actions and interactions indubitably need actors with body and self, these actions are realized in a physical world, where "*actions are characterized by temporality, for they constitute courses of action of varying duration*"⁵⁷. The perceived or expected duration of an action can vary from one actor to another, depending on their skills, experiences and contextual characteristics. This duration could change during the realization of the action due to externalities and/or reevaluations, or as it will be discussed later, due to the action of one or several drugs on the actor.

Finally and following this third point, the development of actions/interactions could be subject to "externalities" or "contingencies", bringing "*about change in its duration, pace, and even intent, which may alter the structure and process of interaction. [...]* Its constituent acts have many unanticipated consequences, some of which may be highly consequential for future acts. That is, the consequences become conditions."⁵⁸ Here, Strauss refers to modifications affecting the "end-in-view" [214] projected by actors, who imagine an end but are unable to exactly know the real achievement of their actions. With this contingency of action, Strauss reaffirms the dynamic dimension of actions.

However, by referring to Dewey's *end-in-view* concept, Strauss underscored the fact that actors plan their actions, which should initially follow a normal "process". He named this process, an individual *trajectory scheme*, which refers to: "[...] the plan consciously designed to shape interaction as desired, given the content of a trajectory projection. [...] The trajectory scheme is essentially envisioned as an overall strategy that when acted on becomes translated into actual actions."⁵⁹

⁵⁷ Strauss A.L. (2008) *op.cit*, p.32.

⁵⁸ *Ibid*, pp.36-37.

⁵⁹ *Ibid*, p. 55.

Two questions follow: how is this "overall strategy" conceived? And what are the mechanisms behind this formulation?

2.3.1.2. *Routine, Problematic Actions and Re-evaluation*

According to Strauss social actions and interactions reveal themselves as being generally "patterned" and "meaningful":

"The actions that interest us generally are patterned, repetitious, and meaningful to the actors themselves. "Acts are teleological" is the usual but not at all accurate way of referring to such actions; that is, actions are directed at goals. As for courses of action, generally it is believed that these can scarcely be thought of as courses unless in some sense directed toward goals."⁶⁰

Social actions/interactions could be divided in two categories: "routine" and "problematic". The first one is described as being: "[...] standardized patterns of action. Without these, nothing much could be accomplished through action carried out on a repeated basis. Repetitive goal-directed action requires a patterning of action that does not need to be invented on the spot each time that a person or collectivity acts."⁶¹ In other words, actors do not deliberate if the situation of the action is well-known, and they do not plan course of actions if the way to handle it, is perfectly mastered by the actor. That explained why Strauss considered most of the social actions as non-teleological: routinized actions do not aim to a cautious and weighed reflection toward a well imagined and projected end, they are "just" acted. Furthermore and as asserted by Giddens [215], these routines reduce the ontologic anxiety inherent in the human condition by securing the daily actions of the social actors.

However, in a dynamic social world, routine actions cannot always accurately response to evolving situations: "When a situation can be defined as slightly different, novel, or unusual, then although

⁶⁰ Strauss A.L. (2008) *op.cit*, pp.33-34.

⁶¹ *Ibid*, pp.194-195.

appropriate patterns of routine action are called upon, these will be supplemented with new actions or a slight adaptation of the routine."⁶² In other words, in problematic situation, routines are modified through two main processes: *adaptation* and *innovation*.

The first one, *adaptation*, corresponds to changes in the trajectory scheme of the actor. It is generally the fruit of a larger process, *reevaluation*, which occurs subsequently to actions:

"Any action [...] is likely to get reviewed and evaluated: whether in part or whole, occasionally or frequently, informally or formally, covertly or overtly. This will lead to judgments about maintaining the course or changing various of its aspects. [...] Evaluation and reevaluation is made also about what is known or guessed about others' experiencing and undergoing. So interactants are making judgments of both overt action and interior accompaniments of the action, along the entire course of interaction."⁶³

Reevaluations have for consequences modifications of both "ends" and "means" on the trajectory scheme, and by extension on the course of actions:

"[...] Thereby, goals as well as means are open to being altered, action changed in midstream in some regard. This is what gives interactional courses an additional potentially open-ended, flexible character. [...] Long after a course of action is physically complete, or is regarded as complete by one or other participant in it, there may be additional reviews, as well as belated projections of "what if I (we) had..."."⁶⁴

Two forms of reevaluations can be distinguished by considering their stances relatively to the actor: (1) *internal reevaluations* are operated through a thought process produce by the "I", called "self-interaction"; and (2), *external reevaluations* correspond to "judgment" operated by other interactants upon the "me" of actor(s). These judgments will be subsequently taken into consideration by the "I" through an internal reevaluation. Self-interactions are not necessarily caused by external

⁶² Strauss A.L. (2008) *op.cit*, p.195.

⁶³ *Ibid*, pp.37-38.

⁶⁴ *Ibid*, pp.37-38.

judgments (actors could review a covert action, such as mathematical calculation, but they could also review a covert action through the eyes of *significant others*) while these external judgments impact upon the "I".

The second kind of routine modification, *innovation*, is generally introduced to address an unsolved issue in the routinized course of actions. It corresponds to: "[...] the making of a successful solution to a problem; eventually in its turn it too will lose its novelty and become routinized"⁶⁵. It is mainly the complete novelty of innovation, characterized by "making of", which differentiates innovation from adaptation.

As aforementioned, there is a dynamic between routines and problematic actions: all routines and routinized actions will most likely face unusual or novel situations in the future, and once treated and solved, these situations will participate to the construction or reconstruction of actor's routines by adding new elements. All routinized actions used to be problematic until situational issues were solved by developing relevant actions, as asserted by Strauss: "[...] routines [...] usually are the end product of solutions to problematic situations. We might usefully think of routines as only the quieter aspect of an unending sedimentation process."⁶⁶ This "sedimentation process" refers to the different adjustments added by actors or collectivities in order to adapt the trajectory scheme to their constantly evolving social environment.

Indubitably, Strauss has presented action in a dynamic perspective, where other interactants and external contingencies can modify pre-established courses of actions. This author has also distinguished two meaningful categories of actions: the routinized and the problematic ones, these latter necessitating a reevaluation of actions course before

⁶⁵ Strauss A.L. (2008) *op.cit*, p.200.

⁶⁶ *Ibid*, p.197.

being "re-routinized". However, if Strauss gave precise explanations concerning when reevaluations appear as being needed and on what kind of consequences reevaluations can imply on actions, the two following questions remain eluded: (1) what are the rationales of social actions, or, in other words, what push actors to act; and, (2) on what criteria do actors base their choices of new or substituted actions amongst all the different possibilities of adjustments⁶⁷.

Hence, the next task will consist in examining the concept of *motivation* attached to actions and interactions, and to delimitate the elements intervening as constitutive of actor's motivations. In order to clarify these questions, the following section will introduce sociological theories of Alfred Schütz.

2.3.1.3. *Motivation, Practicability, and Stock of Knowledge*

Alfred Schütz was the founder of the *social phenomenology*. His approach forms a unique piece of theory by combining the sociology of Max Weber with the phenomenology of Edmund Hüsserl. Weber developed a comprehensive sociology which gives priority to actor subjectivity when trying to understand his (her) social actions. Being subjective, the sense captured by the researcher and gave to these actions, can only be an "interpretation", and not an "explanation", as it happens in the natural sciences. The phenomenology developed by Hüsserl and his successors examined the phenomena as lived experiences and sought to extract the immanent essence of objects. The eidetic investigation, the phenomeno-logical *epoché*, aimed to despoil phenomenon from individual's subjectivity to capture the transcendental objectivity of reality.

⁶⁷ Strauss specified that as "[...] expressed by Blumer, who once remarked that ordinary, everyday behavior sets no problems of explanation, whereas the new behavior precipitated by social change sets major issues for sociology." Strauss A.L. (2008), *op.cit.* p.192.

Contrary to Strauss, whose research was mainly oriented toward work, Schütz investigated human behaviors and their actions into the "meaningful structure of the *daily-life world*"⁶⁸. His scientific project is based on the following assumption: "The sciences that would interpret and explain human action and thought must begin with a description of the foundational structures of what is prescientific, the reality which seems self-evident to men remaining within the natural attitude. This reality is the everyday life world"⁶⁹. In the everyday life-world, or *Lebenswelt*, actor and his "fellow men" can interact and communicate together based on shared meanings and knowledge [216]. This *intersubjectivity* gives to the everyday life-world a social dimension that pushed Schütz to investigate the way actors perceive and interpret their immediate social context and, conversely, the impact of their perceptions and interpretations on their social actions.

In his article "Choosing amongst projects of action" [217], Schütz proposed to analyze "[...] the process by which an actor in daily life determines his future conduct after having considered several possible ways of action."⁷⁰ In the author perspective, action consists in "[...] an ongoing process, which is devised by the actor in advance, that is, which is based upon a preconceived project."⁷¹ This projection is a "motivated phantasying"⁷² that Schütz investigated through two notions: *motivations* and *practicability*.

As just mentioned and contrary to Strauss, Schütz considered actions as *motivated* behaviors oriented toward precise goals. However, Schütz considered motivation as an "equivocal" notion, and distinguished two

⁶⁸ Schütz A. (1971) *Collected Papers I: The Problem of Social Reality*. Martinus Nijhoff. The Hague. p. XXV.

⁶⁹ Schütz A. (1973) *The Structures of the Life-World*, Northwestern University Press, Evanston, p.1.

⁷⁰ Schütz A. (1971), *op.cit*, p.67.

⁷¹ *Ibid*, p.67

⁷² Schütz A. (1951), Choosing amongst Projects of Action, *Philosophy and Phenomenological Research*, 12 (2), p.165.

types of motives in his analysis, namely, *in-order-to* and *because* motives:

(1) "In-order-to" motive is defined as "the state of affairs, the end, which the action has been undertaken to bring about."⁷³ *In-order-to* motives do not furnish the causes of action, but they refers to the future of the actors as it is a projection of a goal with the different phases, means and skills needed to achieve targeted goal. Moreover, "in-order-to motive refers to the attitude of the actor living in the process of his ongoing action. It is, therefore, an essentially subjective category and is revealed to the observer only if he asks what meaning the actor bestows upon his action."⁷⁴

(2) "Because" motives are based on previous actions: "The experiences have determined him to act as he did. What is motivated in an action in the way of "because" is the project of the action itself. [...] His idea of attaining this goal [...] was determined ("caused") by his personal situation or, more precisely, by his life history, as sedimented in his personal circumstances."⁷⁵ The different past experiences were shaped and determined by the actor's specific social context (in terms of societal norms, economical background, geographical neighborhood, etc.) and interpreted through the actor social position at the time of experiences. The "life history" determines the practicability of actor's actions and is directly related to the concept of "biographical situation" (cf. below). These forms of motivations precise the end targeted by an action and the rationales that have determined an actor to search achieving this particular goal.

Once the goal defined and during the "phantasying" projection, individuals gauge the feasibility of the different scenarios in which they might be engaged. The degree of *practicability* of each scenario will

⁷³ Schütz A. (1971), *op.cit*, p.69.

⁷⁴ *Ibid*, p.71.

⁷⁵ *Ibid*, p.70.

determine actor's choice of actions and their future conduct. This "practicability" is based on two sets of experiences: the *biographical situation* of actors and their *stock of knowledge at hand*.

Using a comprehensive approach, Schütz regarded actions and interactions as dependent on the social status and experiences of the actors. According to this author, these elements shape the perception and comprehension developed by the actors regarding their daily-life environment:

"My biographical situation defines the way in which I locate the arena of action, interpret its possibilities, and engage its challenges. Even the determination of what the individual can modify is affected by his unique situation. The funded experience of a life, what a phenomenologist would call the "sedimented" structure of the individual's experience, is the condition for the subsequent interpretation of all new events and activities. "The" world becomes transposed into "my" world in accordance with the relevant elements of my biographical situation."⁷⁶

"The sedimented structure of the individual's experience" is what Schütz named *stock of knowledge at hand*. This concept is defined as: "[...] the actor's experiences and his opinions, beliefs, assumptions, referring to the world, the physical and the social one, which he takes for granted beyond question at the moment of his projection."⁷⁷ In other words, this stock represents the totality of *knowledge* accumulated, selected and memorized by individuals throughout their life, from their primary socialization⁷⁸ until their actual biographical situation. Based on his different past experiences, the individual had built *typifications*, which corresponds to cognitive "shortcuts" (such as categorizations of objects or pre-establish interactions) used as "techniques for understanding or at least controlling aspects of experience."⁷⁹

⁷⁶ Schütz, A. (1971), *op.cit*, p.XXVIII.

⁷⁷ *Ibid*, p.74.

⁷⁸ The term "primary socialisation" refers to the work of P. Berger and T. Luckmann (1966) on the construction of the social reality. The primary socialisation corresponds to the different norms, values and attitudes of a specific social context or culture, transmitted by the parents to their child.

⁷⁹ Schütz, A. (1971) *op.cit*, p. XXIX.

The stock of knowledge is utilized to understand and work out every social situation that actors could encounter: "All projects of my forthcoming acts are based upon my knowledge at hand at the time of projecting."⁸⁰ It is the "I-can-do-it-again" idealization⁸¹ that inclines actors to re-use identical actions to treat identical situations. This stock remains unquestioned until some "[...] intrinsic inconsistency and incompatibility [are] discovered and they are themselves put into question only if a novel experience not subsumable under the so far unquestioned frame of reference turns up."⁸² This statement strengthens the distinction between routine and problematic action, but it also highlights the need to understand the formation of knowledge.

According to Schütz, the stock of knowledge at hand is inherently and mostly dependent on the different social environments that have surrounded or are surrounding the individual. Summarizing this point, Maurice Natanson, disciple of Schütz and responsible of the edition of *Collected Papers*, explained that: "[...] knowledge is socially rooted, socially distributed, and socially informed. Yet its individuated expression depends on the unique placement of the individual in the social world."⁸³ Considering the fact that both biographical situation and stock of knowledge are dependent on the intersubjective dimension of the daily-life world, the impact of interactions on the construction of meanings and motivations attached by actors to their actions needs to be investigated.

Before getting to that point (the interactional dimension will be detailed in Section 2.3.2), further precisions need to be added concerning the concept of *practicability* applied to the field of drug use. Indeed, if recreational drug use consists in a motivated action oriented by a

⁸⁰ Schütz, A. (1971) *op.cit*, p.20.

⁸¹ Schütz refers here to the work of Husserl E. (1929) *Formale und transzendente Logik*, Halle, p.167.

⁸² *Ibid*, p.74.

⁸³ *Ibid*, p. XXIX.

practical reasoning, drug choice has a decisional dimension inferring different forms of rationality to drug consumption⁸⁴.

2.3.1.4. *Practical Reasoning and Rationalities*

Sociologists generally refuse to use the notion of rationality, due to its direct association with the economical concept of Homo Economicus. Here, this notion will be employed in the sense defined by Garfinkel [218]: actions are rational for actors in consideration of their social stances and in concordance with their interpretation of the social world.

Following the work of Schütz⁸⁵, Garfinkel argued that rationality is a misleading concept, and that "ordinary people" designate several conducts as rational. Garfinkel explained that researchers use a scientific interpretation of actor's rationality. If this interpretation is necessary to model actor's actions and shape them into an intelligible form, it can be irrelevant for studying daily-life activities. Indeed for Garfinkel, this "researcher model":

"[...] furnishes a way of stating the ways in which a person would act were he conceived to be acting as an ideal scientist. The question then follows: What accounts for the fact that actual persons do not match up, in fact rarely match up, even as scientist? In sum, the model of this rational man as a standard is used to furnish the basis of ironic comparison; and from this one gets the familiar distinctions between rational, non-rational, irrational and arational conduct. But this model is merely one amongst an unlimited number that might be used. More importantly, no necessity dictates its use. To be sure, a model of rationality is necessary, but only for the task of deciding a definition of credible knowledge and then only but unavoidably for scientific theorizing."⁸⁶

In other words, any universal and idealized model of rationality is likely to fail when apply to the study of the everyday social world. So

⁸⁴ This choice encapsulates more than just the choice of drugs type, it also encompasses the choice regarding quantity, settings, schedule, people who to consume with, etc...

⁸⁵ Schütz A. (1971), *op.cit.*, "Rational Action within Common-Sense Experience", pp. 27-34.

⁸⁶ *Ibid*, p. 280.

what is the interest continuing using the concept of rationality? With his theory, Garfinkel reverses the status of rationality from rational agent to rational action [212] and from a theoretical framework ("the" rationality) to an empirical variable (actor's rationalities):

*"Instead of the properties of rationality being treated as a methodological principle for interpreting activity, they are to be treated as empirically problematic material. They would have the status only of data and would have to be accounted for in the same way that the more familiar properties of conduct are accounted for. [...] In a word, the rational properties of conduct may be removed by sociologist from the domain of philosophical commentary and given over to empirical research."*⁸⁷

This induces the necessity capturing, understanding and describing users own interpretations and "good reasons" concerning their intentions to use one or different type(s) of drugs. It also means that a particular attention must be paid to the summoned reasons concerning the amount to take, the "right" social situation and time frame, the kind of people to take with, etc. because these elements are part of the intentional process. Put in another way, the work consists of investigating the way individuals consider their uses as rational; how their choices are produced, and; how these choices evolve over users biography.

Garfinkel listed fourteen conducts considered and judged as rational by actors in their daily social world [218]. All these actors typifications of rationality, named "rationalities" by Garfinkel, are not relevant to the phenomenon studied in this work; therefore and based on empirical data and drug use literature, rationalities related to polysubstances use could be listed as follows:

- *Categorizing and Comparing*: looking for similitudes between situations and attribute different "degree of rationality" from one action to another;

⁸⁷ Schütz A. (1971), *op.cit.*, "Rational Action within Common-Sense Experience", p. 282.

- *Search for "means"*: reviewing "rules of procedure which in the past yielded the practical effects now desired"⁸⁸;
- *Analysis of alternatives and consequences*: imagined several scenarios to achieve one goal;
- *Concern for timing*: give a "more or less" rational order and timing to actions;
- *Predictability*: "taking whatever measures are possible to reduce "surprise""⁸⁹;
- *Rules of procedure*: following "Cartesian" or "tribal" inferences to judge the correctness of perceptions or categorizations; Cartesian rules refer to what "any man" would have done and tribal rules refer to what members of my group concerning as accurate;
- *Choice*: the fact of being able to choose;
- *Grounds of choice*: the reasons with which an individual legitimizes his/her choices. These reasons could be based on "scientific corpus of information"⁹⁰, based on the personal knowledge of actors or as explanations and justifications regarding the course of past actions.

According to Garfinkel, one legitimized way to approach rationality consists in considering that: "Any factors that we take to be conditional of any of the properties of activities is a factor that is conditional of the rationalities."⁹¹ In other words, the models of actor's rationalities cannot be developed and specified before the analysis of empirical data. Therefore, the description of the "factors" influencing actions (here, drug use) and, by correlation, the form of rationalities will directly take place with the presentation of the findings.

⁸⁸ Garfinkel H. (1967) *Studies in Ethnomethodology*, Polity Press, Cambridge, p. 264.

⁸⁹ *Ibid.*, p. 265.

⁹⁰ *Ibid.*, p. 266.

⁹¹ *Ibid.*, p. 282.

2.3.2. Actions, Decision-making and Temporalities in drug use.

Imagine⁹² that an individual, during a rave party, drinks alcohol without noticing that an ill-intentioned person drops a GHB pill into his/her glass and for consequences, the person who drank this glass wakes up the next morning without any memories about what has happened: could this consumption be qualified as a "use" or as an "action"? It can be easily proposed that due to the absence of a decisional act coming from this unfortunate individual, this action should be defined as unplanned and unintentional⁹³. This particular type of intake cannot be called and considered as being "recreational", since recreational (poly)uses aim to fulfill one or several objectives related to fun, leisure, relaxation and/or social events, such as, chill out after a day of work, being able to socialize easily with strangers, stay awake all night long, etc. (Section 1.4.2).

Concerning objectives associated with drug consumption, several studies have been conducted investigating the decision-making process of drug users (Section 1.2.1). Certainly the most representative study on this topic has been conducted by Boys and colleagues [43, 73]. These authors have focused their investigations on factors influencing drug user's decision prior to consumption. Using structured interviewer-administered questionnaires, their analyses have pointed out ten factors influencing user's decisions classified into two main categories: (1) individual-level influences (*functions*, drug-related *expectancies*, *physical/psychological state*, *commitments* and *boundaries*), and (2) social/contextual-level influences (*environment*, *availability*, *finance*, *friends/peers* and *media*)[43].

⁹² This situation comes from one of the interview material.

⁹³ However, "accidental" (accidental refers here to consumption effectuated in inebriated state) and/or unwanted consumption have their importance, in the sense that they are generally perceived as "negative" experiences by the users, and therefore modify actor's drug representation and their stock of knowledge.

The two main motivational factors appear to be user's *expectancies*⁹⁴ about drugs and conversely the different *functions* associated with these drugs by users. Drug-related expectancies are based on past experiences of users and could be considered as part of the *because* motives, while the functions attributed to the drug could be considered as belonging to the *in-order-to* motives. These functions and expectancies will be largely detailed in the fifth chapter, but it could be already mentioned that they are connected to specific physic and/or psychic states searched by the actors.

The factors described by Boys and colleagues could be split into three categories:

- contextual and contingent factors (*environment and availability*);
- individual's characteristics (*finances, physical/psychical state, commitments* of the user, and *peers/friends* influences) and;
- drug-related representation (*boundaries, media* as well as, *expectations and functions*).

It can be conjectured that the concepts of *biographical situation* and *stock-of-knowledge-at-hand* developed earlier can incorporate these different influential factors of drug-related decisions: the contextual and individual characteristics would be related to biographical situation, while drug-related representation and functions/expectancies would correspond to the stock of knowledge at hand.

Having examined research studying polydrug user's behaviors (Section 1.2.1), it can be assumed that recreational polyusers

⁹⁴ On this particular point, it can be objected that prior to first substance use, individuals could not have developed any real knowledge concerning drug(s) and, therefore, cannot have expectations regarding drugs. Nevertheless, first substance use generally appears to be oriented toward social goals, generally integration to the peer's group and socialisation, and remains therefore intentional. Furthermore, expected effects and sensations reflect information provided by different external sources such as peers, education, and media, which can influence the initiation decision.

intentionally choose specific psychoactive substances in order to achieve one or several specific states. Therefore, recreational drug use could be defined as "instrumental"⁹⁵ forms of consumption. This hypothesis strengthens the point that individuals consuming drugs recreationally are "users" (cf. Section 1.4.1). This intention is related to a decision process leading users to choose amongst a variety of drugs, taking into consideration several factors such as price, purity, duration of drug action, settings, time of the day/night, and/or social role commitments⁹⁶.

However, this decision-making approach suffers from three limitations: First, according to Boys and colleagues "[...] once initiation has occurred, an individual's decisions about substance use do not cease. Decisions are made about whether to use the substance on subsequent occasions and if so, how much to consume."⁹⁷ Should every consumption of drug be considered as a problematic action requiring a decision process or should this consumption been considered as part of a routinized form of use? This point will be further developed with the empirical findings of this research in chapter 5.

Second, if users could plan their consumption, it does not mean that the imagined and phantasied end will necessarily result in what expected by the actor due, for example, to contextual contingencies: lack of availability, bad product, police intervention, brawl, etc. Therefore, "planned actions", "on-going acts" and "experienced uses" need to be differentiated: the first one consists in *practical reasoning*; the second one to the *realization* of the planned action; and, the third expression would be subject to *reflexive judgments* [212, 218].

⁹⁵ Boys, A., Mardsen J. & Strang J. (2001) Understanding reasons for drug use amongst young people: a functional perspective, *Health Education Research*, 6(4), p. 458.

⁹⁶ This list is not exhaustive and will be further detailed in the Chapter 4.

⁹⁷ Boys A., Mardsen J., Fountain J., Griffiths P., Stillwell G. & Strang J. (1999a) What influences Young People's Use of Drugs? A qualitative study of decision-making, *Drugs: education, prevention and policy*, 6(3), p. 374.

Third, despite their precise analysis on the influential factors, research on drug-related decision-making has rarely or partially integrated interactional and symbolic dimensions of drug use, otherwise than by the concept of "peers pressure". Nevertheless, consuming drugs leads to experience physical and psychical effects and in a certain proportion, exhibit wanted and/or undesired behaviors. In a social context, these exhibited behaviors are perceived and also retroactively judged positively or negatively by other interactants (users or abstainers). The consequences of possible group sanctions or approbations on the actors are not analyzed here. It is certainly because this kind of research is focused on the moment prior to actions, and does not take into consideration modifications operated by the actors on their drugs representation after drug sessions. Again, the interactional dimensions and the biographical situation have to be conjunctly integrated to fully capture the subjective meaning attached to actor's drug uses.

This conception of action temporality could be analyzed in 4 moments:

- *Routinized consumption* and *routine* as normalized and standardized actions related to the stock of knowledge of the actors and will remain unquestioned until a problematic situation arise;
- *Initiation* and *problematic situations* appears when the stock of knowledge of the users is not consistent with the situation/event. Problematic situations will be subject to *practical reasoning*;
- *On-going moments* are subject to uncertainty and external contingencies, they can be subject to immediate readjustments through practical reasoning;
- *Experienced uses* represent the result of on-going actions: they will be evaluated and judged by both actant and interactants. They will be included into the stock of knowledge of this user.

Again, illicit polysubstances use, as an action, possesses an evolving dimension: iterative drug uses can modify in various degrees the physical, psychical and/or social conditions of actors, who are going to,

through self-interactions and/or peers judgments, modify their representation about the different drugs they are using. On the other hand, the social context and role commitments impact drug uses and drug-related routines of the actor through reevaluations; these latter can possibly have further consequences on actors' social life, and so on. Hence, concepts of *dynamic actions*, *biographical situation*, and *stock-of-knowledge-at-hand* are relevant to encapsulate situations constantly evolving, but need to be combined in a broader perspective integrating the social and interactional dimension of the daily-life world.

In this section, several theoretical frameworks have been reviewed in order to precise what is meant by "action". The different points attached to action could be summed up as:

- I. Any social action presupposes an actor with his(her) body and self;
- II. Any social action has a temporal dimension and can be subject to contingencies;
- III. Each actor has a biographical situation as well as a stock of knowledge at hand, which orients their interpretation of the world and conversely their actions;
- IV. Four moments of drug use need to be distinguished: Initiation/Problematic situation, Routine, On-going period, and Experienced use:
 - I. *Problematic situations* correspond to situations where the stock of knowledge of an actor is inexistent, inadequate and/or inconsistent to achieve the original motivation behind their actions. These situations lead to a deliberation process in the form of a practical and rational reasoning. Once adequately and accurately solved, every problematic actions will be routinized;
 - II. *Routine and On-going actions* are standardized and patterned. They are based on the stock of knowledge at

hand, but they can be overturned at any moment (Chapter 2);

- III. *Experienced uses* are subject to reevaluation through other interactants judgment and/or self-reflexivity. This process can entail readjustments of actor's routines and/or addition to the stock of knowledge at hand;

Based on these developments and consistent with the literature, it could be hypothesized that recreational polydrug use corresponds to a type of rational action⁹⁸: this specific rationality is dependent on user biographical situation, body, self and stock of knowledge at hand.

The notion of action had to be clearly defined in order to understand the elements, moments, causes and consequences of users' acts. As indicated throughout this section, the questions of interpretations and meanings combined with the notion of interaction appear to be fundamental for capturing the reasons of actions and so, the reasons of drug use. The next section (2.4) will be dedicated to the investigation of the interactional dimension and the acquisition and transformation of meaning.

2.4. Symbolic Interactions and Social Representation

In his interactional theory of action, Strauss emphasized the fact that actions and interactions are nested and interdependent and that the meaning directing actions are built through interactions:

"Actions are embedded in interactions- past, present, and imagined future. Thus, actions also carry meanings and are locatable within systems of meanings. Actions may generate further meanings, both with regard to further

⁹⁸ The specificity attached to that type of rationality is also largely dependent of the particular phenomenon and context in which the actors are engaged. Individuals may not develop the same form of rationality to use drug than to play chess or buy bread.

actions and the interactions in which they are embedded.
[...] This theoretical approach to action links action to meaning, but does so in conjunction with the linking of actions to interactions."⁹⁹

This statement calls for investigating and detailing intersubjectivity as a process of meaning's construction. This conclusion refers directly to theories belonging to "Symbolic Interactionism". The interactional arm of this research theoretical framework is based on this sociologic paradigm. The following sections detail this theory in order to explicitly describe the relation between actions, meanings and interactions.

2.4.1. Meanings, Interactions and the Social World: the Principles of Symbolic Interactionism

Symbolic interactionism is founded on the work of pragmatist philosophers and was developed by members of the Sociological School of Chicago. Herbert Blumer (1900-1987) was the first to employ the term of *symbolic interactionism* [219] and to enunciate the three fundamental premises of this theory:

- I. "Human beings act toward things on the basis of the meanings that the things have for them. Such things include everything that the human being may note in his world [...]";
- II. "The meaning of such things is derived from, arises out of, the social interactions that one has with one's fellow";
- III. "These meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he encounters."¹⁰⁰

In other words, every element of the social and physical world (physical, social and abstract objects¹⁰¹) is not "directly" and objectively perceived,

⁹⁹ Strauss A. (2008). *op.cit*, p.24.

¹⁰⁰ Blumer H. (1998) *Symbolic Interactionism: Perspective and Method*, University of California Press, Berkeley, p. 2.

¹⁰¹ Blumer H. (1998) *op.cit*, p. 10.

but is apprehended through symbols bearing specific meanings. These meanings are subjectively interpreted by actors according to their environment and social stances (or, considering the previous developments, to their biographical situations). Individual's actions in the social world are influenced and dependent on these interpretations:

"In any of his countless acts—whether minor like dressing himself, or major, like organizing himself for a professional career—the individual is designating different objects to himself, giving them meanings, judging their suitability to his action, and making decisions on the basis of the judgment. This is what is meant by interpretation or acting on the basis of symbols."¹⁰²

Thus, the form of rationality attached to actions by actors is based on the interpretations of object's symbolic. Understanding the evolution of these interpretations is needed to capture the evolution of actor's choices. The next question consists, therefore, of understanding how meanings are produced and modified.

Answers to this question stands in the mere nature of the world inside which social individuals live and interact. According to Blumer, actors are evolving in a social context composed of other social beings, and these actors need to be able to understand each other. To do so, social individuals must share common meanings about things. Meanings permit common understanding during interactional situations, but as indicated by the author, meanings attached to objects are produced and defined through these interactions:

"A human society or group consists of people in association. Such association exists necessarily in the form of people acting toward one another and thus engaging in social interaction. Such interaction in human society is characteristically and predominantly on the symbolic level; as individuals acting individually, collectively [...] they are necessarily required to take account of the actions of one another as they form their own action. They do this by a dual process of indicating to others how to act and of interpreting the indications

¹⁰² Blumer H. (1998) *op.cit*, p. 80.

made by others. Human group life is a vast process of such defining to others what to do and of interpreting their definitions; through this process people come to fit their activities to one another and to form their own individual conduct."¹⁰³

Strengthened by Strauss, this "vast process" of definition is in constant movement: meanings are constructed, corrected, stabilised or changed through the course of multiple and iterative interactions lived by individuals:

*"Meanings (symbols) are aspects of interaction, and are related to others within systems of meanings (symbols). Interactions generate new meanings and symbols as well as alter and maintain old ones. [...] meaning are linked in symbolic systems [...] all of this symbolizing was created by interaction and just as surely will be re-created over and over again. A theory of action should put symbolizing (a verb) into the heart of interaction, as being generated and regenerated during the courses of action."*¹⁰⁴

However, Blumer added that the process of meanings evaluation is not only generated through exchanges with others actors but could be self-oriented: "[...] another crucial aspect of human association, namely, that the participant not only interacts with the other person but interacts with himself. In being aware of another, in interpreting and judging his action and in identifying him in a given way, one is making indications to oneself."¹⁰⁵ On one hand, self-interaction is effectuated during two moments that must be distinguished: (1) self-reflexive interaction, which happens during the interaction (as Blumer indicated); and, (2) self-interaction as re-evaluation of past acts (Section 2.3.1.2). On the other hand, external interactions consist in an adjustment based on others expectations: here, re-evaluations of meanings are based on the interpretations of other actors about their common social world.

¹⁰³ Blumer H. (1998) *op.cit*, p. 10.

¹⁰⁴ Strauss A.L. (2008) *op.cit*, pp. 26-27.

¹⁰⁵ Blumer H. (1998) *op.cit*, p. 111.

Nevertheless and as underscored by several sociologists, the social world is segmented into different social worlds and "sub-worlds" of interests and activities [211, 220-222]. This segmentation arises from the obvious fact that the individual's social environment does not contain the totality of existing objects in the physical and social world. Social sub-worlds are constituted by "groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals, and building shared ideologies about how to go about their business."¹⁰⁶ Individual social environment is limited to a certain number of activities, locations, people and objects to interact with. This implies that most of individual's interactions, and so most of the meanings and redefinition processes of these meanings, are embedded in individual's social sub-world(s). Therefore, this research needs to identify and detail the different meanings shared into the sub-world of recreational drug users in order to clarify the orientation that individuals give to their practices.

The question then arises, how actors can manage the multiple memberships to different social worlds? According to Strauss:

*"A major set of conditions for actors' perspectives, and thus their interactions, is their memberships in social worlds and sub-worlds. In contemporary societies, these memberships are often complex, overlapping, contrasting, conflicting, and not always apparent to other interactants. [...] The main point is that in contemporary societies the activities and interactions within social worlds and sub-worlds profoundly shape their members' perspectives. [...] Multiple memberships in social worlds that variously are discrepant, overlapping, or consonant lead to complexities of perspective that, in turn, become conditional for commitment and action. These memberships are not always visible to others, either because actors are deliberately concealing them or they are simply not known to others."*¹⁰⁷

¹⁰⁶ Clarke A.E. (1991) Social worlds/arenas theory as organizational theory. In D. R. Maines (Ed.), *Social organization and social process. Essays in the honor of Anselm Strauss* (pp. 119-158). New York: Aldine de Gruyter. p. 131.

¹⁰⁷ Strauss A.L. (2008) *op.cit.*, pp. 41-42.

The question is even more interesting when integrating this last point within the evolving life-course of actors. Questions then arise: what are the different consequences that a change of social sub-world have on the meanings and interpretations possessed by an individual? An example related to the subject of this thesis is: in what degree, meaning(s) attached by an individual to the different drugs he/she uses get modified if this individual gets a new job or becomes unemployed? Or if a user moves to a new geographical area or gets into a relationship? Furthermore, assuming that actions are conditioned by the meanings actors attached to them, what would be the impact of modifications meanings attached to drugs on the consumption of users? In other words, to what degree changes in social environment modify recreational polysubstances use? These questions underline the necessity of reintegrating actions and interactions in the life-course of users.

Considering the second objectives of this research, the subsequent section will present an operative conceptualization of meanings through the notion of "social representation" that appears to embed both meanings and interpretations.

2.4.2. Social Representations

French psycho-sociologists have developed the concept of social representations in the last fifty years [223-228]. This notion is founded on the concept of collective representation developed by Durkheim in his study on religious life [229] and augmented by the anthropologic works of Levy-Bruhl [230]. These authors asserted that to understand the behaviors of members of a society, social scientists must examine and study the different symbols produced by a particular society.

Psycho-sociologists using this framework consider that¹⁰⁸ "reality is reconstructed in an individual's cognitive systems and integrated in his values system depending on his history and of the ideological and social context surrounding him. And this is this reality appropriated and restructured that constitute the mere reality for the individual or the group."¹⁰⁹

According to Jodelet [226], social representations are "a way to interpret and think about the everyday reality, a *form of social knowledge*."¹¹⁰ This social knowledge differs from the scientific one in the sense that it cannot be qualified as scientific "truths", but as *empirical* constructions based on the experiences and interactions of individuals. Social representations constitute the stock of information, beliefs and opinions that actors have produced through their experiences in the social reality about precise objects. These representations are "socially elaborated and shared, with a practical scope and concurring to the construction of a common reality to a social set."¹¹¹ The "practical scope" responds to social needs and covers different functions: it orients actions of actors in the social world by helping these actors to comprehend their surroundings; justifies their actions; or, allows interacting individuals to communicate by using the same references [228].

Here, it is obvious that the concept of social representation overlaps the symbolic interactionism notion of "meaning": both have a practical dimension by orienting the actions of individuals and both are constructed through the social interactions and experiences of individuals. Furthermore, these researchers have described the

¹⁰⁸ The following quotations have been transcribed by the author.

¹⁰⁹ Abric J-C. (1994) *Pratiques sociales et représentations*, Paris, PUF, p. 12.

¹¹⁰ Jodelet, D. (1984) "Représentation sociale: phénomènes, concept et théorie", p. 366 in Moscovici S. (éd.) *Psychologie sociale*, Paris, PUF.

¹¹¹ Jodelet, D. (1989) "Représentations sociales: un domaine en expansion", p.53, in Jodelet D. (éd.) *Les représentations sociales*, Paris, PUF.

structure of these social representations and have examined their mechanisms of construction and modification.

According to Abric [228], a social representation is structured upon a *central nucleus* and some *peripheral elements*. The "central nucleus" represents the stabilized idealization around which all information and opinions concerning one object are organized. It is mostly socially determined as it is linked to "historical, sociological and ideological conditions" and is "[...] directly associated with values and norms."¹¹² The formation of this central nucleus is based on two main processes that were developed and analyzed by Moscovici [224, 231]. According to this author, the central nucleus is mainly established through two mechanisms: *objectification* and *anchorage*. "Objectification" consists in a simplification of the information regarding an unknown object by selecting notions consonant with values shared amongst the peer's group. These representations are then incorporated in the preexistent thinking systems through the "anchorage" mechanism in order to become operant in the daily-life of the individual.

The "peripheral elements" should be considered as "mediations" between the social world and the central nucleus. These peripheral elements are individualized forms of the central nucleus representation and adjust the core representation to the particular circumstances of the individual:

"[Peripheral elements] are more associated with individual characteristics and to the immediate and contingent context in which lives the individual. This peripheral system permits an adaptation, a differentiation based on the individual lived and an integration of daily experiences. It permits personal modularities vis-a-vis of the central nucleus, generating *social representation individualized*."¹¹³

¹¹² Abric J-C., (1994) *Pratiques sociales et représentations*, PUF, Paris, p. 28.

¹¹³ *Ibid*, p. 28.

Concerning the modifications of the representation, Flament [232] suggested that these modifications appear when external circumstances (due to contradictory information concerning an object, contextual transformations, irrelevant practice during interactions, etc.) transforms operant practices into irrelevant actions; or, in other words, when the social representation associated with these practices become incompatible and inconsistent with the reality.

Flament [233, 234] distinguished two modes of transformations:

- 1) If these incompatibilities are superficial and/or temporary or if they touch only a part of the representation, peripheral elements will absorb inconsistencies. Their "activation levels" and contents change in order to integrate the novelty and adapt the practices. The central nucleus is progressively modified to reflect the adjustment(s);
- 2) If new contextual components emerge or if new practices are mandated in the normal context and if these changes appear to be in direct contradiction to the central nucleus representation, the dissonance between these elements will produce "strange schemes" that will replace central nucleus representation. These transformations are brutal and immediate.

An obvious hypothesis consists in considering that actors do have social representation about "Drug", psychoactive substances and drug users, and that these representations are modified during the life course of recreational polysubstances users. Studying these representations and understanding the different factors inducing their modifications should bring a better comprehension regarding polyuser's choices and their implications on the life of recreational drug users.

Symbolic interactionism asserts that: (1) social actions depend on the interpretations given by actors to the physical and social world they evolve in; and correlatively, (2) these interpretations are shaped and defined through processes of interaction (both external and internal).

Examining actor's social representations and their evolutions should permit capturing the contents of actor's interpretations and requires investigating what are individual, interactional and/or contextual factors influencing their modifications throughout the life-course of recreational polysubstances users. The next section (2.5) will discuss the sociological concept of *career*, which should highlight the dynamical flow of changes that shapes the user's life.

2.5. Career and Biography

As aforementioned, this thesis aims to detail and analyze the behavioral changes in the course of a recreational polysubstances user life. The previous developments have shown that actions and interactions related to recreational polydrug use cannot be separated from actor's biographies. A model able to embed the life of polyusers is, therefore, required.

Multiple factors interact in a dynamic way to shape the life of recreational users. Biographies of these latter are subject to evolutions due to contingent changes in the social world. These externalities can be consequences of their own acts and decisions, or due to judgments and readjustments inherent in their interactions (Sections 2.3 and 2.4). However, particular biographical social events external to the studied phenomenon, such as finding a job, getting married, or simply ageing, could impact their biographical situations and reciprocally, may completely, partially or not change individual's drug use behaviors [235, 236]. Conversely, phenomena such as the neurological drug tolerance, or the social and contextual events, such as, being caught by the police or witnessing a friend accident due to alcohol, can possibly modified actor's representation on drugs, and so, affect future decisions and intakes.

To describe in an organized and intelligible manner the possible evolutions structuring the existence of recreational users, the symbolic interactionist concept of *career* will be employed. As argued by Ulmer and Spencer [2]: "These symbolic interactionist conceptions of criminal careers emphasize that continuity and change are inseparable, and that social constraints and opportunities, socialization, and even biology may influence, but never totally determine the contingencies and choices involved in criminal activity throughout the life course."¹¹⁴ This concept offers the possibility to take into account dynamic and non-deterministic aspects linked to drug consumption. The next section details the sociological notion of career.

2.5.1 Career as an interactionist concept: from work to deviance

Initially, the sociologist Everett C. Hughes [237] has created this concept to retrace the life of actors in their working environment. According to this author:

"A career consists, objectively, of a series of statuses and clearly defined offices [...] subjectively, a career is the moving perspective in which the person sees his life as a whole and interprets the meaning of this various attributes, actions, and the things that happen to him. [...] Careers in our society are thought very much in terms of jobs, for these are the characteristic and crucial connections of the individual with the institutional structure [...] But the career is by no means exhausted in a series of business and professional achievements. They are other points at which one's life touches the social order."¹¹⁵

In other terms, the notion of *career* examines two dimensions and their interaction: (1) the different *objective* roles and functions endorsed by the individual, and; (2) the way that individuals organize and interpret

¹¹⁴ Ulmer J. T. & Spencer J. W. (1999), The contributions do an interactionist approach to research and theory on criminal careers, *Theoretical Criminology*, 3(1), pp. 95-124.

¹¹⁵ Hughes E.C. (1937), "Institutional office and the person", in *American Journal of Sociology*, 43(3), pp. 404-413.

subjectively their trajectory. Social researchers interested in retracing this "series of statuses" have to delimitate different sequences refer as *turning points* traversing and affecting the life-course of the individual. Turning points, as defined by Abbott [238] appear to be rare changes characterizing a radical new orientation in the life course of the individual. Indeed, Abbott understands turning points as marks strictly delimitating temporal segments in between. Indeed, this author considers that turning points are characterized by a "passage of sufficient time "on the new course" such that it becomes clear that direction has indeed been changes."¹¹⁶

These concepts of career and turning points have been widely used in criminology to study the life course of offenders [65, 236, 239-242]. The first author proposing a description of the criminal life spans as a sequence of moments was Edwin H. Sutherland in his book *The Professional Thief* [47]. In this research, the author describes daily activities and social context of a "professional" thief, Chic Conwell. According to Sutherland, being a thief, as an activity, could be compared to any other legitimate worker. In his description, he underlines the necessity for the individual to go through several stages before becoming a professional. No one born thief, the thieves generally start by legitimize works. Once they leave their legitimize job to enter the "underworld", candidates will go through different stages before be named "professional":

"The severance of legitimize connections is followed by a period of unemployment, forced or otherwise, hanging around places frequented by thieves and generally known in person by the thieves through previous work. He is first filled on for a day's work on a particular job of no great danger and calling for no particular ability [...] If he does this unimportant part well, he may be called on later for more important parts, and gradually acquires the expert skill of the professional."¹¹⁷

¹¹⁶ Abbott A. (2001) *Time Matters: On Theory and Method*, University of Chicago Press, p. 245.

¹¹⁷ Sutherland E.H. (1937), *op.cit*, p. 23.

The individual needs to learn skills and norms associated with the underworld through his different interactions with other professionals (Section 1.1.2.1). The final stage would consist in becoming proficient and capable to execute "important" tasks. It is not until this particular moment that his peers will grant him the status of professional. Here, the different stages description allows understanding how interactions and actions undertaken by the thief participate to the evolution of the individual toward a new status.

Moreover, John H. Laub and Robert J. Sampson suggest that the concept of career "offers the most compelling and unifying framework for understanding the processes underlying continuity (*persistence*) and change (*desistance*) in criminal behavior over the life span."¹¹⁸ Therefore, employing a diachronic framework appears to be the best option to capture cause and consequence of drug consumption on the biographical situation of users.

N.B: Despite the fact they are both related to the individual life, the concepts of "career" and "biographical situation" differ: *career* represents actor organized life course observed through the prism of one status or phenomenon, while *biographical situation* embodies the social, cultural, and physical characteristics of an actor at a precise moment. In other words, career describes the evolution of different biographical situations of an actor through a specific activity or status.

2.5.2 Career as a sequential model

Alfred R. Lindesmith has realized one of the pioneer interactionist studies on heroin users [243]. Based on this research and its methodology, Howard Becker investigates the drug career of marijuana smokers. Becker asserted in *Outsiders* [67] that psychological

¹¹⁸ Laub J.H. & Sampson R.J. (2003) *Shared beginnings, divergent lives: delinquent boys to age 70*, Harvard University Press, p. 13.

approaches based on a synchronic perspective of drug use were irrelevant regarding the trajectory of users. For him, synchronic approaches are based on multivariate analysis, which "assumes that all the factors which operate to produce the phenomenon under study operate simultaneously."¹¹⁹ Conversely, Becker considered that to understand the life of marijuana smokers:

"[...] we need a model which take into account the fact that patterns of behavior develop in orderly sequence [...] we must deal with a sequence of steps, of changes in the individual's behavior and perspectives, in order to understand the phenomenon. Each step requires explanation, and what may operate as a cause at one step in the sequence may be of negligible importance at another step. [...] The explanation of each step is thus part of the explanation of the resulting behavior."¹²⁰

For his study, Becker interviewed 50 regular cannabis users and showed that for becoming a marijuana smoker *for pleasure*, an individual needs to fulfill the next different "steps":

- (1) "commit a nonconforming act": to enter in a deviant pathway, a motivated action has to be undertaken by the actor. The fact to know if this person is really willing to do so or if there are social determinisms beyond this act will not be discussed here;
- (2) "learn smoking techniques" (initiation): how to roll a joint, how long to keep the marijuana smoke into the lungs, where and to whom buy cannabis... These different elements require the presence of other experienced marijuana users to be taught;
- (3) "learn to *recognize* the effects" (occasional use): apprentice needs to recognize the symptoms related to cannabis intoxication and to perceive them as pleasurable¹²¹;
- (4) "continue using" (regular use): this obvious step hides the necessity for the user to continue considering marijuana effects as pleasurable and to manage his status of drug user;

¹¹⁹ Becker H.S. (1963) *Outsiders*, Free Press of Glencoe, NY, p. 22.

¹²⁰ Becker H.S. (1963) *op.cit.*, p. 23.

¹²¹ The notion of pleasure will be examined in the first chapter of the second part, but it can already be noted here that if pleasure has a socially constructed part, it is largely dependent on the neuropharmacologic properties of the drug. The subsequent displeasurable sensation could also been explained in neurological terms (cf. 4.1.1)

(5) "ceasing" (stop)¹²²: if the effects of cannabis are perceived as not pleasurable, the user "may make this the occasion for a rethinking of his attitude toward the drug and decide that it no longer can give him pleasure. When this occurs and is not followed by a redefinition of the drug as capable of producing pleasure, use will cease."¹²³

Considering the sequence as described by Becker, it can be conjectured that the main theoretical concepts develop in Sections 2.3 and 2.4 are influencing the drug career of cannabis user at different moments:

- *interactions* with other smokers appear to be fundamental during learning stages (1-2-3), while self-reevaluation seems to be particularly important in stage 5;
- transformations on the cannabis *representation* are operated throughout the career and especially during stage 1, 3 and 5;
- cannabis consumption, as an action, seems to be *routinized* in stage 4, while it becomes *problematic* during stage 1 and 5;
- if Becker did not discuss the *because* motive associated with the initiation of cannabis, the *in-order-to* motives appear to be related to hedonism and pleasure.

In summary, conceive drug user's lives through the concept of career permits capturing the complexity inherent in recreational polysubstances use. Therefore, describing the drug career requires to create a sequential objectification of user's life by integrating the different experiences, interactions and contextual events influencing actions and decisions of individuals [244].

Nevertheless, Becker's research on drug use was only oriented on cannabis use. Duprez and Kokoreff [245] have questioned the relevance of the Beckerman conception of career if adapted to other category of

¹²² With the possibility of relapse.

¹²³ Becker H.S (1953) "Becoming a Marijuana User" p. 241, in *The American Journal of Sociology*, 59(3).

drug users. Furthermore, if Becker briefly talked about the impact of polysubstances use on the pleasure felt by users¹²⁴, his research did not give any indication on the career of poly-users. In this particular case, different sequences of different "mono-substance" career could coincide: for example, the cessation of cannabis does not necessarily mean the cessation of all other substances, the initiation to cannabis could have co-occurred to the regular use of amphetamine to reduce its effect, and so on.

Therefore, a framework able to integrate inside a global "individual-oriented career", the various sequences of the different mono-substance careers is needed to describe the drug career of polysubstances users and to capture the dynamic interplay shaping both individual-based and substance-based careers. The subsequent section aims to describe such a framework.

2.5.3 Drug User Career in the polysubstances use context

In their article *Starting, Switching, Slowing and Stopping*, Measham, Parker and Aldridge [133] developed a framework that capture the different moments of polysubstances user's careers by taking into account each initiation to new substances or changes between substances use, as being "turning points". Through their 24 interviews conducted at two different timeframes (one year distant), these researchers have described the drug career of young individuals (17-20 years old) by identifying and analyzing the modifications concerning the meanings and interpretations attached to their consumption.

¹²⁴ "[...] people who become heavy users of alcohol, barbiturates, or opiates do not continue to smoke marihuana, largely because they lose the ability to distinguish between its effects and these of the other drugs. They no longer know whether the marihuana gets them high." Becker H.S. (1963) *op.cit*, pp. 52-53.

Authors described four moments: *starting, switching, slowing, and stopping*. These moments do not constitute a fixed and mechanical order: if the "starting" stage is obviously shared by all users interviewed, the importance of other transitions is variously embedded into user's careers. These variations and transitions between substances have been categorized into "switching" and "slowing down". According to the authors, the decisions of switching or slowing down arise from a decision process based on a specific form of rationality:

"The cost-benefit assessment of different licit and illicit drugs affected young people's choice of drug on any given social occasion and such assessment included risks, financial costs, access and availability, peer influences, positive/negative physical and psychological effects, perceived longer term effects and the possibility of getting caught by parents, police or other authority figures."¹²⁵

Furthermore, they indicate that users consider their "perceived and projected image" on drug as a factor for drug choice: "Such concerns about self-image are reflected in the ways in which the effects of drugs for them are linked to issues of maturity and immaturity, self-control and disinhibition."¹²⁶ This point confirms that evaluations and judgments of other interactants modify user's perceptions and drug's representation, orienting their choice regarding drugs. However, if Measham and colleagues consider switching as oriented toward new habits and substances, they do not mention any element concerning possible comebacks to stopped substances.

These switching transitions are generally related to "slowing down" in other consumption. Slowing down moments refer to "either reducing input in terms of quantity or frequency of drug use or cutting out the use of a specific drug."¹²⁷ Reasons summoned by interviews mainly refer to three causes: substances side effects out-weighting the benefits; new social roles commitments, and; changing in peer's network.

¹²⁵ Measham F., Parker H. & Aldridge J. (1998) *Starting, Switching, Slowing and Stopping*, Report for the Drugs Prevention Initiative Integrated Programme, pp. 11-12.

¹²⁶ Measham F., Parker H. & Aldridge J. (1998) *op.cit.*, p. 12.

¹²⁷ *Ibid*, p. 16.

Consequently to a "slowing down" step, some respondents have stopped using drugs definitively, while others have just gone through new drug use "cycles". Reasons and causes of stopping will not be detailed in this chapter, but again, stopping results of the interplay between several factors belonging to different levels of analysis.

Through their description of polyuser career, these researchers have described the "cost-benefit" decision-process inherent in drugs choice, but the different skills and techniques acquired throughout consumption, as well as the meanings and social representations given by users to substances, are not discussed in their work. Preliminary results from the empirical data indicate that transitions from one step to another are related to modifications in drug's representations and practices (cf. Section 5.3). Therefore and again, the different outcomes of actions and interactions, as experiences, have to be integrated into the different stages of user's drug career to take their full sense.

To conclude this section, the interactionist concept of "career" provides a flexible framework that allows capturing the different moments of drug user life in an "intelligible" order. It also permits contextualising both causes and consequences of actions/interactions, which shape future actor's decisions and retroactively impact the drug career of users. In order to incorporate the polysubstance dimension as part of the drug career of recreational users, it has been proposed to integrate "switching" and "slowing down" steps developed in the work of Measham and colleagues to the sequential model of Becker.

Conclusion:

The purpose of this chapter was to present the different sociological theories and concepts considered as being relevant to study and describe recreational polysubstances use. As aforementioned, the idea

that polysubstances use is an action based on rational decisions of actors is sustained. These individual "rationalities" depend greatly on biographical situations and stocks of knowledge of users. These stocks are practical social-based knowledge encompassing the different skills, beliefs and meanings that individuals develop and use to orient their actions and interactions in the daily social world. Shaped and learnt during interactions, meanings and beliefs regarding psychoactive substances evolve, as social representation, throughout the drug user career. This one could be understood as the dynamical product of the different actions/interactions lived and incorporated as experiences by the recreational polyusers. Re-evaluation by self-reflexion and through the interactants judgments permit to users adapting and adjusting their actions in case of problematic situations. These adaptations will similarly modify and transform actor's rationalities and related decisions, and so on.

The subsequent section (2.6) will be dedicated to describe and explicit the several notions belonging to the field of artificial intelligence that allow putting into relation all these theoretical elements into an artificial society. To do so, a disciplinary "bridge" needs to be created. This one will facilitate the dialog between, on one hand, the sociological empirical data and theoretical framework and, on the other hand, a formal and computational abstract model using distributed artificial intelligence.

2.6. Intelligence Artificial Concepts: Complex Systems, Model and Simulation

Again, the purpose of this work is double: studying the impact of polysubstances use in the life of recreational users and creating a social simulation to get a better understanding about this social phenomenon. The second objective of this research implies the use of artificial

intelligence techniques. Creation of artificial societies requires "translating" sociological data and concepts into virtual inputs and structures. Considering the extreme complexity of the social reality and in a lesser extent of recreational polysubstance use, complex adaptive systems seem to tally the objectives of this research.

2.6.1. Complex Adaptive Systems

Complex systems could be described as "[...] any system consisting of a large number of interacting components (agents, processes, etc.) whose aggregate activity is non-linear (not derivable from the summations of the activity of individual components), and typically exhibits hierarchical self-organization under selective pressures."¹²⁸ Complex Adaptive Systems (CAS) from a specific set of complex systems in the way that their "interacting components" could adapt to their external contexts and learn from their interactions. Researchers interested in modeling social systems generally consider CAS as the best suited to reproduce and mimic parts of the social reality [98].

If complex adaptive systems have been used in a large number of disciplines (neurobiology, biology, ethology, sociology, political science), CAS share common characteristics, which could be listed in the following way:

- *Parallelism*: "Complex Adaptive Systems consist of large numbers of agents that interact by sending and receiving signals. Moreover, the agents interact simultaneously, producing large numbers of simultaneous signals¹²⁹".

¹²⁸ Cliff J. and Rocha L.M. (2000) "Towards Semiotic Agent-Based Models of Socio-Technical Organisations." *Proc. AI, Simulation and Planning in High Autonomy Systems (AIS 2000) Conference*, Tucson, Arizona, USA. ed. H.S. Sarjoughian et al., pp. 70-79.

¹²⁹ Holland J.H. (2006) Studying Complex Adaptive Systems, *Journal of System Sciences and Complexity*, 19: 1-8, p. 2.

- *Self-Organization*: no centralized intervention influences or imposes actions or interactions of agents;
- *Unpredictability* and "diversity of behaviors": interactions between agents are non-linear, which implies that initial conditions could produce different outcomes [246];
- *Sub-optimal equilibrium*: due to the two previous characteristics, CAS do not exhibit and are not aiming to produce optimum outputs;
- *Resilience*: important shocks and perturbations are "absorbed" by a CAS, which after fluctuations, will come back to its previous equilibrium;
- *Conditional action*: agents behave accordingly to rules incorporated in algorithms. However, these conditional actions could change over time due to two properties of CAS agents: (1) *Modularity*: rules of actions can evolve in "[...] groups of rules often combine to act as “subroutines” [...] These “subroutines” act as building blocks that can be combined to handle novel situations, rather than trying to anticipate each possible situation with a distinct rule. Because potentially useful building blocks are tested frequently, in a wide range of situations, their usefulness is rapidly confirmed or disconfirmed."¹³⁰; (2) *Adaptation and evolution*: agents modify their characteristics over time. Holland considers that agents learn new rules through adaptation, while other authors speak of "strategies" that agents modify based on "measure of success" [247].

One of the main hypotheses of this research is that recreational polysubstance use is a Complex Adaptive System. Modeling the artificial society based on this framework allows encompassing both notions of actions and interactions, and encapsulating these latter inside the entity of "agent". It also permits to integrate the dynamic and progressive dimensions inherent in the life of social actors by introducing the notion of "adaptation".

¹³⁰ Holland J.H. (2006) *op.cit.*, p. 3.

Nevertheless, Holland understands the concept of "adaptation" in a biologic sense and uses "genetic algorithms" to perform agents routines transformation [158]. For social research, agents are considered as adapting to their social environment by *learning* [98]. In simulation, learning is the fruit of repetitions and impact agent's social representation and routinized actions. Matching what appear as best suited actions according to their biographical situations, agents modify in return their environment leading to further modifications at the micro and/or meso level(s).

Modeling and describing CAS entails to use specific methods able to encompass the previously described characteristics. Simulations have known an growing interest in the last twenty years and have been increasingly used to study phenomena belonging to social sciences [248].

2.6.2. Social Simulation Paradigm

Different types of social simulations existing have been shortly reviewed in Section 1.3.1, but the theoretical basements of this method have not been described yet. As claimed by Gilbert and Troitzsch [104], simulations consist of creating a *model* of a "real world" phenomenon, named *target*. The virtual model is a simplification of the real target that allows social scientists to study and draws conclusions about the real phenomenon.

Models applied to social sciences aim to reproduce macro-phenomena that are inherently dynamic (i.e. evolving over time and impacting and modifying their environment), and complex (i.e. presenting numerous heterogeneous entities interacting non-linearly together inside a structured and symbolic context). Thus, social models (1) need to capture these two characteristics to mimic their social targets and, (2)

must be "adequately" construct in order to produce relevant conclusions regarding these same targets.

However, testing the adequacy of social models reveals to be an uneasy task: when the phenomenon could be designated as linear (the output is in direct relation with the input) an analytical method could be used to test the validity of researcher assumptions; but, in the case of non-linear and dynamic systems such as most of social phenomena, analytical comparisons appear to be ill-adapted. In that precise case, *simulations* seem to be the best suited to check the model validity. As indicated by Gilbert and Troitzsch: "Simulation means 'running' the model forward through (simulated) time and watching what happens."¹³¹ This technique enables the researcher to redo the validation process until the best match and conversely the best inference are achieved.

2.6.3. Building a simulation: main processes

Gilbert [249] has described a "sequence of steps" to be followed in order to produce a social simulation:

- 1) Define a *research question*: social simulations generally look to explain macro-phenomena regularities, such as appearance of norms or equilibrium;
- 2) Specify the different types of virtual entities or "*agents*" (Section 2.6.2) to be involved in the model as well as their characteristics and behaviors;
- 3) Specify the *environment* in which the macro-phenomenon is observed (networks, precise geographical area, abstract plan....);
- 4) Collect *data* related to the target and fill theoretical gaps¹³²;

¹³¹ Gilbert M. & Troitzsch K.G. (2005) *op.cit.*, p. 16.

¹³² This point does not appear in Gilbert N. (2008), but in Gilbert M. & Troitzsch K.G. (2005).

- 5) Implement in a *formal model* (differential equations, logic statement, or here, computer software) hypothesis formulate about observed processes;
- 6) *Verify* the model: debug the code or formula;
- 7) *Validate* the model: it is not because the code has no mistake that the model will draw relevant conclusions about the target.

The first three points are discussed in the first part of this research, while the point number 4 will be the object of the second part of this thesis. The fifth point will be progressively exposed considering how some elements of the simulation are drawn from the theoretical literature, while some other are empirically-based. These last two points will be the object of ulterior developments directly linked to the verification of the model (cf. Sections 7.2 and 7.3). These authors illustrate the simulation process with the following Figure 2.9.

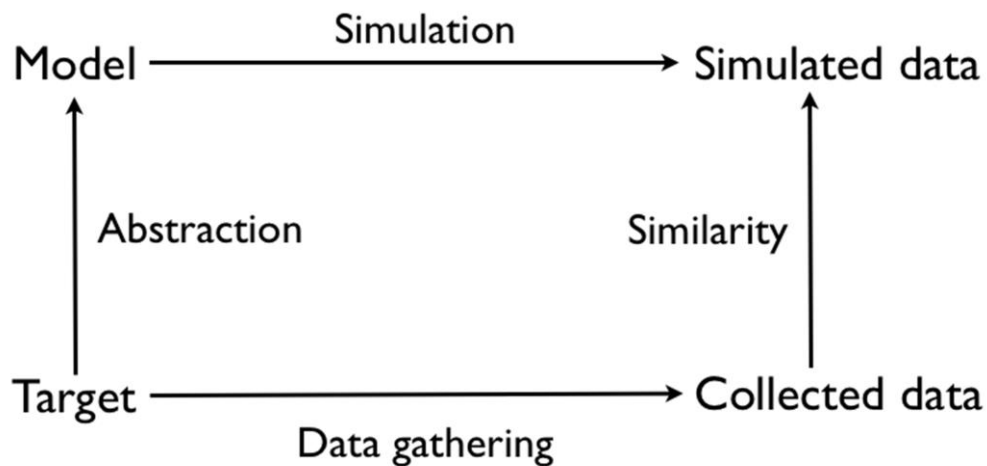


Figure 2.9. The logic of simulation (Gilbert & Troitzsch, 2005)

2.6.4. Objectives and Types of Simulations

Two important factors will shape the form of social simulations: types of results researchers want to draw from the simulation, and, similarly, its level of precision.

First, the role attributed to simulations mainly depends on the level of understanding researchers possess on the target [250]. Three roles could be distinguished:

I. "*Generator*" models are used when little is known about the system of interest and are employed primarily to determine if a given conceptual model/theory is capable of generating observed behavior of the system;

II. "*Mediator*" models are designed where the system is moderately understood and are mainly used to establish the capacity of the conceptual model to represent the system and to then gain some insight into the system's characteristics and behaviors;

III. "*Predictor*" models are built where the system is well understood and it is used primarily to estimate or predict a system's behavior with little time spent on ensuring that the conceptual model is correct because this aspect of the simulation has already been established¹³³.

Second, level of precision of social simulations depends mainly on the category of phenomenon studied, and on the potential extension of conclusions drawn out of the simulation [249]:

I. *Abstract* models are dedicated to study basic social mechanisms touching a large number of processes and to evaluate social theory. As indicated by Gilbert, the Schelling's model of segregation is a perfect example;

II. *Middle-range* models "aim to describe a particular social phenomenon, but in a sufficient general way that their conclusions can be applied widely [...]"¹³⁴ Due to the general aspect of the phenomenon studied, middle-range models cannot be compared to exact statistical

¹³³ Heath B., Hill R. & Ciarallo F. (2009) A Survey of Agent-Based Modelling Practices (January 1998 to July 2008), *Journal of Artificial Societies and Social Simulation*, 12(4), p. 9.

¹³⁴ Gilbert N. (2008) *op.cit.*, p. 42.

data, but could be validated by "qualitative resemblances". Simulations related to consumers choices or response to innovation are examples of middle-range simulations;

III. *Facsimile* models are designed to reproduce as exactly as possible, precise social processes embedded in specific contexts and to produce predictions about the future of such phenomena. Such simulations would be rare and dedicated to special cases. Indeed, social phenomena always contain some elements of randomness invalidating any quantitative comparison.

Due to the scope of this research, the simulation produced with this work will be based on a middle-range type model. This simulation aims to be a mediator model with humble intentions of predictor (even if the term of "prevision" is preferred to prediction, the first being less exact and precise and more realistic than the second). This "mediative" process will be the object of the next section.

2.6.5. Abductive Modeling and Generative Sociology

As indicated in the previous statement and stipulated by Gilbert and Troitzsch [104], social simulations should generally help to "develop theories, not accurate models"¹³⁵. The process of implementing algorithms and data into a virtual society helps to understand and identify lacks and gaps that are populating the conceptual model: the different experiments effectuated during the validation process enable modelers to test their assumptions integrated into the model and, if necessary to modify them. In other words, social simulations offer the chance to reformulate and/or add assumptions and hypothesis as long as judged necessary by the researcher (this particular point will be the object of a specific part in the third part). Here, the model is used as a theoretical structure that empirical data constitute, shape and modify

¹³⁵ Gilbert N. & Troitzsch K.G. (2005) *op.cit.*, p. 26.

throughout the research process. This "go between" movement from *local knowledge* to *global knowledge* is ensured by the presence of a flexible model encompassing the different theoretical levels of the research.

The rules and assertions on which are built the model could be possibly subject to revision. Using simulation to study social phenomena consists of proceeding by *abduction*. The philosopher Charles Sanders Pierce has initially described this particular form of reasoning as the process of "guessing". The process rests upon the choice of the best suited inferences regarding a particular observation. Abduction mainly differs from deduction and induction in the way that it imputes the existence of several possibilities to explain one phenomenon. Put into a more formal way, an abductive process could be expressed as: "Given evidence E and candidate explanations H_1, \dots, H_n of E , if H_i explains E better than any of the other hypotheses, infer that H_i is closer to the truth than any of the other hypotheses."¹³⁶

This third logical way of reasoning sounds similar to the epistemological position of Axelrod regarding simulation:

"Simulation is a third way of doing science. Like deduction, it starts with a set of explicit assumptions. But unlike deduction, it does not prove theorems. Instead, a simulation generates data that can be analyzed inductively. Unlike typical induction, however, the simulated data comes from a rigorously specified set of rules rather than direct measurement of the real world. While induction can be used to find consequences of assumptions, simulation modeling can be used as an aid intuition."¹³⁷

This abductive process of building artificial society is directly related to what Epstein calls "Generative Sociology". This sociology is based on

¹³⁶ Douven, Igor, "Abduction", The Stanford Encyclopaedia of Philosophy (Spring 2011 Edition), Edward N. Zalta (ed.), <http://plato.stanford.edu/archives/spr2011/entries/abduction/>

¹³⁷ Axelrod R. (1997) Advancing the Art of Simulation in the Social Sciences, p. 22, in Conte R., Hegselmann R, & Terna P. (Eds.) *Simulating social phenomena*, Springer-Verlag, Berlin, pp. 21-40

the following question: "How could the decentralized local interactions of heterogeneous autonomous agents generate the given [social macro-phenomenon] regularity?"¹³⁸ To answer that question, Epstein proposes to consider as valid, explanations allowing researchers to generate the social macro-phenomenon targeted via an artificial society. Put in a different way, researchers implement their hypotheses and assumptions in a software program and observe if the program's outputs are able to reproduce data observed in the targeted phenomenon:

"What constitutes an explanation of an observed social phenomenon? Perhaps one day people will interpret the question: "Can you explain it?" as asking "Can you *grow* it?" Artificial society modeling allows to "grow" social structures *in silico* demonstrating that certain sets of micro-specifications are *sufficient to generate* the macro-phenomena of interest."¹³⁹

For "generativists", an artificial society is composed of virtual agents interacting together and the result of their actions and interactions generates a macro-social regularity:

"Situate an initial population of autonomous heterogeneous agents in a relevant spatial environment; allow them to interact according to simple local rules, and thereby generate, or grow, the macroscopic regularity from the bottom up¹⁴⁰. This is the way generative social scientist answer the generative question."¹⁴¹

Modeling a social phenomenon and its outcomes asks a framework enabling to capture both its characteristics and evolution. Considering the precedent developments, Agent-Based System appears to be the best suited to achieve the objective of this thesis [251-253]. The next section (2.7) will be dedicated to describe this simulation method.

¹³⁸ Epstein J.M. & Axtell R. (1996) *Growing Artificial Societies: Social Science from the Bottom Up*, MIT Press, Cambridge, p. 41.

¹³⁹ *Ibid*, p. 20.

¹⁴⁰ If this generative process gives good incites concerning social micro-to-macro processes, it completely eludes to treat the question of structural influences (macro-to-micro) on "heterogeneous agents" populating the artificial society. This important limitation will be discussed ulteriorly (cf. Discussion and Further Works).

¹⁴¹ Epstein J.M. (2007) *Generative Social Science: Studies in Agent-Based Computational Modelling*, Princeton University Press, p. 2.

2.7. Distributed Artificial Intelligence and Foundations of Agent-based Modeling

According to Davidson [254], constituents of Agent-based Social Simulations (ABSS) is situated at the intersection of three research areas, namely, agent-based computing; social sciences, and; computer simulation. ABSS arise as a method from the aggregation of techniques developed at the intersections of these research areas, namely, *Social Simulations* (social sciences and computer simulation); *Social Aspects of Agent Systems* (social sciences and agent-based computing), and; *Multi-Agent Based Simulation* (computer simulation and agent-based computing). The following development will describe the two last techniques. But before getting to that point a brief review of the history of the AI's field should help to capture the foundations of Agent-based Model.

2.7.1. Brief History of AI

Historically, the field of artificial intelligence (AI) has known three important development phases:

- 1) In the 1950's: based on the contemporary findings in neurology and computational sciences, classic AI rests on the principle that "every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it."¹⁴² Classic AI has primarily focused on the development of machines able to automatically demonstrate theorems [255, 256];
- 2) In the 1980's: appearance of "expert systems" part of "knowledge-based systems" [257]. These systems attempt to solve complex problems

¹⁴² McCarthy J., Minsky M., Rochester, N. & Shannon, C. (1955) *A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence*.

by using knowledge, experiences and logical reasoning integrated in software;

3) In the 1990's: one of the principal critics about classic artificial intelligence and expert systems, rests on how AI should mimic human intelligence and that human cognitive capacities arise and get modified through social interactions [258]. *Distributed Artificial Intelligence* (DAI) aims to palliate this issue by integrating the interactional dimension of reality. In other words, DAI aims to create artificial societies where agents coevolve and interact modifying their own characteristics and social context.

2.7.2. General structure of Multi-Agents Systems

According to Ferber, this approach, that he named *kenetic*, considers that: "[...] simple or complex activities [...] represent the fruits of interaction between relatively independent and autonomous entities, called "agents", which operate within communities in accordance with what are sometimes complex mode of cooperation, conflict and competition in order to survive and perpetuate themselves. Organized structures emerge from these interactions which in turn restrict and modify the behaviors of the agents."¹⁴³

In other words, Multi-Agent System (MAS) aims to encapsulate the different levels or subsystems delimited in social reality in a dynamical way. "Autonomous entities", "communities", "organized structures" are put into relation and act on each other creating a system of interconnected subsystems. Multi-agent Systems, as defined by Ferber, are constituted of the following elements:

(E) An *Environment* that is, a space that generally has a volume;

¹⁴³ Ferber J. (1999). *Multi-agent Systems: An Introduction to Distributed Artificial Intelligence*, Addison-Wesley, Edinburgh, p. 4.

- (O) A set of passive *Objects*, which can be perceived, created, destroyed and modified by the agents'
- (A) An assembly of *Agents* representing the active set of objects;
- (R) An assembly of *Relations*, that link active or passive agents to each other;
- (Op) An assembly of *Operations* that define the way agents of A act on objects from O.¹⁴⁴

In a MAS, Objects and Agents interact on or with each other via Relations and Operations inside the Environment. The fact that the system evolves through different relations affecting the various elements of a MAS namely actions (Objects-Agents), interactions (Agent on itself or Agent-Agent(s)) and structuration (Environment-Objects and Environment-Agents) imply a systemic division of the artificial reality in different sub-levels. Ferber has conceptualized artificial reality through three levels:

I) *Micro-level* corresponds to actions of agents on objects, self-reflexivity and modification of agents characteristics;

II) *Meso-level* should be considered as the group or network dimension: interactions as communications, evaluations and/or concerted actions, as well as structuration of group roles and activities, composed that stratum;

III) *Macro-level* refers to the societal dimension constituted of institutions, norms, and shared symbolisms. It subsumes objects, agents, and groups; it restricts both agents and groups and evolves accordingly to the dynamic created by these latter¹⁴⁵.

¹⁴⁴ Ferber J. (1999) *op.cit.*, p. 11.

¹⁴⁵ On this subject, the author has indicated that this classification is not "a fixed standard for studies, but rather a guide for us to refer to as we make our own judgement and analyses." [Ferber (1999), *op.cit.*, p.14]

As just specified, these three sub-levels interpenetrate each other creating a non-linear and dynamic system. However, ABS is particularly focused on the micro-level, on the agents and most of the work coming from DAI is based on the definition of agent behavioral rules that will determine their future actions and interactions. The idea of "agent" is common to both sociology and artificial intelligence. In order to avoid any amphiboly around this term, the next paragraph will precise and describe the essential characteristics of this central concept.

2.7.3. Definition and types of agent

Conventionally, agents in artificial intelligence are described as having four fundamental characteristics:

- *autonomy*: there is no direct control from the modeler on the agent, that's mean that agents have the control of their actions (programmed actions however);
- *social ability*: agents can interact with other agents;
- *reactivity*: agents perceive their environment and are able to react appropriately to specific stimuli;
- *pro-activeness*: agents do not only respond to their environment, they are goal-oriented and take initiative to fulfill their goals [259].

However, if agents share these common capacities, they could differ by their capacities. Ferber [258] differentiates four categories of virtual agents. These types arise from the combination of two characteristics: their behaviors (having a goal or just react to the context) and their perception of their environment (possible adaptation to the context or not). These differences could be sum up in Table 2.4.

Table 2.4. Taxonomy of agents according to their relation to the world and their conduct.

Relationship to world Conduct	<u>Cognitive Agents</u>	<u>Reactive agents</u>
<u>Teleonomic</u>	Intentional agents	Drive-based agents
<u>Reflexes</u>	Module-based agents	Agents

Depending on studied phenomena, properties of agents differ: modeler will prefer pure reactive agents to study the ethology of inferior animal such as ants [260]; conversely, intentional agents appears to match the human cognitive and reflexive capacities [261]. Characteristics of agents depend greatly on the phenomenon studied and can reflect any characteristic wished by the researcher.

The model developed in this research aims to mimic a social target composed of individuals having a large panel of characteristics; could choose amongst several projects of actions, and; could participate to numerous interactions. Based on this last point and on the very nature of the recreational polysubstances use, the choice of **intentional agents** seems to be the most appropriate. This particular category of agents can be compared to *rational agents* that could be described as: "[...] software entities that perceive their physical or software environment through appropriate sensors; have a model and can reason about the environment that they inhabit; and based on their own mental state take actions that change their environment¹⁴⁶."

To achieve such cognitive actions, intentional agents need two additional characteristics: (1) most of the intentional agents are *hysteretic* agents, it means that they learn and stock information in

¹⁴⁶ Rao A. and Wooldridge M. (1999). Foundations of Rational Agency in M. Wooldridge and A. Rao (eds.), *Foundations of Rational Agency*. Kluwer Academic Publishers. Netherlands. p. 1.

their *memory* based on their experiences in their environment; (2) these agents have a set of *beliefs and knowledge* initially programmed and accumulated through actions/interactions. This representational system is completely dependent on the *memory* skill [258].

Some could critic the reification of social human beings into virtual agents, which dispose of a limited number of characteristics and behaviors. However, the scientific constructs of social scientists regarding the actions and interactions of real individuals do proceed from the same mechanism. Indeed, and according to Schutz, social scientists also produce models of the social world, by creating "puppets" or "homunculi" representing social actors:

“[This process] begins to construct typical course-of-action patterns corresponding to the observed events. Thereupon he co-ordinates to these typical course-of-action patterns a personal type, a model of an actor whom he imagines as being gifted with consciousness. Yet it is a consciousness restricted to containing nothing but all the elements relevant to the performance of the course-of-action patterns under observation and relevant, therewith, to the scientist's problem under scrutiny. He ascribes, thus, to this fictitious consciousness a set of typical in-order-to motives corresponding to the goals of the observed course-of-action patterns and typical because-motives upon which the in-order-to motives are founded. Both types of motives are assumed to be invariant in the mind of the imaginary actor-model. Yet these models of actors are not human beings living within their biographical situation in the social world of everyday life. Strictly speaking, they do not have any biography or any history, and the situation into which they are placed is not a situation defined by them but defined by their creator, the social scientist. He has created these puppets or homunculi to manipulate them for his purpose. A merely specious consciousness is imputed to them by the scientist, which is constructed in such a way that its presupposed stock of knowledge at hand (including the ascribed set of invariant motives) would make actions originating from it subjectively understandable, provided that these actions were performed by real actors within the social world.”¹⁴⁷

¹⁴⁷ Schutz A. (1971), *op.cit.*, "Common-sense and scientific interpretation of human action", p.40-41.

As pointed in the previous citation, the "homunculi" built by the social scientists are based upon characteristics relevant to the investigated phenomenon. These "puppets" act accordingly to a set of in-order-to and because motives and interact with each other. The only difference that seems to exist between the virtual "agent" as defined by Wooldridge and Ferber, and the homunculi of Schutz rests on the formalized dimension of the virtual agent. Nevertheless, the creation process of these two entities remains similar and both approaches consider that their constructs are deciding, acting, and interacting intentionally. The next subsection (2.7.4) investigates this intentionality and the decision process of the virtual agents.

2.7.4. How does agent decides: BDI approach

Originally developed by the philosopher Michael Bratman in *Intentions, Plans and Practical Reason* [262], "belief-desires" model attempts to recreate the process of *practical reasoning*. This latter could be distinguished from *theoretical reasoning* oriented on beliefs about the world: practical reasoning is oriented toward actions in the daily-life world. This distinction is comparable to the difference between overt and covert actions (Section 2.3.1.1).

Bratman founds his theory of practical reasoning on the assumption that human beings create plans regarding future actions (which appears consistent with notions developed in Section 2.3.1.3). These plans are based on desires and beliefs of individuals about the world: "[...] we understand intentional action, and action done with intention, in terms of the agent's desires and beliefs, and actions standing in appropriate relations to these desires and beliefs."¹⁴⁸ This desires-beliefs planned construction is "straightforwardly", according to Bratman, extended by availability of "all the main materials needed for a

¹⁴⁸ Bratman M.E. (1987) *Intentions, Plans and Practical Reason*. Harvard University Press, Cambridge, p. 6.

satisfactory treatment of future-directed intention."¹⁴⁹ In the case of polysubstances use choices, the "straight-forwardness" of this availability is subject to difficulties inherent in the illegal nature of most of the drugs. As it will be discussed below (Section 5.2.2), integration of "means" as a restrictive category will be necessary to capture the decision-making effected by polysubstances users (users do need to have drug-related connections and money to buy substances as developed in the chapter 5).

Despite the "mechanical" appearance of Bratman theory, this later acknowledges the *incompleteness* of such plans: the course of action may change due to the vast complexity of the social world¹⁵⁰. Beliefs-desires practical reasoning theory aims to produce a formalization of the reasoning that orients actions and not on the whole elements on which depends the course of action. This practical reasoning formalization: "[...] appears to consist of at least two distinct activities. The first of these involves deciding *what* state of affairs we want to achieve (*deliberation*); the second process involves deciding *how* we want to achieve these states of affairs (*means-ends reasoning*)."¹⁵¹ Nevertheless, individuals do not rethink and rebuild plan *ad infinitum*. The commitment to one particular desire and to its plan is named *intentions*.

The *Belief-Desires-Intention* (BDI) *model* is widely employed in the field of AI and forms the basement of agent's rationality [263]. The components of BDI are defined as follow:

- *Beliefs* are the agent's representations of the state of the world and are obtained by self-inference or interactions. Therefore, agent's beliefs do not need to be true, but need to be in adequacy with the environment as it is perceived by the agent;

¹⁴⁹ Bratman M.E. (1987) *op.cit.*, p. 6.

¹⁵⁰ *Ibid.*, p.3.

¹⁵¹ Wooldridge M. (2000) *Reasoning about rational Agents*, MIT Press, Cambridge Massachusetts, p. 21.

- *Desires* represent goals and objectives. These one can be either idiosyncratic or influenced by the social environment in which the agent evolves. An agent may have several desires at a time, leading to contentious situation;
- *Intentions* refer to the commitment toward a selected desire and to the way this desire is going to be handled. Intentions stop the decisional belief-desire process and are consistent. This means that, contrary to desires, the agent could only have one intention at a time. This intention expresses the choice of agents regarding their future actions.

As already pointed, this BDI model needs to be adapted to the recreational polydrug use phenomenon by inserting empirical elements to ensure the validity of the agent's choices algorithms implemented. These elements will be added throughout the presentation of the empirical findings (cf. Part II).

Conclusion:

The variety of proprieties exhibited by "agents" and the flexibility of agent-based systems offer the possibility to model and shape artificial entities in order to reproduce a particular phenomenon observed. As already indicated in Section 1.6, this simulation attempts to encompass five levels of reality (namely, *drug*, *individual*, *network*, *context*, and *society*), to represent the actions, interactions, and drug career's evolutions of recreational polyusers. Considering that an ontology is defined (in computer sciences) as a "description of a particular domain defined by its objects, concepts, and their properties and relations" [264], SimUse could be defined as an "ontologic" model of recreational polydrug use. By integrating the theoretical framework into an agent-based model, this thesis aims to:

(1) Specify physical, psychological, economical and/or social characteristics represented by statistic or qualitative-based variables in agents. These characteristics could be either similar to, or different from one agent to another. Furthermore, differences amongst characteristics will guarantee the obtaining of a heterogeneous virtual population.

(2) Give agents specific goals and beliefs. The beliefs would be considered as agent's social representation and these one will be modified according to agent's experiences and interactions with other agents.

(1) and (2) compose the biographical situation and *career* of agents;

(3) Implement routine with empirical-based rules of actions and interactions, which could be different or generalized amongst every agents or subset of agents and would be subject to modifications;

(4) Give agents the possibility to make choice through a rational process using an "adapted to recreational polysubstances use" variation of BDI in case of newer or problematic situations, and even modify orientation of action(s) during their course;

(3) and (4) allow differentiating routine actions from problematic situations;

(5) Integrate self-interactional processes based on agents experiences: agents will be able to evaluate their own characteristics and actions, which may impact their future actions/interactions;

(6) Create a meso-level by incorporating agents into specific groups (according to agent's characteristics and experiences). Members of a same network will be able to exchange information or goods. Furthermore, group's members will also be in the position to judge and evaluate actions and behaviors of other members;

(5) and (6) condensate reevaluations processes assuring the adaptation of agent to their context and will cover the interactional processes;

- (7) Build a drastic simplification of a geographical environment composed of locations with differentiated and specified characteristics in which agents could act or interact;
- (8) Integrate an "artificial time" to schedule agents activities and enable the system to evolve;
- (7) and (8) restrain agents into a "physical" context and force them to act in a semi-ordered manner;

- (9) Add external events (drug depletion, police intervention, music festival, media campaign) that could interfere with agent's characteristics or with the course of their actions/interactions;
- (10) Implement public policies scenarios to test their efficiency;
- (9) and (10) will allow testing the robustness of the system and the adequacy of this one to the target.

This present chapter has presented a new theoretical perspective to capture and analyze the actions, interactions, and evolutions of recreational polydrug users. This perspective will permit creating an agent-based social simulation encompassing several levels of complexity. Retroactively, building this artificial society will allow testing the theoretical framework presented above. Therefore and due to the abductive nature of this research, the model has been designed in two phases: a first model has been built based on the literature review and on the precedent theoretical developments; while the second one is an updated version that integrates the empirical findings. The first model, the proto-ontology, was initially conceived as indicated by Figure 2.10.

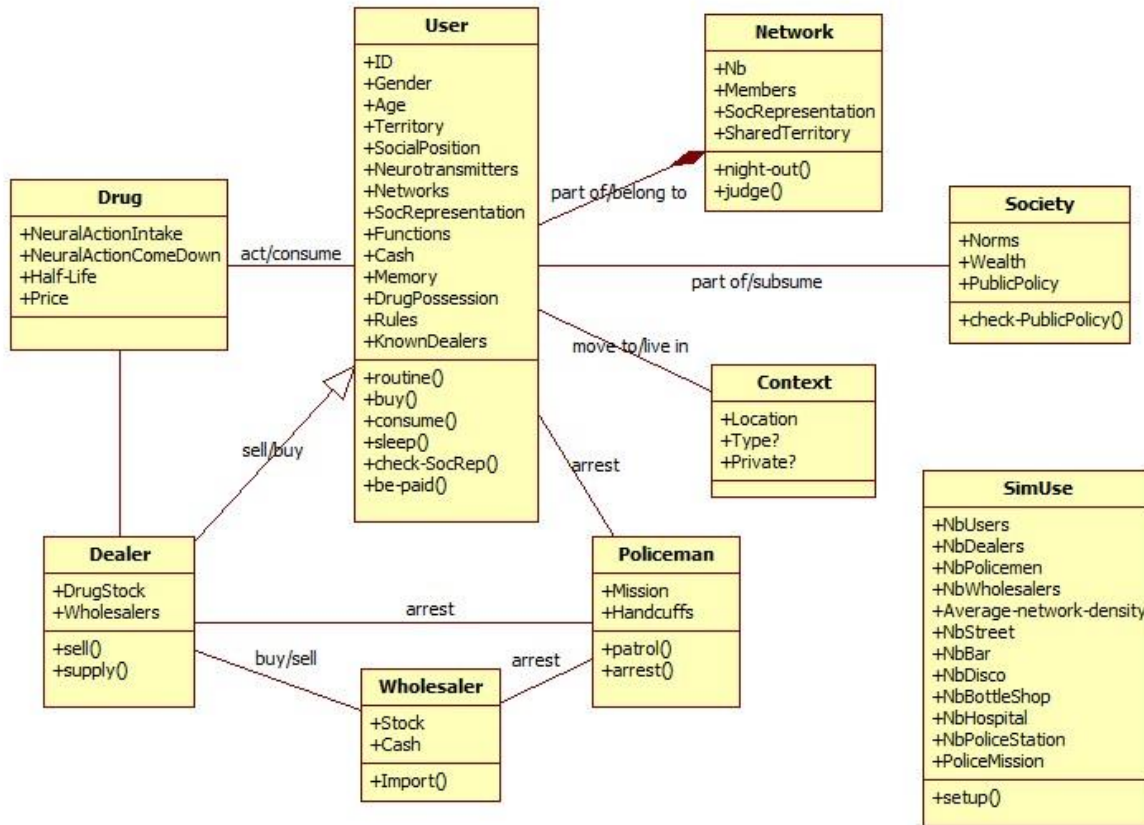


Figure 2.10. Class Diagram of the proto-model.

This class diagram presents one of the several ways of understanding and modeling the recreational polydrug use based on the theoretical framework previously developed. This proto-model shows the different attributes and relations that exist amongst the five main dimensions of the real phenomenon. Except for two links, all classes are linked by normal associations. The arrow between the dealer class and the user class is a "generalization". *Dealers* share the same attributes and operations than *users*, but have some specificity, such as selling and supplying drugs to their *wholesalers*, which is a distinct class of agents. The link between the 'User' class and the 'Network' class is finished by a diamond on the *network* side: this means that *networks* are composed of *individuals*. The SimUse class represents the modeler interface. This one allows the simulation users to create an instance of the model shaped with the global and initial parameters they are interested to test

and to give the overall shape to the context in which the virtual users will evolve and interact.

In order to build the model and get a better understanding regarding the recreational polydrug users and their practices, more information is required. This information was collected through an empirical investigation that aimed to collect data concerning the different notions developed in this chapter (notions regarding actions, decisions, interactions, representation, drug career and turning points). The empirical arm of this thesis consists of collecting information directly from the recreational polydrug users. Once analyzed, these empirical data have been "translated" via UML before implementation. The chapter 3 describes the methodology employed to collect and analyze these empirical data.

Chapter 3. Methodology and Survey Conduct

"I keep six honest serving-men they taught me all I know:
their names are What and Why and When and
How and Where and Who."
Rudyard Kipling

As discussed earlier in Section 2.5, modeling constitutes a third way of doing science. Building a simulation on drug use forces the researcher to find answers to problems related to both global architecture of the model and granular functioning of the agents. Question such as "How does user choose their consumption?" will irretrievably branch to other foundational questions requiring answers technically implementable, such as: "When do they choose to consume? When do they consume? In what order? Where? With whom? What kind of substances and in which quantities? What kind of behaviors these different agents will exhibit? When does an agent will become violent? How does the group of peers react and judge violent behaviors? etc. From this research point-of-view, the modeler needs to constantly keep in mind the following question: "What is missing in the model to make it as realistic and functional as possible?" This double objective, realistic feature and programming functionality, is nonetheless essential and fundamental to guarantee the abductive logic shaping the creation of social simulations.

As already indicated in chapter 2, the first version of the simulation was based on the theoretical concepts extracted from the review of the scientific literature. However, during the different phases of the conceptual process many questions called for further investigations. The process of interviewing recreational polydrug users was intended to

obtain a clearer picture of their drug careers and answer precise questions concerning their drug's choices and evolutions of these latter throughout their experiences. This chapter describes the methodology employed to achieve the empirical arm of this thesis. The sections 3.1, 3.2, 3.3 and 3.4 explain methodological choices concerning the empirical investigation, detail the questionnaire and the way data collected have been analyzed. The sections 3.5, 3.6 and 3.7 describe the choices regarding the population targeted, the way the interviews were conducted, and the demographic of the respondents' samples.

3.1 The choice of the comprehensive interview

The empirical arm of this thesis aims to study and recreate sequences of life moments, as well as the different evolutions shaping the drug career of recreational polydrug users. Within these different sequences, the goal of the research was to determine how external factors and individual experiences were perceived and evaluated by users (in accordance with theoretical points developed in Section 2.3) and how these perceptions and evaluations impacted future choices and conversely the drug career. To capture the subjective dimension of recreational polydrug use, an *emic* approach, focusing on actor's point-of-views, has been preferred to an *etic* one. The distinction *emic/etic* was originally introduced in sociology by the linguist Kenneth Lee Pike [265] to distinguish *phonemic* sounds (which are significant to a group of individuals) of *phonetic* sounds (which constitute the whole set of sounds human can make) [116]. In social sciences, this dichotomy reflects the difference between "outsider's" view-points (*etic*) that are constituted of their own perceptions and interpretations about the phenomenon and, information directly draw from interactions with "insiders" (*emic*), who are living and evolving into the studied phenomenon [116]. Put in another way, *etic* aims to objectively and neutrally analyze a social phenomenon, while *emic* tends to extract

what appears to make sense for actors through their discourses and experiences.

This kind of "comprehensive" approach¹⁵² is generally achieved by using qualitative methods, such as participatory observation and qualitative interviews. These methods were preferred to a statistical approach using questionnaires that employ hypothetico-deductive logic and statistical comparison. Quantitative approach is mainly employed to study macro-phenomena and remain of a limited relevance once it comes to capture micro/meso-phenomenon, such as diversity of modes inside a social practice, hidden negotiations between actors or transformations in opinion over the life span [266, 267].

Given the diachronic approach of this research, the choice of face-to-face interviews appears to be the best suited to render and reorganize the drug career of recreational polyusers. This method was preferred to participative observation that mainly focuses on the practices of a group of individuals during a limited period. This method is neither able to capture the modifications affecting social and individual representation throughout the users career, nor the biographical changes shaping the lifespan and influencing the drug career of individual. Furthermore, this task was not facilitated given the illegal nature of the practices studied in this research and because the fieldwork was conducted into two distant countries. The former because observing drug use inside a group of peers would ask the approbation of all the different members, and the latter, because the follow-up of distinct and distant groups of individuals would have been difficult and potentially fruitless.

As pointed by Olivier de Sardan [268], qualitative interviews could take at least two forms. They could be a *consultation* or a collection of

¹⁵² We refer here to the notion introduced by Max Weber (1864-1920). Founder of the *methodological individualism*, in radical opposition with the durkheimian *holism*, Weber considered *action* as the basic unit of analysis and affirmed that the sense attached by actors to their social actions is fundamental to understand these latter.

experiences. In the first case, the interviewer collects information concerning knowledge and/or opinions of respondents about particular activities, competences or professions related to the topic. With the second possibility, interviewer interrogates individuals about their life through the prism of a particular activity. The timeframe of this kind of investigation integrate the whole life of individuals, as "guided biographies" [268]. Considering that this work's interest concerns a particular activity — recreational drug(s) use — and its related consequences on their daily life, the interviews were designed to cover relevant life's sequences, and gathered information regarding subjective perceptions of recreational users through user's experiences. To do so, the questions constituting the interviews were shaped to reorganize the career of the interviewees. The arrangement of questions into a guideline is presented in the subsequent section.

3.2 Structure of the questionnaire

As just discussed, interview questions have been designed to capture *retrospectively* the subjective *perceptions and meanings* attached by respondents to their drug and/or polydrug *experiences*. Therefore, the interview guide was built to integrate these three dimensions and their interactions by using open questions (except for the demographic section) in a semi-structured framework that followed the building of respondents' drug career. Open questions leave the possibility for respondents explaining and describing with their own words and expressions the way they apprehend their past and/or present consumption. Open questions also give to the interviewer the opportunity to ask respondents clarifications or meaningful illustrations concerning particular elements of the participant's narration.

Four preliminary interviews were conducted to test the guideline, its relevance and the order of the different questions. A few questions were

discarded while some were added¹⁵³, or modified reflecting new interrogations inherent in the inductive nature of qualitative methods. Therefore, these preliminary interviews have a different structure from the rest of the sample. The interview guide was structured in seven main steps to ensure the collection of the different points previously enumerated. The following guideline constitutes the final version:

I) Demographics.

This section examined the personal characteristics of respondents and helped the researcher to socially "categorize" and situate each respondent. It also helps to "break the ice" between interviewer and interviewee and, the general aspect of questions reaffirms the confidentiality of the interview.

- Could you please choose a nickname? (*Gender was noted on the interview separated paper sheet at that moment of the interview*)
- How old are you?
- What is your highest diploma?
- What are the professions of your parents?
- What is your actual occupation?
- Do you have specific hobbies?

II) Building the "drug career" and list of combinations

As previously discussed (Section 1.4.3), polysubstances use could be studied through two temporalities: simultaneous (SPU) or concurrent (CPU). In this research, it has been postulated that these two types of poly-consumption are interrelated and that to understand one, the second also needs to be captured. Hence, interviews intended to collect data relative to these two temporalities.

Therefore, the first questions of the interviewer aimed to create a chronology of the different drugs used by the participant. This

¹⁵³ These additions are indicated with an asterisk in the presentation of the guideline.

chronology consists of a series of initial age of uses that helps to delimitate the different sequences that needed to be further interrogated. Once all these different substances enumerated, interviewer asked respondents to try remembering the different combinations already consumed in their past sessions:

- a. Could you please tell me the different drugs you have used (including alcohol but not tobacco) and if possible the chronology of use?¹⁵⁴
- b. Can you tell me what are the different combinations of drugs you have used or are still using?

These lists and their related data were written in a separate sheet of paper and reused by the interviewer to orient future questions (III, IV and VI).

III) Understanding the “first experience”

It has also been postulated that recreational drug use and polydrug use are intentional. The review of the related literature indicates that recreational drug users have expectations and functions attached to the drugs they are consuming (Section 2.1.4). Questions of Section III attempt to examine functions, representation and their modifications for each substance enunciated by the participant prior to the first intake and just after that particular occasion:

- Could you please describe to me the first occasion you used this drug (with who, when, where, how you obtain it)?

¹⁵⁴ Some respondents have cited a large list of drugs (with a maximum of 19 different substances for an average of 5-6). This situation is generally due to the variety of hallucinogens or designer drugs these polyusers have tried. Because most of these substances had a limited duration of appearance on the drug market and/or a limited number of use by the participant and because informational contents were generally repetitive, information concerning substances with quasi-identical molecular structures (i.e, 2C-B and 2C-I belong to the phenethylamide class of psychedelic, LSA and LSD to the lysergic acid class of psychedelics, etc...) has been regrouped into one set of questions. In that case, respondents were nevertheless asked their representation on the substance, their occasion of use, frequency of consumption, effects expected and overall experiences and on what aspects those drugs were different.

- What were you doing at that time in term of work or activities?
- What was your opinion about it before you used it? (*ask for details*)
- What was the opinion of your close friend/family about this drug?
- For you, what made you try it?
- Have you continued to use it through time? [if no,] could you give me the reasons?

If the participant has definitively stopped this substance after the initiation, researcher went back to the chronology of use constituted in section II.a and asked questions of section III for these new substances.

If the participant declared having continued to use that substance, the interviewer proceeds with the Section IV.

If this substance was the last on the chronological list II.a, the interviewer went to section V.

IV) Understanding the “Normalization of conduct”

Section IV aimed to capture the pattern of substance use and its evolution until the cessation or actual time of the interview. The interviewer attempted to capture the different changes in functions and representation attached by the participant to that substance by questioning the different moments associated by the interviewee to that particular substance. This section also intended to capture in which dimensions personal experiences and peer's witnessed behaviors could impact on participant's representation. The questions asked were:

- Could you describe the evolution of your consumption since your first intake?
- Could you tell me on what occasion you used this drug?
- How did/do you feel with this drug?
- Does your use relate to a specific state you want to feel? [if yes,] Could you tell me which effect(s) do you seek?
- How do you obtain it generally?
- What make you continue using this drug?
- What do you like/dislike about that drug?

- What kinds of behaviors do you like/dislike when other people consume that drug? Could you give some example?
- Have you ever had any problems with that drug? Or felt in danger? [if yes,] On what occasion (example) and what was your reaction?
- Have you ever witnessed any problems/risky situations with that drug on your peers? [if yes,] On what occasion (example) and what was your reaction?

If this drug is not available, would you take another drug to replace it? [if yes,] Which one?

What is your opinion on that drug now?

[If continuing,] What make you continue and what can make you stop using this drug?*

[If stopped,] Could you (re)explain the reason(s) that make you stop using that drug?*

V) Understanding the “decision process”

These questions examined the impact of external, interactional and personal factors on a drug user's decisions and intentions. They also searched to capture the different representation and changes affecting those individuals, who operate throughout their experiences with this specific substance. By reconstructing the different moments that users have traversed, the interviewer tried to understand and make precise the reasons and consequences of modifications of drugs representation on participant's different consumption.

- Could you tell me which “factors” or event that could impact your drug use?
- Is there any element (physical or mental states/peers/professional/economic/others) could make you take it or not use it?
- Do you give specific role to each drug? [if yes,] Which roles for which drugs?
- Are there specific places for you to use each drug you cited?
- Do you have particular “boundaries” or rules about drug use?

- Have these rules evolved through time? [if yes,] Could you tell me in which proportion and what are the reasons of these evolutions?*
- What make you not using some drugs (cf. list II)? Could you give me your opinions on these drugs?
- Could you describe a "normal" night-out? [*repeat the question in case of several type of consumption*]*
- Could you give me your approximate budget for one of this "normal" night-out? [*reiterate question if several types of night-out*]*

VI) Understanding the “poly-use” of drugs

This section examines the overall process of poly-consumption in term of decisions, expectations, mode of consumption, settings and evolutions of combinations by basing questions on the list elaborated in II.b.

- What make you mix drugs you have cited in II.b? Do you have expectations regarding these combinations?
- Do you think there is a kind of “cookbook” (e.g. mix of drugs) that can give you specific effects? [if yes,] Could you give me some illustrations?
- Do you have specific environment/occasion to combine drugs?
- Does your poly-use have evolved through time? [if yes,] How did this evolved?

VII) Concluding questions

The following questions gave the occasion for the participant to "look back" at their career and, clarify, one more time, some important points. Respondents were also given the occasion to ask any further questions or raise issues that might have happened during the interview. If no issues were raised concerning the interview, most of the respondents asked for information regarding the project (especially the agent-based model arm) and its future utilizations.

- Can you tell me your feelings about your "career" as a user?
- Do you have any questions about the interview?

The second step of the empirical data collection consisted in defining the population targeted by the semi-directed interviews. The following subsection (3.3) describes the different criteria of sample selection as well as the modalities of recruitment.

3.3 Population targeted, eligibility criteria and recruitment process

As opposed to mono-substance survey, this research targeted a broader population of users. To reduce significantly the number of people that could have applied for the interview, potential respondents were first screened on the following criteria:

- *Legal age*: respondents had to be of 18 years old of age mainly due to ethical concerns but also because it was hypothesized that younger respondents would not have a career long enough to inform the different transformations that shape the drug career of a recreational polyuser;
- *Polysubstance consumption*: to be eligible for the interview, future respondents must have consumed at least two illicit substances in the last six months;
- *No history of treatment*: once contacted researcher ensured that the future participant had any past history of treatment (recreational users).

Because the category of substances consumed by polyusers cannot be known prior to the interview (for ethical and confidential reasons), forty recreational polydrug users were recruited and interviewed in order to ensure the collection of data from a large variety of polyuses. Due to the international nature of this project an equal number (twenty) of interviews were realized in both countries.

In order to create a sample matching as much as possible epidemiological data, respondents were recruited based on age and gender criteria. Concerning gender, Australian statistics [128] show that of the 2.7 million Australians of 14 years or older who have recently (in the last 12 months) consumed illicit drugs, 57.4% were male and 42.6% of female. In France, OFDT does not present a global statistic concerning illicit drug use¹⁵⁵. However, similarly to Australia, these different statistics describe an overall higher consumption for male than for female (68,75% of male and 31,25% of females have used cannabis, 78% of male for 22% of female have used cocaine, 71%/29% for ecstasy, 75%/25% for amphetamine and 80%/20% for heroin). The recruitment therefore searched for a ratio close to 2/3 of male participant and 1/3 of female interviewee.

Concerning age, Australian statistics reflect a higher percentage of recent use in the 18-29 years old age group (52.6% of the overall recent users) while in France a similar statistic does not exist, it appears, according to the OFDT, that the 18-34 years old subpopulation represents the majority of the consumers¹⁵⁶. However, the recruitment of respondents was effectuated in order to create a sample around two age groups: individuals from 18 to 24 years old and individuals of 25 years old and more. This division has two main purposes: (1) to obtain further information regarding long drug use careers and the way representations and functions get modified over a long period and, (2) to examine generational differences through the underlying impact of hyper-availability. This process, by compiling different lives episodes, simplifies comparisons between the different interviews and, therefore, eases potential explanations in case of divergence.

¹⁵⁵ Observatoire Français des Drogues et de la Toxicomanie (2011) Tendances: Les niveaux d'usage des drogues en France en 2010 - Exploitation des données du Baromètre santé. 76.

¹⁵⁶ Observatoire Français des Drogues et de la Toxicomanie (2005) Baromètre santé 2005 (Institut national de prévention et d'éducation à la santé (INPES).

Recruiting polydrug users for face-to-face recorded interviews appears to be a difficult task due to the illegal nature of the topic. However, this survey has been realized in two different important agglomerations (Lille and Sydney) have slightly facilitated the recruiting of respondents. But this double anchorage has increased the duration of the overall process: the 4 exploratory interviews were conducted in France during February 2010, 20 Australian interviews were conducted during May and June 2010, and the remaining 16 interviews were lead in France during December 2010 and January 2011.

The four exploratory interviews were driven with users introduced by friends of the researcher. Twelve respondents were recruited through advertisements posted in different sites (university, pubs, cafés, associations, and the Australian website "Youthgas") and the remaining 24 were attained using a snowball technique [269].

3.4 Ethical concerns

Human Research Ethics Approval (2009/174) was granted on the November 2009 by the Charles Sturt University Human Research Ethics Committee (HREC) in concordance with the National Statement on Ethical Conduct in Research Involving Humans (NHMRC). Two subsequent amendments and annual reports were provided and approved. On the French side, ethics committees do not exist. Researcher has nevertheless followed the guideline from NHMRC while conducting interviews in France and even if some clauses appeared to be inapplicable.

All respondents were volunteers and provided written informed consent and were assured of the confidentiality and anonymity of the interview. Locations of the interviews mainly depend on the country where they were conducted. In Australia, 15 of the 20 interviews were recorded at NDARC, in rooms dedicated to that purpose. The remaining five where

directly administrated at the domicile of the participants. In that last case and for security reasons, the researcher phoned or texted information relative to the exact address and starting time of the interview to Professor Terry Bossomaier, and confirmed by another message the termination of the interview, as noted in the Ethical Clearance Statement. In France, all interviews were typically conducted in public locations (generally in cafés or classrooms) with due regard for confidentiality and at mutually agreed timeframe. No interviews were realized with respondents who exhibited signs of intoxication (such as, blood shot eyes, dizziness or unusual signs of excitation). Information regarding support services was made available in case of any respondents who requested assistance or exhibited signs of distress.

All interviews stored according to Australian national guidelines in order to preserve the confidentiality of respondents and the integrity of the dataset. In accordance with NHMRC regulations, transcriptions, recorded data and consent forms are kept in a locked cabinet (in a room that is locked when unoccupied) and will continue to be so for a minimum period of seven years before being destroyed (consent forms and transcriptions are stored in different locations). Mp3 files were renamed with the chosen nickname of the participant while the consent forms do not show any indications regarding that nickname to ensure anonymity. All computerized data are stored on a firewall-protected file computer, which is password-protected and only accessible to the researcher and his supervisors on demand. No adverse or unexpected events have arisen out of this research.

3.5 Interviews administration

Given the illegal nature of the practices interviewees were asked about, the negotiation of the interviews and their conduct require several precautions. The first one concerns anonymity. The first 5-10 minutes of the interview were used to ensure the full comprehension of

respondents regarding implications of their participations to the interview. All respondents were provided and read an "Information Sheet" explaining conditions and the main objectives of the interview (cf. Annex 3). The researcher reiterated all the main points covered in the information sheet and ensured that the participant had fully understood the terms and implications of his/her participation. Respondents had the opportunity to ask any questions or seek clarification on any issues related to the "Information Sheet". Participants were also reminded that they could decline to answer any questions judged intrusive and had the right to withdraw from the research at any moment. Respondents were assured of the anonymity and confidentiality (within legal limits) of the interview and written informed consent was obtained from all respondents by signing the "Consent Form" prior to the beginning of the interview (cf. Annex 4). These two forms were textually translated to French respondents who could not read English.

The second point concerns the overall conduct of the interviews. The moment of the interview is one of adjusting to and negotiating the exchange of information. Interviews constitute particular social interaction where one individual questions. The researcher/interviewer has to reply appropriately to interviewees' expectations. A dose of empathy was required, while moral judgment/suspicious attitude were avoided in order to maintain an open dialogue where drug users can answer freely on practices of private and illegal nature. Andrea Fontana and James Frey even talk about 'empathetic interviews', which consist in taking a friendly stance, contrary to the scientific image of interviewing, based on the neutrality [270]. This stance consists in "desacralizing" the position of the interviewer/researcher by creating an informal discussion with different techniques, such as making jokes, complain about the poor English of the French interviewer, start the Australian interview by speaking French and conversely. In other words, the candidate aimed to represent a "normal" other person in

order to reduce any subjective or socially constructed distance between him and the interviewees. Furthermore, the general demographic questions introducing the interview did not contain any question regarding names or address, which helped to ensure the confidentiality of the record and diminish the seriousness of this artificial situation.

Concerning the recorder, the advertisement specified that the interview would be recorded. Therefore, none of the interviewers recruited by this mean complained about the presence of an audio recorder. The respondents recruited by snow-balling appeared to know that the interview would have been recorded prior to the interview. Overall, the fact of audio recording the interview appeared to have no major impact on the respondents. Again, the fact of creating an informal atmosphere helped to make the recorder appeared as a tool for the researcher more than a threat for the respondent. This was accentuated by the fact that each respondent, both Australian and French, had read the "Information Sheet" and "Consent Form" (see above).

The duration of the interview could have also created a bias. Again the advertisement specified that the interview could last from 45 minutes to two hours. The average duration of the interview was around 1h40, but time for completion mainly depended on the "drug history" of the participant and varied from 41 minutes to 4 hours and 9 minutes. As it could be expected, average duration for the group composed of respondents above 24 years old is higher (133 minutes) than for the 18 to 24 years old group (79 minutes). Interviewees were reimbursed AUD\$50 or 30€ for their private time and travel or transport expenses. Four respondents refused their reimbursement considering the interview as "therapeutic", in the sense that the interview gave them the opportunity to have a "look back" on their drug career.

Reimburse the respondents has facilitated the recruitment process, but has two main inconveniences. First, the recreational users with a stable

social situation and incomes might not have been interested by this amount of the reimbursement in regard of the risk entail by revealing their illegal consumptions. This last point could have represented a bias in the population sample. However, most of the interviewees (24) were recruited by snowballing and come from the networks of respondents who have answered the advertisement (Section 3.3). These latter provided a form of "guaranty" for users in their networks, which brought a variety of profession and status (see below). Second, the fact of paying interviewees might have encouraged some individuals to overestimate the number of drugs they have consumed or properly lie about their career. This point was in most cases overcome by the friendly stance adopted by the researcher or, when the answers of the respondents seemed exaggerated or illogic, by asking similar questions again later in the interview (the answer was corrected if needed by the researcher after the interview).

3.6 Participant demographics

This section will briefly present socio-demographic characteristics and substances consumed by the respondents, an extended presentation of each interviewee could be found in the Annex 5. Fourteen females and twenty-six males were interviewed (giving a ratio of one third of female for two thirds of male) with a mean age of 25. Nineteen respondents were aged of 18 to 24 years old and twenty-one respondents belong to the 25 years old and more group. The level of education varies greatly depending on the age group. The majority of respondents of the 18-24 years old groups were still students at the moment of the interview and over half of them had a part-time job (especially Australian respondents). For the older group, all respondents, with the exception of two, had completed HREC/Baccalauréat and approximately two thirds had completed post-secondary education. The majority of them have a full-time occupation (student plus part-time job or full-time work). Participant's professional activities belong to different areas: hospitality,

geology, comedian, engineer, barman, researcher, cook and various others.

Concerning psychoactive substances consumed, the totality of the respondents have experienced or recently used alcohol and cannabis. The majority of the respondents had already used ecstasy/MDMA and/or cocaine (34 out of 40 respondents) as well as amphetamine-type (31 out of 40 respondents). Only eleven respondents have experienced heroin with two of them on a regular basis. Concerning hallucinogens, the large majority of respondents (36 out of 40) had experienced or recently used one or several hallucinogens. The different ages of initiation are generally lower in the younger group, but do not differ significantly between genders (generally less than a year).

None of the respondents mentioned prison history, but three respondents have already been arrested for possession of illicit substances. Interviews of two respondents, one French male (38 years old) and one Australian female (22 years old), were rejected because they did not fit the eligibility requirements (history of treatment for the French male and absence of poly-use in the last 6 months for the Australian female).

The last step of this fieldwork consists in transcribing and analyzing the data collected during the interviews. This particular point is developed in the next section.

3.7 Interviews Analysis

According to Bingham and Moore "the interview is a conversation with a goal", the "goal" being to extract data concerning the subject of inquiry. As explained in Section 3.1, the qualitative interviews are adapted to capture the emic dimension and the subjective interpretations of individuals concerning a particular social phenomenon. The researcher,

as any social other subject, is forming his own interpretations regarding the interviewee's interpretations and representation. The process of analyzing the interviews aims to reduce this subjectivity by creating patterns, delineating themes and capturing descriptions.

It has to be underlined by several authors that data analysis and data collection are not separated processes, they occur concomitantly [271]. Indeed, during the conduct of the interviews, some themes and particular objects arise inductively, forcing the researcher to rethought his hypotheses and reshapes the interview questionnaire to capture these notions. This inductive-based process stops when the analysis ends.

Once recorded the interviews were transcribed verbatim for coding and analyses. No analytic software has been used to achieve this analysis. This one has been executed through an 'interpretative and reflexive reading' that aims to build a version of what the research think the data show and what can be drawn from them [272]. This interpretative reading has been executed through three main steps. As just indicated, the first step took place during the conduct of the interviews, where themes and relevant expressions have been outlined.

The second step consisted in, once all the interviews conducted, refining the themes captured during the interviews. This thematic phase helped in properly delimiting these central themes in the content of all interviews; but also assisted in checking their relevance through the accumulation of cases; and, in identifying interrelations between themes if any. Moreover, because the interviews questionnaire was built in a diachronically perspective, this second stage helped to delineate the different steps of respondents drug career by identifying the modifications of content inside those themes or by the appearance of new thematic.

Inside these themes, the respondents were using different terms to refer to similar attitudes or opinions toward drugs and their related practices. The last stage, the descriptive phase, was dedicated to the coding of the interviews. This coding indexed the different expressions and notions employed by the respondents to express their opinions and describe their practices about psychoactive substances. Furthermore, because one of the main points of this research is to integrate qualitative data into an agent-based model, this descriptive step also helped to give precise terms and symbolic "values" to some particular attributes of the simulation.

As specified in the conclusion of the last chapter, this research aims to capture through an agent-based ontology the complexity of recreational polydrug uses. To do so, this thesis proposes to combine an inductive technique (structured qualitative interviews) with an abductive approach. The data collected empirically have been employed to shape the architecture of the simulation and inform the algorithms constituting the model. The next part presents those data and the different attributes and algorithms that have been created based on them.

PART II.
Recreational
Polyuser's Drug
Career:
Representation,
Choices, and
Control

This second part aims to describe the evolutions of recreational polyuser's career as a sequence of moments. In these different moments, the recreational practices, drugs' choices, social representation and techniques of control evolve to reflect the different transformations assuring the continuation of their drug consumption over time. As mentioned in Section 2.5, building the drug career of individuals consists in a sequential objectification of their life courses. Applied to polydrug users, this concept will be employed to investigate two perspectives: (1) a substance-based perspective, describing the different steps the users could experiment with the various substances they might consume; and, (2) an individual-based perspective, representing the global evolution of one individual through her consumption of drugs. Because these two perspectives are interlocked and dynamically interrelated, their descriptions will be combined to highlight the modifications affecting the representational schemes and drug use-related practices linked to the psychoactive substances, throughout the drug career of polyusers. Based on the interviews, this type of career has been decomposed in three main stages gathering the different moments the polydrug users can get through. Each of the following chapters represents one of these main stages.

The Chapter 4, "Starting and Learning: Experimentation, Socialization and Representation's Transformations", investigates (1) the initial state of individual's primary social representation and their transformations after initiation; (2) their influences on substance initiation and the main reasons and conditions of these initiation; (3), the way these initiation are managed in terms of risk and image, and the consequences of these initiation in terms of social representation modifications and the correlated impact of these modifications on further substances experiments.

The Chapter Five, "Instrumenting and Switching: Functions, Substances and Social Injunctions", describes (1) the different functions

attributed by recreational polyusers to the psychoactive substances and the impact of the current norms on the choices of these functions; (2) the different elements pondered by the users when deciding whether or not to consume and which substances to use; (3) the different rationales enunciated by the respondents to explain the different "switches" of substances during this phase of their drug career, and; (4) the description and investigation of the different forms of polyuse, stating about their functions, order and evolution.

The Chapter 6, "Slowing and Selecting: Autonomy, Control, and Second-Order Deviance", examines (1) the reasons summoned by respondents to reduce their consumption in quantity and frequency, as well as the reasons why specific drugs are kept and in which kind of occasions they can be used; (2) the different control techniques elaborate by the recreational users to keep their consumption in control and their lives in balance, and; (3) the origins of the techniques of control and, conversely, the mechanisms of labeling by which the "status" of controlled and recreational user is constructed.

In these three chapters, statements of interviews will be employed to illustrate the analyses of the empirical data and describe the different social representation by using terms of the respondents. These extracts will be preceded by a brief contextualization of the narration that stipulate the [nickname, nationality (A for Australian and F for French), gender (F or M), age, and the general topic relative to the participant's answer]. The extracts of French interviews have been translated by the author of the research. However, the French extracts are numbered (the number appears after the F of French) and the original version could be found in the Annex 6.

Chapter 4. Starting and Learning: Experiments, Socialization, and Social Representation Transformations

Considering the empirical material gathered, the starting and learning step of a recreational polyuser's career consists of two main phases: (1) the first few uses of a substance from each type of drug (stimulants, depressant and hallucinogenic substances) and (2) the acquisition of the different techniques of consumption. The starting phase generally takes place during the adolescence of the respondents: most of the "classic" substances are experimented before the age of 20 (except cocaine) and, except for two respondents, no substances has been initiated after 25 years old. Most of the respondents indicated that they were in the educational system (secondary school, high school or university) or in their early drug career when going through this step.

This chapter examines this initial phase by detailing three main themes, essential to understand the initiation of drug consumption: (1) the "primary" social representation on which is based the decision of first substance use; (2) the different elements involved in this decision, and; (3) the consequences of first consumption on the representation, status, and social environment of the user.

4.1 Primary Social Representation and their Modifications

The present section examines the different key-concepts structuring the social representations acquired by the respondents before their first substance use(s). These different representations will be described through the discursive operators used by the respondents to characterize the different substances they known about. This process allows extracting the subjective meanings attached by the respondents to the different drugs they have encountered. As indicated in section 2.3, knowing these meanings could clarify the way users shape their future decisions regarding first substance uses [273, 274]. Therefore, this section examines the evolution of such representation by presenting the "primary" social representation and their modifications through the experiences and interactions of the respondents.

4.1.1 Primary social representation and sources of socialization

At a "pre-starting" stage, future users dispose already of social representations regarding drugs. These social representations are essentially developed through the socialization process. According to the social learning and differential association theories (Section 1.1.2.1), these "primary" representations are learnt by the individual through their interactions with their family members and significant others. These primary representations correspond to the beliefs, ideas, and opinions shared amongst peers. When asked about their first thoughts on substances, the respondents generally describe and interpret substances by using the dichotomy licit/illicit drugs, encompassing on

one side tobacco and alcohol, and on the other side the remaining psychoactive substances, into the global notion "Drugs"¹⁵⁷:

[Soph, A, female, 23, general] My opinion, I guess - I mean, [alcohol] is legal so how can it be bad if it's legal? That sort of thing. That's the same for tobacco. Even though they're the biggest killers in Australia, they're still legal so it's not as bad generally. I did think "Oh, drugs are bad. I'm never going to do other drugs", all that stuff.

Among all the psychoactive substances, alcohol constitutes an exception given the fact that it is generally consumed by parents or siblings of the respondents. Indeed, all of them had a clear idea on the effects that alcohol induces, the behaviors associated with such effects, and the type of occasions that are associated with its consumption. Respondents frequently refer to behaviors of their family members when describing their initial opinion regarding alcohol. The content of their initial representation mainly depends on the perceived impacts that the consumption of alcohol could have had on the life of their significant others:

[Cloum, F1, female, 20, about alcohol] I was used to see it in my family, my parents drank during celebrations and I have older brothers, so I've seen them drinking alcohol before me. I hadn't got a really negative opinion about it because I've never seen alcoholics in my family or anything like that.

, or, conversely:

[Marie, F2, female, 21, about alcohol] [*What was your opinion about alcohol before taking it for the first time?*] I had a bad vision about alcohol: I saw people that alcohol turned into really nasty persons. So I said to myself: never. [...] My father lost his driving license because of alcohol. In fact, he got caught twice, the second time he has been suspended. He has already had problems with alcohol. He has already got into fight because of alcohol. [*What was your reaction after what happened to your father?*] I was still young. For me, it was really: "No, I didn't want to drink", for me, it was really the devil.

¹⁵⁷ Drugs with a capital "D" will be used throughout this section to characterize illicit psychoactive substances as a global notion.

The construction of primary representation on illicit substances seems to follow the same process as alcohol. If any significant others were consuming illicit substances prior to the starting stage of the respondents, these representations reflect the personal interpretations of the individual. Again, the respondents indicate that their appraisal of the substances mainly depends on the significant other's behaviors and practices while consuming these substances:

[PBoy, A, male, 39, about cannabis] I find it more of a down drug than up drug. Yeah just – I always associated - I was very anti-drugs. I guess I'd seen my mother smoke it or my sister smoke it and I would associate it with that, the negative.

Nevertheless, only two respondents have directly witnessed family members using illicit drugs and these cases remain limited to cannabis. As a matter of fact, the majority of respondents had never witnessed any of their parents or siblings using illicit drugs prior to their initiation to illicit substance. The primary social representation that respondents attached to 'Drugs' is essentially established on the opinions and information transmitted by parental and institutional educations.

The educational system, through prevention campaigns and health courses, provides information focusing on the dangerousness and addictive potential of the different psychoactive substances. In most cases, the parental discourses relay this general social representation, associating (1) illicit drugs users to the figure of the heroin injectors or crack cocaine smokers and, (2) illicit substance use to addiction [275, 276]. When asked about their parents and close family opinion regarding the illicit drugs, respondents describe these opinions by using the general term of 'Drugs' and by using terms, such as, "bad", "negative", "insane", "for sick people", "dangerous", or "detrimental". All the respondents seem to have integrated the initial social representation provided by institutional prevention, which could be summarized by the expression: "Drugs are bad/detrimental/addictive".

However, the transmission of these representations differs accordingly to the history of consumption and drug-related knowledge of the interviewee's parents. Parents working in a field related to drug consumption (e.g., psychiatrist, social worker, psychologist), or having a history of consumption, appear to provide an "empirical-based" form of prevention. These parents tend to differentiate forms of use from substances, and they also nuance the risk associated with drug consumption:

[Neron, F3, male, 28, about alcohol and 'Drugs'] [...] In my family it was a reasonable consumption [of alcohol] during the celebrations at certain times of the family calendar, it was squarely tolerate with no misconduct. Then, there was the prevention side concerning the amount of alcohol to ingest. I have been really warned that if you drink too much you can have alcohol poisoning, or the alcoholism could develop in human beings. [...] For my parents and for my family, drugs in general are harmful for your health. They still have quite a protective speech concerning these substances while saying that it is like flipping a coin, if you have an addict profile, just once intake and you can fall into it. I've always been aware since my earliest childhood that we do not born equal, there is no equality in substances consumption.

On the other hand, parents in a state of "empirical ignorance" regarding illicit psychoactive substances, tend to relay the social representation "Drugs are bad/detrimental/addictive" without differentiating substances and their relative danger. In some other cases, respondents declare that their parents did not even discuss the drug topic, leaving these respondents with an empty representational scheme.

When questioned about their primary representation, the respondents falling in the last category generally indicated extra-familial sources, such as movies (Human Traffic, Requiem for a Dream, Transpotting, Scarface), TV series (Weeds, Breaking Bad), books (with reference to William Burroughs or Hunter S. Thompson), or for respondents belonging to the younger group, references to specialized websites and forums (such as, Erowid, Pill Reports, or more rarely institutional

websites), as their primary sources of information. If most of the institutional sources reinforce the general social representation, the specialized and unofficial sources frequently contradict the institutional representation. These sources of information indirectly participate to the normalization process (Section 1.3.2) and for the neophytes to the acquisition of dissonant representational schemes from the "Drugs are bad/detrimental/addictive":

[Billy, A, male, 22, about cannabis] I didn't really think a whole lot about it. You get taught these things at school. They say, cannabis, they just give you all the negative effects of it. So that's what I knew of it. But I also did know that, of hearing from a lot of people, the actual drug effects of it. I knew that it makes you laugh a lot, makes you hungry, you know, from pop culture. You just see these movies about people doing it. So my opinion was quite neutral. I really didn't think much about it.

If the central nucleus social representation of Drugs socially produced remains "Drugs are bad/detrimental/addictive", respondents tend to develop peripheral elements in agreement with observed behaviors and with the various sources of information they have examined. These peripheral elements, as individualized representation, are described in the next subsection.

4.1.2 Concepts associated by respondents to substances.

As just discussed, the different sources of information facilitate the "objectification" process (Section 2.4.2) required to form and structure the individual's representation. Based on this different information, most of the respondents were able to specify their opinions and representation about the different drugs at the pre-starting time. The interview's analysis reveals that, before experimentation, the respondents attach four main representational schemes to the different psychoactive substances: "Poison"; "Detrimental"; "Enjoyable"; and "Neutral".

The substances with the '*Poison*' representation are perceived as dangerous and harmful. But more importantly, this '*Poison*' representation is directly associated with the notions of dependence and social stigma. Substances such as, heroin, crack cocaine, and crystal methamphetamine, as well as, the injecting mode of consumption are strongly and negatively connoted. Respondents attached to these different substances and practices terms such as, "addictive", "get hooked", or "dependent". This representation is generally opposed to the concept of pleasure, due to the harmfulness associated with these types of consumption:

[Neron, F4, male, 28, about heroin] For me, it remains the destruction, heroin is the drug that destroys you. Even taking drugs, we think this is certainly not good, but it may be to overcome uneasiness, a malaise, but it is not necessarily for killing yourself. Well, when I was on a drug that was never in the purpose of killing me.

In the discourse of the respondents, these representations are founded on their perception about addicts. Indeed, when speaking about this topic, respondents always associated these substances and/or mode of consumption with the figure of the "toxico" or "tox"¹⁵⁸ in French interviews, and through the figures of "junkie", "addict", "crack-head", or "meth-head" in the Australian one, as shown in the following quotation:

[Ubik, F5, male, 19, about heroin] Heroin, I'm absolutely not interested. Well, if I were offered smoking opium, I wouldn't say no, but snorting heroin, take a parachute or inject, no. Not heroin, I do not. I know it is an opiate but I don't want because of the cultural connotation of heroin, I think. When I hear "heroin" or heroin addict, I think "Trainspotting," "Requiem for a Dream" immediately, and everything that goes with its unhealthy side. That, for me, heroin is really detrimental and it is connoted in my head with "unhealthy". So, I put a red cross on it. I have access to it but I never used it.

¹⁵⁸ "Toxico", or sometimes "tox", is an abbreviation of the French term "toxicomane" and could be translated in English by the term "addict". But it is worth to underscore the direct link between these terms and the adjectives "toxic/toxicity", which could be perceived as a severe form of self-inflicted harm.

Most of the respondents considered these kinds of substances or practices as a form of *boundary* concerning their future drug use. Terms such as "barrier" or "limit" are frequently used by respondents to characterize their attitude toward these substances [277]. These attitudes are related to a strict unwillingness to cross a limit, to not "go too far":

[ElPoyo, F6, male, 32, about drug addiction] After, I get more thought in my head: a drug addict was someone who shot up with heroin. At that moment, I would never inject and I would have never take heroin. That was clear and that was impossible to me. I could take anything else except that.

, or:

[Jurion, F7, male, 27, general] That's true that at that time I would have taken almost anything. I'd never inject and even if I didn't know much about drugs at that time, but for me, the junky, the junky/thief/criminal/beggar was the guy who injected. I was really marked by the image that the media and movies made of it. So I'd never injected. But except that, any other drugs, yeah okay.

Generally, '*Detrimental*' and '*Poison*' are employed to describe the initial opinions of respondents concerning illicit drugs. The essential distinction between these two representational schemes could be found in the lack of addictive potential attributed by the individual to substances perceived and designated as '*Detrimental*':

[Mike, F8, male, 30, about magic mushrooms] [...] I was a little scared by these stories of hallucinations. I knew it could go quite far. But, I did know that it was not that dangerous either, it was not an addictive drug. It was "not so dangerous" in quotation marks because it is still quite dangerous. But it was still pretty clean, it seemed pretty clean as a drug.

Nevertheless, the '*Detrimental*' representation remains always associated with substances interpreted as potentially harmful, physically and/or mentally, and potentially leading to physical, psychological, and/or social problems. This representation is defined through terms and expressions such as, "harmful", "dangerous",

"damaging", "awe", "fear" and "worrying". The next quotation illustrates that point:

[HandyCool, A, male, 25, about speed] I was a bit wary. I was in a different place with older people and I wasn't sure about the whole thing. This was a new drug that I didn't know much about and so was wary of it. [...] I wasn't entirely sure I guess. I can't really remember but I guess if I was wary of it and felt a bit of trepidation - in which case I was obviously uncertain of it. I was aware of its potential to cause harm that was obviously apparent to me.

Contrary to the representational scheme 'Poison', the scheme 'Detrimental' is not necessarily associated with an impossibility of initiation. The curiosity and its related thrill can outweigh the risk of using 'Detrimental' psychoactive substances (cf. Section 4.2).

The third scheme, '*Enjoyable*', regroups terms such as, "exciting", "funny", "cool", "positive", "euphoric", or "festive". This representational scheme is generally related to a favorable attitude for initiating the drug. This representation is built on expected effects that future users look forward to experiment:

[Nick, A, male, 18, about MDMA] It was extremely positive. It was entirely euphoric, which was energy and euphoria and along with the sort of dancing to the big music experience, it was a great experience. I was positive about trying it before and, if anything, I was more positive about it afterwards. So I was really quite enthusiastic about it. [...] Just the way it was portrayed as euphoria and energy, I had the willingness to experience it. I wanted to have that experience, that sort of altered state.

, or:

[Albie, A, female, 19, about alcohol] It was interesting, yeah. It just seemed cool. It seemed like I felt like before I had alcohol I felt like it would have more of a psychological effect than it actually does. That's the perception I had of it.

Respondents who have not received or obtained any objective and/or informed knowledge regarding the different substances cite a fourth representation '*Neutral*'. Indeed, despite the multiplicity of possible information's sources, some of the respondents state their complete

lack of references or opinions on drugs. Their ignorance regarding the aspects, specific risks, effects, and effect's duration of some or all psychoactive substances, produced what can be defined as a 'Neutral' representation. Following his previous quote concerning his view of on heroin, Jurion explains his representation on other drugs:

[Jurion, F9, male, 27, general] Until my 16 years old, I was a good boy, I was a good child, didn't smoke, didn't drink. So I knew drugs just by their names but... It was the drugs, the Drugs [*imitating a satanic voice*]. I didn't know anything about it; it wasn't part of my life, simple as that. It wasn't something that frightened me, it wasn't something that interested me, it was just not there. Until that first moment, I haven't had the opportunity to get interest in it or learn anything about drugs. I didn't see anyone close to me that was using it and it came from nowhere that first time. So I had no a-priori on it. I told you I didn't know what the effects were. The first time someone proposed me a joint, I said: "yeah, why not" [...] But at that time, you would have put before my eyes hashish, weed or pills, I wouldn't have known what it was, I didn't know how it looks like, I was out of that.

Neutrality regroups terms such as "no opinion", "didn't know", "naïveté" or "neutral". Attached to a particular drug, the practical dimension normally inherent in social representation is inactive and cannot orient future actions: the individual's attitudes will be more likely to be influenced by the social environment, than by their own initiative. Contrary to substances with the 'Enjoyable' representation, the individuals with such representation will not look forward to use this drug.

These four terms could be used to characterize the peripheral schemes that structured their initial attitude of respondents toward drugs. These representations could be formalized in the following way:

Individual Attribute 9: SocialRepresentations

Type of values: list (character, integer (-5 to 5))

Value: ("Poison"; -5)

 ("Detrimental"; -3)

 ("Neutral"; 0)

 ("Enjoyable"; +3)

Employed in: update-SocialRepresentations

 Check-SocialRepresentations

 deliberate

 check-GroupInfluence

(1) The second values added to the representation symbolize a numerical score to facilitate the formalization and transformation of the representation in the simulation.

(2) Each individual has a set of nine SocialRepresentations encompassing the representation of the nine drugs modeled in SimUse, noted, for example:

Alcohol-SocialRepresentation ("Neutral"; 0); LSD-SocialRepresentation ("Poison"; -5)...

The interviews analysis reveals that before first substance uses, the drugs representational schemes could be modified through the different interactions and communications that neophytes have with significant others and by the observations of these latter behaviors (which appears as consistent with the concepts theorized by the social learning theory). By extension, it can be argued that these initial social representations are based on the social representation shared amongst the members of their primary socialization network.

In SimUse, each *individual* is a member of two distinct 'Networks' that influence its opinions and actions. The first *network* represents the family and close friends of the *individual* (strong ties), while the second one was designed to represent acquaintances and secondary peers (weak ties) [278]. Each *network* is identified by the GroupID attribute and *individuals* are randomly integrates into two *networks* at the beginning of the simulation. The group attribute of the *individual* indicates to what *networks* an *individual* belongs to.

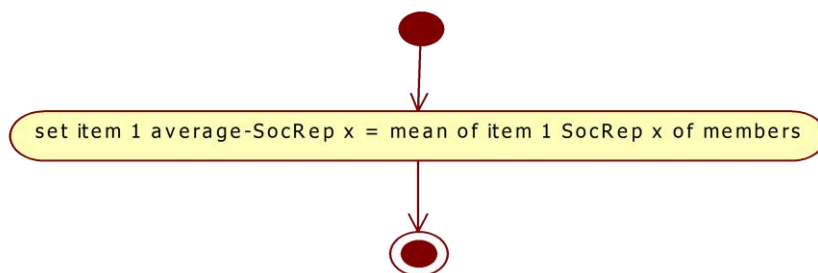
To mimic this value homophily amongst members of the same network, the model needs to create for each *network* an average attribute (named average-SocialRepresentations) that will represent reference points for *individuals* to compare their own representation with the global opinions of the group they belong to.

Network Attribute 1: average-SocialRepresentations
 Type of values: list (character, integer)
 Value: ("Poison"; -5); ("Detrimental"; -3); ("Useless"; -1); ("Neutral"; 0); ("Curious"; 1); ("Enjoyable"; +3); and, ("Need"; 5)
 Employed in: check-GroupInfluence
 update-Network-SocialRepresentations

This also implies creating an operation to fix this average value, called **update-Network-SocialRepresentations**, described below:

Network Operation 1: update-Network-SocialRepresentations

update-networkSocialRepresentation



The average-SocialRepresentation of each substance is calculated by averaging the value of the different social representation attributes of each 'Individuals' belonging to the same network.

In a second time, the model has to integrate another method that mimics the influence of these average-SocialRepresentations on the SocialRepresentations of its members. This is embedded inside the **check-Group-Influences** operation. While running this operation, the *users* refer only to their primary *network*.

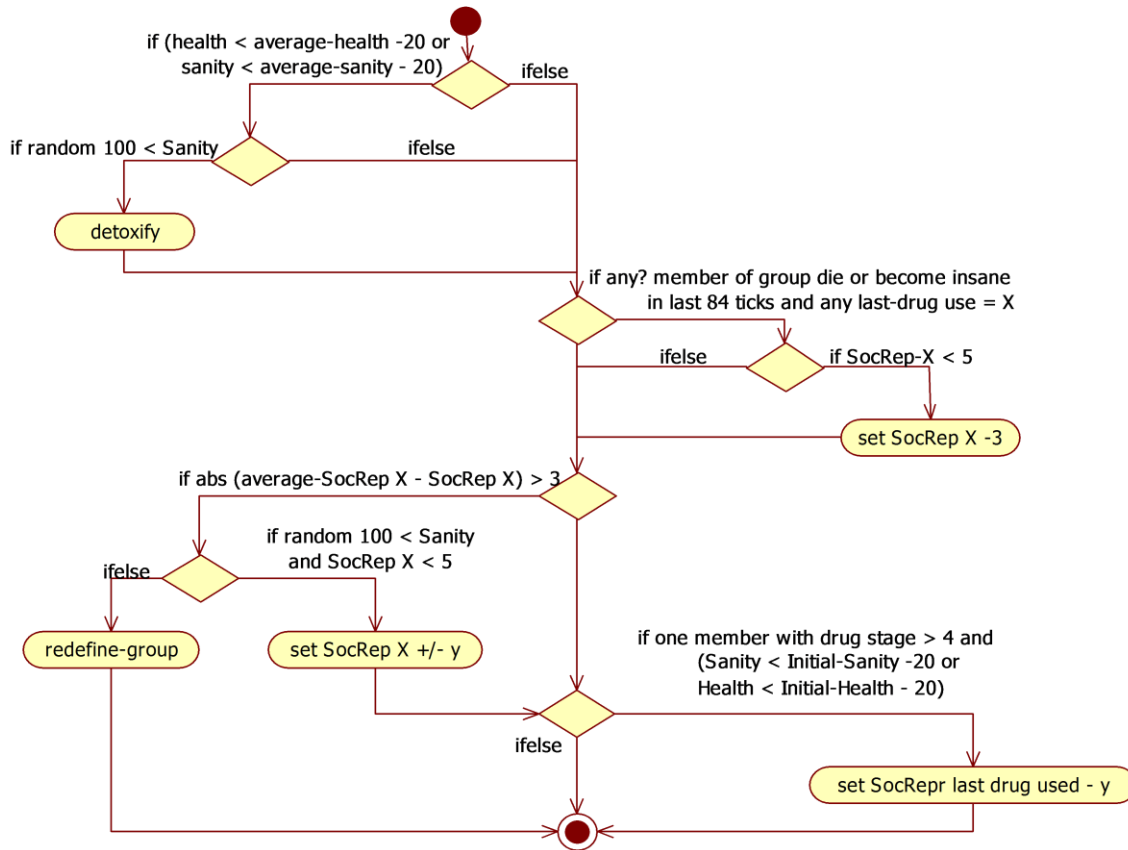
On top of the major role plays by *network's* members on the construction and modifications of the social representations, these

members could also impact the future decisions of the *user*, by either becoming a guaranty of safety or counter-examples (cf. below). This influence from the network is modeled in SimUse through the **check-Group-Influences** operation:

Individual Operation 8: check-Group-Influence

Check-group-influences

SocRep X: SocialRepresentation of the drug X
 $y = \exp((-item\ 1\ SocRep-Drug\ X^2)/(2.5^2))/(0.8v2\pi)$



This method encompasses four situations that can possibly modify the SocialRepresentations attribute of the *user*:

- (1) If the Health or Sanity values of the *user* is largely below (by 20) of the average-Health or average-Sanity, members of the Network could recommend to the *user* to **detoxify** (Section 6.3.2). If the *user* passes the SanityTest, it will execute the detoxify operation, if not, it will continue its normal routine;
- (2) If one *users* of the *network* has become "Deceased" or "Insane" in past 84 ticks (one virtual week) members run a SanityTest: if this one is positive the Social-Representations values attached to the different drugs used by the deceased or committed *user* will be reduced by 3 (except if the value of drug-related Stage is higher than 5);
- (3) If the difference between the SocialRepresentation of the *user* and the average-SocialRepresentation of a substance is greater than 3, the *user* could either change the value of its SocialRepresentation, or decide to change of primary *network* through the **redefine-group** operation;
- (4) If a member of the group shows an addiction (any Stage higher than 5) and signs of bad physical/psychological states, users, after a SanityTest, lower the related SocialRepresentations elements by the value y (cf. above).

Concerning the case of dissonance between the representation of the group and of one or several of its members, the interviews clearly indicate that respondents do modify their representations or change their peer group. However, the interviews have missed the elements that weigh in favor of one or the other solutions. In order to compensate this lack of information, the simulation asks the *individual* to run a "Sanity-test". This test functions by using the value of the *user's* Sanity attribute as a probability. During this test, SimUse asks NetLogo® to produce a randomized number between 0 and 99, if this number is inferior or equal to the agent's Sanity value the first possibility occurs; otherwise, the *user* will act as prescribed by the second possibility. This test will be frequently employed in SimUse to either create more randomness in the model or to solve such situations¹⁵⁹.

Once settled, the different SocialRepresentations attributes could be modified during the evolutions of the agents. To inform these modifications and to understand the way these changes affect the drug career of recreational polyusers, Section 4.1.3 examines the different mechanisms entailing the peripheral schemes' transformations.

4.1.3 Transformations of primary representation before first substance use: social learning and meaningful others

The primary representational schemes remain taken for granted and unquestioned until future users have the opportunity to witness direct consumption and/or interact with new peers or acquaintances, which have already used these substances. These different events generally transform the primary central nucleus of one particular substance into a peripheral scheme (Section 2.4.2). The content of this peripheral

¹⁵⁹ The detail of how the different SocialRepresentation are settled at the beginning of the simulation is discussed in Section 7.1.1.

scheme depends, again, on the peer's behavioral responses to the drug(s):

[Batman, F10, male, 19, about cannabis] I was opposed to cannabis. I said that it destroyed people's lives, etc... Basically, I repeated what I was told in school: that one joint equal to seven cigarettes, that it makes your brain becomes smaller, that it makes you go to prison, that it makes you want to kill people as shown by study dated of 1936 (*in an ironic tone*). [...] Then, when we learned that my parents smoked too, I thought it wasn't that bad, they weren't big wrecks and they were still bright enough in their lives, so I began to doubt that it does shrink your brain.

When the primary representation scheme is in direct contradiction with what is directly observed and perceived in the behaviors of significant peers, the representational schemes change to reflect the outcomes of what was observed. The next extract illustrates a modification of the representation attributed to cannabis:

[Bobby, A, male, 25, about cannabis] my friends in year 11 started smoking weed when I was 17, and I was like against it. [...] I guess the reason I thought it was because school had put this into my head, weed illegal, like really bad, "you're going to die", sort of thing. Then my friends did it for about six months and nothing happened to them. Nobody went crazy, nobody killed themselves, nobody got kicked out of school or anything like that. [...] When I saw that nothing was happening, then I'm like "well maybe school's not teaching me the stuff right, and maybe it is okay because they all seem to be fine. They're all having fun. They're all still the same and I'll give it a try". So I smoked weed, loved it, laughed hysterically, smoked more and more.

In this example, the initial interpretation, which could be considered as being 'Detrimental' turns into 'Enjoyable'. This transformation, comparable to a form of social learning (Section 1.1.2.1), is a consequence of two main observations, (1) no significant others behave as prescribed by the initial social representation; and (2), another representation appears to be more appropriate to interpret the object and handle it into future situations. The inconsistency and ineffectiveness of the initial representation with the directly and real observed behaviors create a strange scheme (Section 2.4.2). This latter

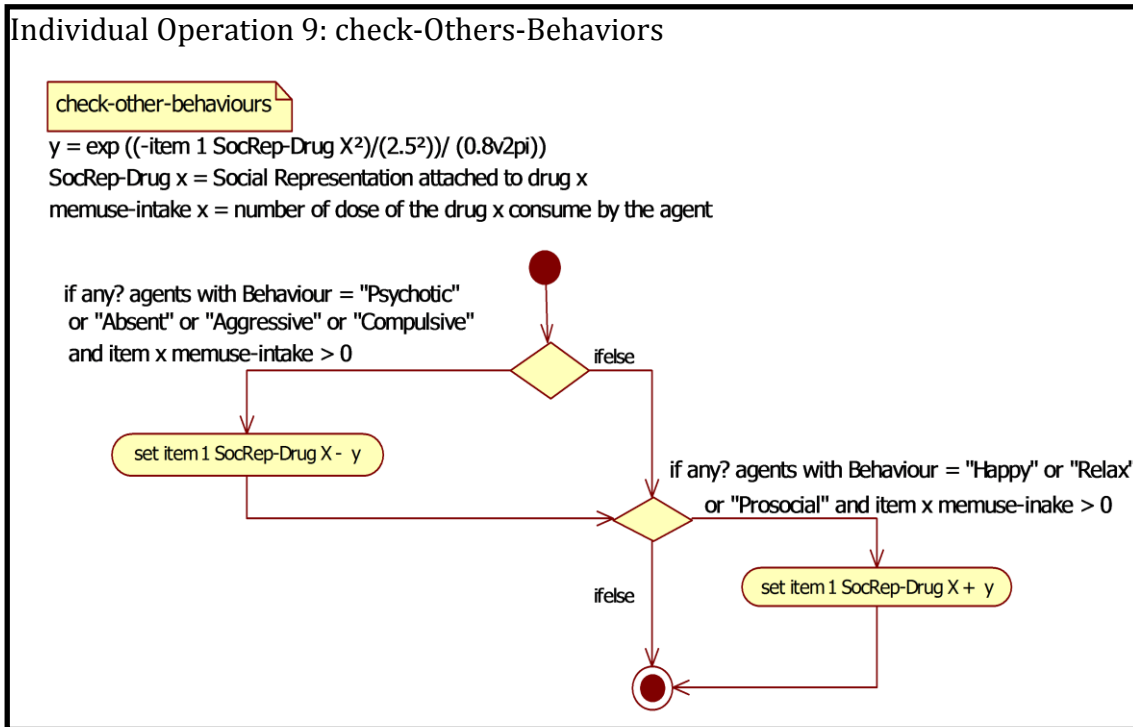
is rapidly replaced by a representation concordant with the social reality observed by the user.

Conversely, witnessing what is considered and interpreted by the individual as a harmful form of consumption or unacceptable behavior (e.g., aggressiveness, erratic moves, sickness, fight, obnoxiousness) leads or reinforces the development of negative representation associated with the drug. This negative representational scheme will be linked to a negative attitude toward initiation of this specific substance. The next example shows how interactions with known drug users can change a representation from 'Detrimental' to 'Poison', and influence future intentions to use:

[Soph, A, female, 23, about cocaine] He [her ex-boyfriend] was a bit fucked up. He would just get onto any drug. If he had it in his possession, he would have it for him to take. For me, I feel like it was kind of good seeing him and his friends craving cocaine - sorting it out and seeing that aspect of addiction because it really turned me off doing that sort of - I could just see when it happened, when the addiction starts and how to avoid it. [...] I saw him and his mates just getting an eight ball of coke and it disappearing. I just saw this cocaine addiction and it was so disturbing. That really put me off, and then I never really wanted to do it.

Considering the previous developments, the model needs to capture the modifications of representational schemes arising from the interactions with other users. In SimUse, these modifications could result from either the modifications of the average-SocialRepresentation or by observing the behaviors of surrounding peers. To represent these modifications, the model will ask the *users* to run the **check-Others-Behaviors** operation consists for the *user* of "observing" the Behaviors attributes of other *users* situated on the same location. Because some *individual* exhibit particular Behaviors (cf. Section 2.2.4) while under the influence of specific *drugs* will possibly increase or decrease the values of the different drug's SocialRepresentations that *users* have

observed the consumption. These modifications could be modeled as follows:



It is important to specify that recreational polyusers do not stop to reevaluate their representational schemes after the first stage of their drug career. Therefore, the *users* in SimUse will continue to run periodically the **check-Others-Behaviors**, and **check-Group-Influence** to update their SocialRepresentation and ensure the adaptation of their practices to their social environment. Nevertheless, if the peripheral schemes constrain and condition future usage, they do not constitute the main "trigger" for the individual to initiate drug use. The Section 4.2 investigates the main reasons inducing the first substances uses.

4.2. Reasons for Initiation: Curiosity, Socialization, and Risk Management

As discussed above, the drug usage could be considered as a practice, a socially situated and constructed action, and, as pointed earlier (Section 2.3.1.3), an action is either routinized or problematic (Section 2.3.1). Based on these two points and on the fact that, during the starting

phase, no actions could be considered as routinized, new substances initiations should be considered as a problematic action (Section 2.3.1.2). To investigate this last point, this section (Section 4.2) examines the decision process leading individuals to engage in such problematic actions.

The analysis of the interviews reveals that there are several reasons for neophytes to engage in drug use, but an entanglement of several factors. A typical description of the reasons associated by the respondents to their initiations could be illustrated by the following extract, depicting a first cannabis intake:

[Nick, A, male, 18, about cannabis][*Could you describe the first time you used cannabis?*] It was at a party. Some of my friends, about five or six of my friends had been using it for a year or two longer than me. They all said really good things about it. I was interested to try it. I had researched on the Internet, just a brief sort of what exactly does it do. Am I going to die if I take it, sort of thing. So at that party - it wasn't planned - they just said, we have this, do you want to try it? I wasn't drinking that night, so I said sure. I just tried it with friends who offered it. [...] [I had] the desire to just experience it and see that sort of altered state, experience that. [*Does the fact that you know it wasn't so harmful influence you?*] Yeah, that was definitely a motivating factor. Because it seemed to be a lot less harmful than other drugs.

The interviews indicate that initiations to new substances are always related to four elements: (1) the way individuals perceive the substance (social representation); (2) their willingness to experiment (attitude and related function); (3) their social environment, and; (4) the conditions of consumption (contextual externalities). These four elements appear recurrently in the interviews as being part of the decision process to initiate first substance use. The following two subsections (Sections 4.2.1 and 4.2.2) describe in detail the role of these four factors on the decision to start consuming a new substance. The Section 4.2.3 examines the impact of perceived risks on drug initiation. The Section 4.2.4 details the way respondents have managed their entry in their

polydrug use career. This last section investigates the way respondents diminish their risk perception induced by the primary social representation on Drugs.

4.2.1. In-order-to Motive: the Sociability Function.

As discussed in Section 2.3.2, drug use consists in a motivated action. The motivation attached to first substance use cannot be thought as an action entirely oriented toward specific pharmacological functions, mainly because, at that time, the individuals cannot objectively know the effect of the substance on their organisms. The content of the interviews suggests that at the early stage of their polydrug user's career, respondents considered taking psychoactive substances as a social activity taking place inside their group of peers. Indeed, the narrations of initiations and immediate continuations are mainly structured around three elements: (1) initiation to new substances, especially regarding the first substance ever used, always take place in private settings (i.e., house party, celebration) or in semi-public (i.e., rave-party, festival, concert) social events; (2) participant's first uses of new substances took place with close friends, or, more rarely, with siblings (in two cases), and; (3) substances are bought and/or brought in quantity considered as sufficient for the group; are shared amongst group's members; and are consumed as special occasions. The next quotations illustrate these characteristics of first usage:

[LittleDevil, F11, male, 29, about alcohol] At the beginning, it was with my friends, it was behind the booth of one mate of mine. We were a group and because we were all living in a small village, there wasn't that much to do on Saturday nights and we didn't have cars yet so we were going to the small grocery where we bought some beers, we got behind my friend place and we drank between friends, [...] it was recreational, I wasn't drinking every day. It was really just for the weekend, we drank a few beers, we got back home in pretty bad states, we didn't need that much at that time ...

and that's it, at the beginning it was really the group that was prevailing ...

or,

[Neron, F12, male, 30, about alcohol] At that time, alcohol allowed us to initiate, to facilitate a link to the group. There were those who drink and who could manage it, the one who drank and is drunk and who couldn't managed it, there is the one who drank and vomited, there is the one who drank and would always get nasty and bad. That was it, they were places created, based on the group with whom you were and your reaction to alcohol.

Discovering the effects of a substance on oneself and on the different group members reinforce the process of socialization between young peers, shaping roles and status for the different group's members. Furthermore, these shared experiences also facilitate to integrate the network, mainly because they allows the development of *similarities* (shared experiences and values) between peers, reinforcing their friendship [34, 279].

Moreover, these first socialising experiences combined with the testing of an individual's limits contribute to the modification of the individual's *self* through the regard and judgments of others (Section 2.4.1). Some respondents expressed the idea that consuming substances permit changing their "image" toward other peoples, in order to be accepted by members of their social environment:

[Ursula, F13, female, 25, about alcohol] The desire to get high, to give a different image for others, the desire to get rid of my image of the little nerd, major of the class. I wanted to be like the others and then, well, also try like the others, to see what it's like to get high on alcohol.

Furthermore, if these consumptions favor the "reconstruction" of young user's self through peer's regards, it is also perceived by the individual as a mean to create a rupture with their teenager identity. For example, respondents generally consider alcohol as a substance used by older people, and by correlation, as a sign of maturity. Indeed, several

respondents retroactively perceived their first alcohol use as being part of the "growing up" process:

[Neron, F14, male, 30, about alcohol] At first, it was growing up, get out of childhood because alcohol was for adults. This is a first point; the second point is rather connected to the party and its primary effect of disinhibition, that's what I thought of alcohol. So something social, festive and only for people who are not children.

The first substance ever used by the respondents is in most cases alcohol (only one respondent has used other substances before alcohol) and is mainly oriented toward the social integration of the individual in a group of peers and to modify the identity of the user. The subsequent substance experiments still participate to the construction of bonds between peers, but due to the deviant and illegal nature of these substances, and due to the lack of witnessed consumption in their direct social environment, the illicit drugs demand specific conditions to be met. These subsequent initiations are also part of the integration and adhesion to the group through the adoption of the group's norms and values. The next subsection (4.2.2) develops the *because* motives underlying the initiation to illicit psychoactive substances and the section 4.2.3 details the conditions of such use.

4.2.2. Because motive: curiosity, initiators, and the role of representational schemes

The most common motive or reason invoked by respondents to explain why they have consumed new substances is *curiosity*. Terms such as "try", "experience", "test", or "experiment" are generally found in conjunction with narrations of initiation. This curiosity generally reflects the willingness to experience (expected) new sensations mediated by the pharmacological properties of psychoactive substances, as indicated in the next extract:

[Blondie, A, male, 22, about MDMA] [*What made you use it?*]
Definitely the environment, the friends and always

curiosity. With any new drug it's always just curiosity to see what it's going to be like and how you're going to feel. The experimental process I guess.

This idiosyncratic characteristic does not seem related to a particular social or familial environment, or to a specific study, occupation, or hobbies. However, this statement needs to be mitigated due to the small size of the sample and the fact that no interviews have been conducted with mono-substance users and/or abstainers. It remains that for a part of the respondents, this "experimental process" refers to their willingness to "tick a new box" for each substance used. Their desire to test as many drugs as possible constitutes the main because motive of the experimenting step of their drug career:

[Jurion, F15, male, 27, general] Curiosity and the desire to discover new things, I always said about drugs that I wanted to try them all and if I thought that if I was trying all of them only one time I couldn't get addicted and so I could very well use them once and never again. [...] And I tested all drugs by curiosity to see what it was.

These respondents also explained that they were generally those who introduced new substances in their group. They were influencing other peers in their decisions to test psychoactive substances by searching and bringing new drugs to the group. However, most of the respondents belong to a second category of users, those who *adopt* the new substances (this framework has been borrowed to the diffusion of innovation paradigm [280]). Their curiosity is directly related to other peer's consumption and generally arose through the interactions with friends that were already using substances. For these respondents, terms such as, "everyone else", "all my friends", "people", "everybody", and "others", but also reference to their "best friend" are frequently employed to describe the trustable sources that provoke the interest toward drugs. As proposed by the Social Learning theory (Section 1.1.2.1), the repeated exposure to deviant behaviors also contributes to the construction of a "drug-based knowledge" and eases the entry into

such practices. In the case of polydrug use, this indirect peer's influence plays a fundamental role in the decision to try the substance:

[Billy, A, male, 22, about alcohol] [*What made you try alcohol?*] Peer pressure, most likely. Not like "Try this, you've got to try this", it's very voluntary. But the interest and the intrigue of people I'd seen doing it did, at a naive age, make me think, this might be fun to try or at least attempt [...]. If you're going to get real reasons from this, yeah, that'd probably be one of the major reasons, that if everyone else is starting to try it then it would affect me.

However, this intention to try is highly dependent on the representational scheme associated with the targeted substance. The analysis of the interviews shows that this decision results from the interplay between a desire to try, on the one hand, and the representation, as the sum of beliefs and opinions toward this object, on the other hand. Considering the different representational schemes described in the previous subchapter, four main situations arise from the confrontation between attitude toward drugs and dedicated representational schemes:

A) A positive representational scheme ('Enjoyable') is associated with the substance: respondents appeared as being eager to try the substance and were looking for the right occasion to test it:

[Annie, A, female, 25, about cannabis] [*What was your opinion about cannabis before using it?*] I thought it was cool. It was naughty, rebellious. I was curious as to exploring different states of consciousness. So I thought that would be a vehicle to do that. I had lots of male friends at that time that were the same age that were all smoking bongs. I thought they were cool and I kind of wanted to be cool as well.

B) The social representation associated with the drug is highly negative ('Poison'): the peripheral scheme "outweighs" the curiosity and desire to experiment that particular substance:

[Albie, A, female, 19, about boundary] I don't want to inject anything, that's like heroin and meth. Basically, I feel like injecting things is going too far. Yeah and you know, heroin, I don't want to get addicted. It's just I feel like the possibilities of addiction to heroin far outweighs my

curiosity for knowing how it feels. I'm just like not curious just because of so many possible bad effects.

C) The individual has a 'Neutral' representation about the substance: despite the absence of relevant information, the individual could initiate it, if the social environment and peer network have overall a pleasurable representation of the substance and if these peers are inclined to use it at that particular moment (Section 4.1.3). Indeed, the absence of perceived danger combined to the immediate and direct presence of peers who are enjoying the substances or are frequently using the drug without any side effects, could trigger the first experience:

[Jurion, F16, male, 27, about methamphetamine] Ice was something that I didn't hear about before... I wasn't sure about what it was, that's maybe why I took it [laughs]... Because if I'd known at that time that it was something 'hardcore' I might haven't use it. At that moment, I was more like "Okay, Ice, everyone else is taking it" so my mind-set was something like "Let's try it..."

D) During the experimental step, most of the respondents appear to have the 'Detrimental' representational schemes attached to illicit substances. But, the 'Detrimental' scheme could be tainted by respondents frequently depicting their feelings before trying a drug as being a mix of interest and fear:

[Raoul, F17, male, 19, about magic mushroom] It was rather mitigated, because there was a kind of fear mixed with interest. Magic mushrooms are a substance that has a power psychedelic and psychedelic for me, it means everything. It was the door of the mind to enter another world and also the fear of never returning back. It was pretty well explained by everyone on the Internet. That's why I had not taken that much. It was an awe mixed with interest. I was attracted to it but I was afraid at the same time.

In this last case, the initiation is generally accompanied by a form of "risk management", (e.g., the fact that Raoul "had not taken that much" of magic mushrooms the first time he tried them). These techniques of risk management are further examined in Section 4.2.4, which details the different risks, as subjectively perceived by the participant in their

early drug career, as well as the different mechanisms that individuals can deploy to manage these risks.

Considering the previous developments, it can be asserted that during the starting phase of the polyuser's career, the intention to try substances results from the interplay between an idiosyncratic (initiators) or socially constructed (adopters) curiosity of actors and the representational schemes concerning drugs of interest. Nevertheless, this intention to use illicit drugs remains conditioned by several external factors that are going to be examined.

4.2.3. Conditions of initiation: experimented peers, availability, and learning

During the starting phase of their drug career, recreational polyusers experiment with more or less large variety of illicit substances. Contrary to the case of alcohol, illegal drugs require from the user, as conditions of acquisition and consumption, knowing peers, who have already consumed these drugs and have developed connections with drug dealers. They are called *initiators* in this research. These ones brought to dealers of their acquaintances and brought the different drugs into their network, indirectly supplying and proposing the neophytes to test it:

[Blondie, A, male, 22, about cannabis] The first time I tried marijuana was also in high school. I obtained it through a friend of mine who was actually smoking a decent amount at the time, so I just smoked with him. We smoked just on occasions when it was available or whatever, we would smoke a joint.

, or:

[Youssof, A, male, 28, about cannabis] [smoking tobacco cigarettes] led into me being introduced into a particular crowd that was all smoking marijuana, or all starting to smoke a lot more marijuana. So I started, I tried marijuana when I was probably about 17 for the first time. [...] I didn't really feel there was a huge amount of peer pressure but I really wanted to try it and I didn't know how to smoke it so it was the perfect time to learn is with a group of friends.

Because some of them might have already perfected the art and so it just makes sense. It was good timing to do it and everyone was starting to smoke weed.

Initiators could have already routinized¹⁶⁰ their drug practices and by consuming regularly, create a favorable environment, where illicit substances are readily available and socially used. This environment indirectly encompasses the pre-users as participating actors, as Jurion indicated:

[Jurion, F18, male, 27, about cannabis] The day I took my first joint with my best pal, clearly he had already smoked it and he knew what it was. He immediately said: "yes, we take some." So that's why I followed him, because I trusted him.

The initiators also play a major role during the first intake when the substance tried involves particular consumption techniques requiring to be learned. As described in the previous quotations, the techniques consuming cannabis require knowledge and guidance of experimented peers. As previously discussed (Section 2.5), Becker [67, 281] considered "learn smoking techniques" and "learn to recognize the effects" as fundamental and necessary stages for the future developments of cannabis smoker's career.

However, extracts from the interviews concerning the different substance initiation underscore that the number of techniques to be learnt and their difficulties differ from one substance to another. The necessity of having experimented users teaching the way to consume mainly depends on the substance's mode of administration, which in return depends on the chemical form of the substances used. Drugs in a solid or liquid form, such as, alcohol, magic mushrooms, LSD, and ecstasy (pill), do not require the acquisition of any particular techniques of consumption. Conversely, substances, which are generally found in powder (i.e., cocaine, speed, heroin and, methamphetamine) or crystal form (i.e., speed, methamphetamine or MDMA) ask the individual to

¹⁶⁰ This theme will be extensively developed in Chapter 5.

learn how to snort, to smoke by using pipes, to burn the product on an aluminum foil ("spotting") to inhale the vapors produced by combustion, or to inject the substance previously transforms into a soluble solution.

These techniques of consumption are generally learnt by mimicking the practices and gestures of other consumers and/or initiators. Even if they are correctly acquired, some way of administration asks the users to cross a symbolic border. At that early stage of their drug career, all respondents perceived 'snorting' as a higher step, the "next level" in drug use. This is either perceived as a source of apprehension and reluctance or as a limit that the participant has imposed to himself and did not want to cross:

[Jacko, F19, male, 31, about ecstasy/speed] Ecstasy is a lot easier when you begin to use drugs because it is something that you swallow and as you've already swallowed pills when you were sick, it doesn't differ that much. When you take speed, I know that I really remember that because it is something by the nose and that, it's really weird! At first, I had a real reluctance with it. Anyway, once you've done that a few times and that you see all your friends who do the same, that's it, it's all okay. But it is much easier to eat or take a pill at the beginning than snorting some powder...

As it could be legitimately expected, none of the respondents has injected any drugs or smoked crystallized substances at that stage of their career. As already discussed in Section 4.1.1, when asked about their opinions and representation on these particular modes of administration, respondents link symbolically these methods to addiction and risk of overdose.

Concerning the learning (both perception and recognition) of effects, the narrations vary accordingly to the setting in which the first use took place and on the substance consumed. Some substances require taking in the right environment for the user to experience the "true" effects of the substance:

[Neron, F20, male, 28, about ecstasy first uses] [...] I took them without really know what it was. I was in a car going

to a bar and I was feeling quite agitated, I had not really felt an enormous effect except that when I had a good "oomph" [boost] but I wasn't so aware of the high that slowly get installed, since I wasn't really expecting that. [...] After that, I took it again listening to music in parties. The first time with music I thought the party had lasted 20 minutes or half an hour, while I was there since seven hours.

Some other substances, such as cannabis and cocaine, which are considered by most of the respondents as having "subtle" effects, require a longer time for the individual being able to capture the small behavioral variations induced by these substances. This could be illustrated by the extract of Jurion continuing the narration of his first cannabis uses:

[Jurion, F21, male, 27, about cannabis] So, we smoked the joint and after, I remember that we were playing table football and others who had smoked, they were stoned, smashed. But it had done nothing at all to me. I felt nothing at all. [...] It took me two months to really feel the effects of cannabis. At that time when I smoked, it wasn't doing anything.

Conversely, it appears that for hallucinogenic substances, such as ecstasy, LSD, LSA, magic mushrooms, or for strong stimulant, such as amphetamine-type substances, the majority of the respondents were immediately able to discern and feel the particular effects of these drugs. But, being able to identify the pharmacological effects of these substances does not mean that respondents were able to take the right dosage for a first intake and control the physiological and/or psychological effects of it:

[Neron, F22, male, 28, about LSD initiation] We all took a whole trip [a complete tab of LSD], and we went to see a movie in a quasi-empty movie theater. From my memory, it has been a series of giggles throughout the movie. We couldn't see anything. We didn't know if there was someone in the theater, we saw people passed while there was none. We spent the entire movie really bullshitting, we didn't dare looking to each other. At the beginning, we were seating right next to each other and 10 minutes after, we had 10 seats between us, and we were still laughing. We turned back to say hi, but we didn't know if there were people to see us. So what we were doing was pure non-sense. Once

the movie over, we didn't dare leaving the room, we thought that there were people waiting for us outside. We had already some paranoid delusions. We stayed at least fifteen more minutes in the room before leaving. We were really affected by the substance. [...] After that, I was buying fries for everyone that we haven't eaten since you cannot eat on LSD, you can't even open your jaws. And I remember that someone did hurt an electric pole, and he had bitten his lip so hard that he pierced it with his canine. His jaw was too contracted and when he returned to us after an hour, his lip was all blue, all purple with the pressure in the jaw that he couldn't relax. So we did not knew what was going on, because we saw his face all distorted and because of our vision that was really altered and distorted. And we did nothing to help him.

In the previous case, the new users were left on their own, without any guidance of initiators. In most of the interviews, experimented users were present during first intake. Respondents described these initiators as playing the role of "safe keepers": they help the neophytes to relieve their apprehension by giving them indications regarding the dosage, duration and nature of effects to come. They are also considered, due to their experiences, as a guaranty of "safety" in case of problems:

[Nick, A, male, 19, about ecstasy] I was there with a friend - an acquaintance - you'd say, who was big into it. He'd bought a whole lot of pills off someone in Scotland. He didn't even pressure me, just asked me if I wanted to try it and I thought "you know what, I do it". I mean, obviously it was the right moment; I was at the right place [...]. So I thought it wasn't a bad place to try it, wasn't a bad place to give it a go. He said he'd look after me the night. He stayed with me. Any questions I had during it, he'd done it a million times before so I was with someone who was experienced. That was a safe enough environment for me to try it.

Several respondents also consider the presence of such experienced users as a factor in the outcomes of their first experiences.

These first substance uses are effectuated while the respondents have no objective idea of their reactions to the presence of psychoactive substances in their system. Once the neophytes are able to recognize the effects that a substance can have on their body, these phases of

learning end. At that moment, new users become able to manage their intakes and orient these one toward the achievement of one or several of the searched effects:

[Nick, A, male, 18, general] [...] it's sort of a case of me working out how my body reacts to different amounts and modifying that to get to the effect that I want, so MDMA, speed. As I said earlier, I took too much speed a couple of times, got far too aggressive in what I was comfortable with. It's a case of modifying that, so it's a lot less speed now. I feel comfortable with the ratio to get to the sort of the effect that I want. (This extract could illustrate the "Aggressive" behavior that virtual agent might display in Section 2.2.4)

As shown in this section, the initiation to new substances is largely dependent on the presence of experimented peers within the initial network of the individuals. These initiators influence the curiosity of undecided individuals; but they also facilitate drug initiation (1) by supplying the substance; (2) by teaching consumption techniques to future users; and, finally, (3) by proposing guidance and relative safety during the few first experiences.

Modeling the initiation to illicit drugs will need to capture several points. The acquisition of illicit drugs requires the presence of a drug market and more importantly of drug dealers. The model needs, therefore, to create and inform such dealer's agents. In SimUse, the *users* and *dealers* belong to the same class (*individual*) but differ by their typ? attribute:

Individual Attribute 10: typ? Type of values: character Value: "user", "dealer", "Deceased", "Insane" Employed in: routine schedule

Furthermore, each *individual* in the simulation is differentiated at its creation and presents an identification number represented by the ID attribute in the model.

To facilitate the functioning of the simulation, only users can consume substances. This point is obviously questionable, but facilitates the functioning of the simulation by creating "stable" drug dealers that are not consuming their own stash and disappear prematurely from the simulation. Considering the previous developments, the operations designed to model the decision to initiate illicit drugs need to integrate two main elements: (1) the role of the "initiators" on curiosity, initiation, and supply; and (2) the influence of the social representation on the decision process. Concerning the former, the first requirement is to create *users* with a history of consumption that will be modeled through the memuse attribute:

Individual Attribute 11: memuse
Type of value: array of 9 items
Values: integer
Employed in: update-stage

The values of each item of the list are updated every intake and represent the drugs history of the agent. Simulation is initiated with "Curious" *users* having several values greater to zero (cf. Section 7.1.2).

Added to that, these virtual 'Initiators' agents would also need connections with drug dealers, which are represented here by the known-dealers attributes updated by the **update-Known-Dealers** method:

Individual Attribute 12: known-dealers
Type of value: array of 8 items
Values: integer
Employed in: update-known-dealers
all buy operations
become-dealer

This attribute is composed of an array of eight elements for the eight illegal substances modeled in SimUse. The value of each item corresponds to the unique ID number of a *dealer*. The position of this number on the array depends on the drugtype of the *dealer*. This attribute represents the kind of drug(s) sold by the agent: if the *dealer* sells "Cannabis" its ID will appear on the first item of the "known-dealers" array; if it sells "Cocaine" its ID will appear on the second item and so on.

Individual Attribute 13: drugtype

Type of value: character

Values: "Cannabis", "Cocaine", "Ecstasy", "Heroin", "Meth", "Speed", "Cannabis+MagMush", "PolystimEnergy", "PolystimSocial".

Employed in: update-known-dealers

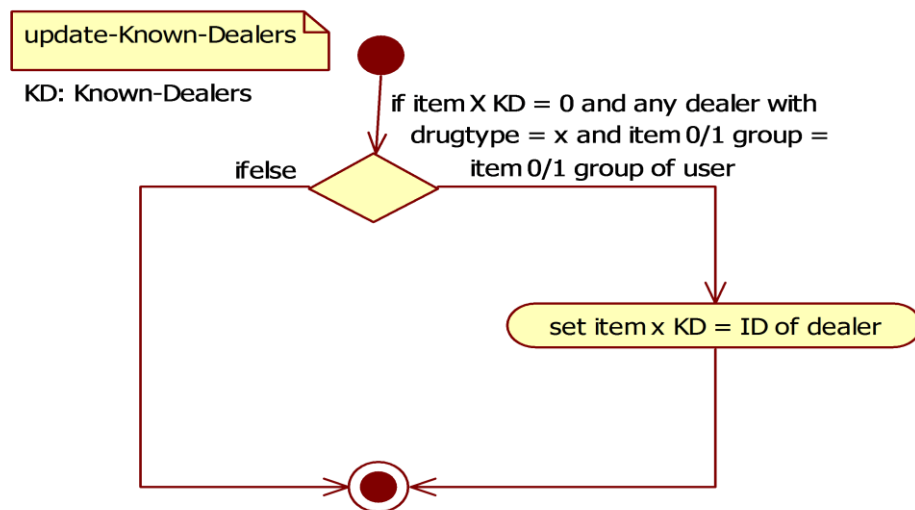
all buy operations

become-dealer

Some dealer agents can sell different substances at once: dealers with the drugtype "Cannabis+MagMush" sell cannabis and hallucinogenic mushrooms; "PolystimEnergy" dealers sell ecstasy, methamphetamine, and speed; and, "PolystimSocial" agents deal ecstasy, cocaine, and LSD.

The functioning of the **update-Known-Dealers** operation is described through the following activity diagram:

Individual Operation 10: update-Known-Dealers



User checks if they have any *dealer* in their *networks* and replace the different items of the known-dealers attribute by the ID of the corresponding *dealer*.

The complete explanation of how SimUse is populated, in terms of type of users and number of dealers, will be covered in the Chapter 7. It could already been said that the simulation displays a range of archetype creating variations on the agents attributes. The fact of using such archetype also permits for the simulation to get closer to the reality: a simulation starting with a population constituted by only one type of "blank" agent (i.e., that has never used drugs) is not

representative of the reality, and, will experience difficulties to reproduce the drug initiation inside a population of "blank" agents.

Before reaching that point, the perception of risk and its management, as elements of the decision process, need to be examined to fully capture the justification of a user's decisions to start using.

4.2.4. Deviance and risk taking: managing the entry to drug usage

In his work on cannabis users, Becker [281] considered that the first step to a deviant career was an act of transgression on a dominant social norm. In the American 60's, cannabis use, and by extension drug use, were seen as a transgression of moral norms. According to Parker [72], these moral norms have weakened, while recreational usage became more visible in everyday life and illicit drug use got partially normalized (Section 1.3.2). Consistent with the theory of normalization, only four respondents expressed the idea that they perceived their first initiations as a transgression of a moral norm. However, respondents consider these first uses as risk takings possibly leading to harmful consequences (this point will be further developed in Section 6.3.1).

The analysis of the interviews reveals that the notion of risk plays a fundamental role in the decision to use psychoactive substances and that, throughout the career of the recreational users. In order to entirely capture the importance of that notion in the decision processes of the respondents, this research describes the evolution of the risk perceptions and its implications on the choice of the users throughout their career. Before getting to the description of drug's risks as perceived by the respondents during the initiation phase, some concepts relative to this notion need to be clarified.

First, if risk and danger are directly related, they remain different in nature: *danger* is defined as an objective damage that a specific event or object could inflict to people and/or material; *risk* refers to the probability that this event or object will happen and damage an entity when exposed to a particular danger. Hence, there is no risk without objective danger, but the risk remains a probability. Second, risks are socially constructed. A society identifies and defines both dangers that can potentially affect its global functioning and techniques and methods to control these socially constructed dangers [282]. Finally, in a society where the risks are minimized, the decision to engage in such conducts is considered as a deliberate choice (*risk taking*); while in societies where risks are largely present in day-to-day normal life, the risk is said to be accepted (*risk accepting*) [283]. On this last point, it could be easily asserted, that in modern western societies the choices of engaging in recreational drug uses, and by extension in recreational polydrug use, consists in a risk taking. Concerning the initial phase of their drug career, it is conjectured in this research that drug initiation is based on an intentional and motivated action, planned through a phantasied projection (Section 2.3.1). When the substance intended to be used is associated with the 'Detrimental' representational scheme, the participant's narrations always contain one or two forms of rationalization — an argumentative and an objective one — to facilitate the norm transgression.

The argumentative forms of risk rationalization allow the future users to palliate the cognitive dissonance between their representation and their future actions [40]. Indeed, respondents appear to apprehend short-term and irremediable effects that could be triggered by their consumption: the respondents generally refer to risk using terms such as "overdose", "death", "dependence", or "madness"

(paranoia/psychosis)¹⁶¹. This perception of risk is the direct result of the core social representation, which, as already discussed, presents illicit drugs as lethal and addictive.

Indeed, the lack of objective information concerning the neuro-pharmacological properties of most of the illicit drugs creates an uncertainty regarding potential harmful side-effects of unknown substances. In order to reduce this uncertainty, users tend to justify their decisions through different *neutralization techniques* and forms of *risk denial*. As briefly introduced in Section 1.1.2.1, neutralization theory was initially developed by Sykes and Matza [64] to describe the different argumentative techniques that delinquents build to legitimate their deviant and criminal acts. If most of the techniques describe in Section 1.1.2.1 are not part of the arguments enunciated by respondents, the *denial of injury* is frequently employed to justify their initiation. Nonetheless, Peretti-Watel, assuming that modern western societies are societies of risk¹⁶² [284], argues that these techniques of neutralization are irrelevant to study drug use, because drug use is nowadays labeled as both deviant and risky. Considering that drug users do rationalize their consumption, this author proposes to update the neutralization theory by using findings from the risk denial theory, which encompassed three main techniques [66, 285]. The interviews reveal that three forms of risk denial are currently employed by the respondents to counter their apprehension and legitimize their risk takings.

The first technique, *scapegoating*, consists of creating a distinction between a "safe" category of entities (which could be a group, a particular form of use or substance), and comparing it to a "risky" category that will serve as a counter-example. In the following extract,

¹⁶¹ Respondents generally speak of psychosis by using expressions such as "stay high" or "stay perched" in French, indicating the impossibility of coming down, coming back to reality. These expressions are frequently used in conjunction with the risk associated with hallucinogenic substances such as LSD or magic mushroom.

¹⁶² This point will be more detailed in the Section 5.1.

the participant illustrates the scapegoating by comparing the substance he wanted to try (cannabis) with other substances (methamphetamine or heroin) considered as more risky:

[D., A, male, 18, about cannabis] Well I knew it was illegal. So I was a bit apprehensive with trying it but I didn't really care actually. I knew that it wasn't as dangerous as other drugs like Ice or Heroin so I wasn't that scared of having any. So - yes I just tried it.

With the second form of risk denial, *self-confidence*, individuals considered that they are able to manage the risky situations due to particular personal characteristics and/or special abilities. This risk denial technique is related to other forms of control that can be call *risk management techniques*. The following quotation is a good example of the self-confidence form of justification coupled with risk management techniques. This extract illustrates a situation where the individual knows for sure a substance to be dangerous and potentially lethal, but considers that he is able to manage this risk by developing appropriate rules of consumption:

[Yousseuf, A, male, 29, about ecstasy] [*What was your opinion on ecstasy before using it?*] I was a little bit worried because around that time this girl [NfA, Anna Wood¹⁶³] had passed away and there was all this news. [...] I think it was around 1998 when it happened, and that was my first impression of it, worried that if you take it you're going to die. That was a bit of a concern but I was around enough people that had taken it so I didn't really feel like I was at harm. If anything, even though that girl had died which is tragic that she passed away, I think a lot of people knew that you need to keep your fluids up. Also I don't think she went to the toilet or something, or something was happening and something broke down inside her, inside her body. We just knew not to take too much really and so my thoughts were it must be pretty good. It must be pretty strong if it can kill you. If it can kill you then it must be good.

¹⁶³ Anna Wood was a fifteen years old Australian teenager, who tragically died from water intoxication (hyponatremia) after her first intake of ecstasy. The large media coverage following this event has led to a decrease in the experimentation rate of ecstasy [NDARC, 2007], while this one was increasing in other western countries.

The next example illustrates the third technique, *comparison between risks*, which consists of "comparing [this risk] to similar risks that are already well-accepted by most people"¹⁶⁴:

[Bobby, A, male, 25, about amphetamine] I looked it up on the internet and I saw that there's like a one in 50,000 chance of having an allergic reaction. So I go, yeah, I can live with that. There's probably a one in 50,000 chance that I'd get hit by a car tomorrow as well maybe, I don't know. But then you could also die from overheating, you could die from drowning yourself with drinking too much water, sweating out all your electrolytes. So I thought okay, well as long as I don't drink too much or not drink at all and I'm not allergic to it, which is unlikely, I should be fine. So I rationalized that I'd be okay and that was my opinion.

As the extract from Bobby illustrates, the respondents generally try to reduce the uncertainty through an *objective* rationalization of the risks. This rationalization is based on information gathered by the actors and participates to the management of risk inherent in drug use. Indeed, respondents from the younger generation are generally inclined to search for scientific information or experienced user's knowledge through the online literature or dedicated forums, looking for numerical information or experiences judged as relevant and realistic:

[Soph, A, female, 23, about ecstasy] my friend that I did it with, [...] she always looked up information on the Internet about it and did lots of research into - she's really invested in scientific understandings. I understand it to an extent, so if she looked it up and explained it to me - it's not like we were just doing it willy nilly, any information. We knew what to expect in a way - the come down and the peak. We knew that was going to happen so it wasn't a shock. It wasn't an overwhelming feeling because I was expecting those feelings maybe. That's why I could stay in control of it.

This information allows individuals to reduce their apprehension regarding future experiences and gives a rough estimation of correlated odds of harm. Based on these data, respondents indicate that they

¹⁶⁴ Peretti-Watel P. (2003) Neutralization Theory and the denial of risk: some evidence from cannabis use amongst French adolescents, *British Journal of Sociology*, 54 (1), p.28.

operate a calculus between estimated risk and the degree of dangerousness they impute to the substance:

[Billy, A, male, 22, about ecstasy first use] I knew lots of people who did do it already. I'd heard about it and I heard about the comedown that you have, and how you feel really flat and really shit. My attitude before was a little worried, but I knew deep down that I was probably going to end up trying it. [*Did you consider it as dangerous?*] I thought - what if - that was running through my head. I was like, this could be really dangerous, something really bad could happen to me. So I did feel it was dangerous, but not dangerous enough. I didn't feel the odds of something horrible happening were strong enough for me to not do it.

, or:

[Sammy, F23, male, 36, general] I am the kind of guy who likes to know what it is before consuming, I always tried to get information before taking it: what are the effects? What does it do? Even though it is very difficult to describe effects with words, I wanted to know what are the dangers I could be exposed to, what were the consequences? What were the physical and mental risks? So I always made a little bit of inquiries before. And, when it was the first time, I wasn't going into it like a grunt. I was just testing a little bit...

A second form of objective rationalization consists of using a reduced dose of the substance at first. Here, the participant considers that taking a reduced dose of the substance could palliate the potential danger and addictive property of the substance. The belief that "small dose can't kill" is widely spread amongst respondents at the beginning of their drug career.

A third form of objective rationalization consists of observing the behavior of other users before taking the substance and considered the absence of visible side-effects as a proof of safety:

[Sony, F24, male, 28, about first uses] It may look strange, but in fact, I always get informed a lot about what that thing was really like, and what I might risk. Okay, it's true that late in the night and with a number of different things in your blood, you don't really care, but anyway if I heard about a new product, I always tried to see what it was and how long it lasted. Well, this is the kind of thing you're not going to do completely blind [NfA without knowledge]

although there is always a doubt phase with the first time about what is going to happen, will it be okay, will I bear the thing... so, you are not going right ahead the first time.

, or:

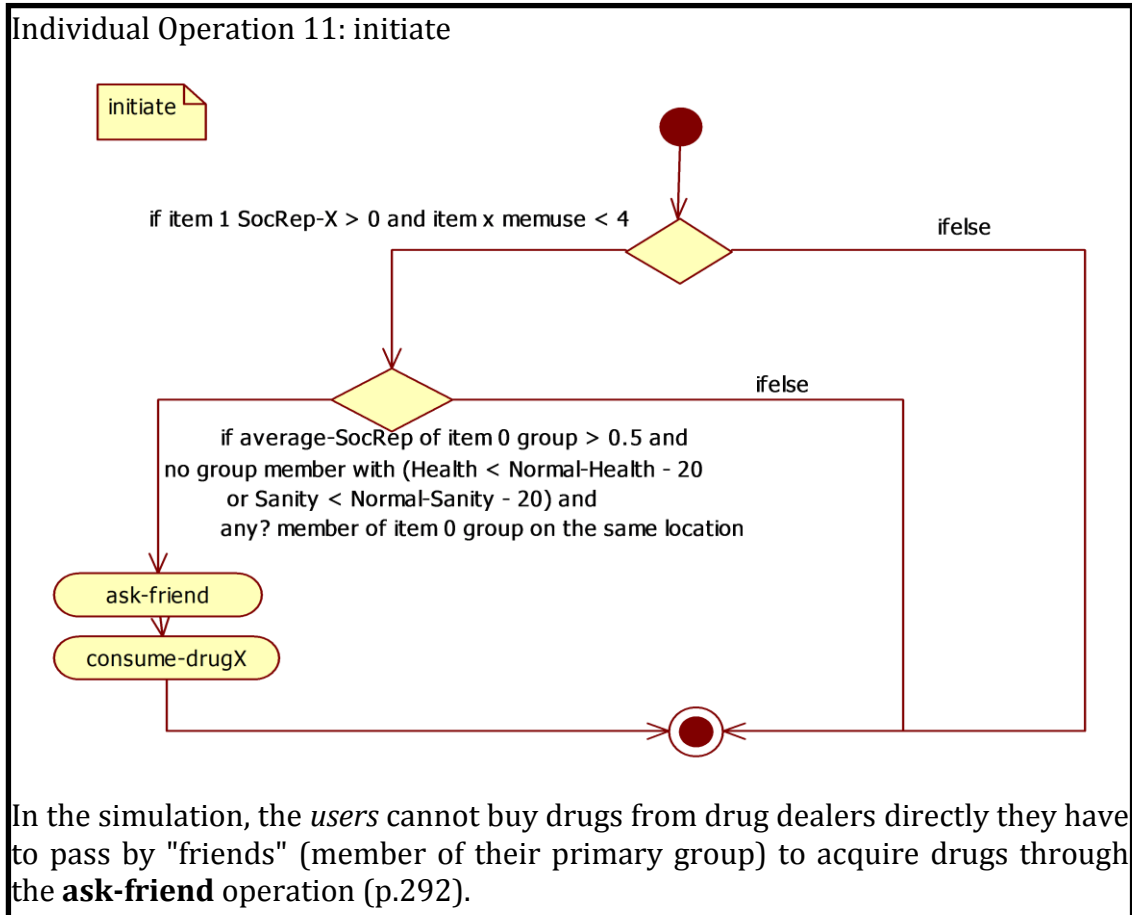
[PBoy, A, male, 39, about cocaine] [...] it was very social, like the plates would be going around the table. Although I had no peer pressure I thought well this is not going to kill me because everybody around me is doing it so I wouldn't feel threatened. Like if I was trying something for the first time I wouldn't do it at home by myself.

This last technique is however rarely used during the few first experiments and mostly concerns synthetic substances (e.g., amphetamine-type and MDMA-type drugs). But later in the drug career, this observation of other behaviors will constitute a form of guarantee about the purity of the substances.

Overall, objective risk rationalizations could take three different forms: by getting information from sources judged relevant and valuable by the future users; by taking a reduce dose of the substance to test the effects; and by observing the behavior of people, who are using the new substance. These different objectivations always follow the risk denial and risk neutralization techniques, but still participate in the decision to initiate substances perceived as dangerous. SimUse does not capture these neutralization techniques mainly because the origins and/or the "transmission" of such techniques through interactions with experienced users have not been studied in the frame of this research, and asks further investigations.

As indicated in the previous subsections, the initiation is not only dependent on the individual capacity of supplying the illicit substances. Indeed, during the experimental phase of the recreational polyuser career, the initiation to new illicit substances needs to gather several conditions such as (1) the presence of other peers, (2) a favorable or neutral representation about the substances, and (3) members of the primary network that do not exhibit detrimental effects of the drug.

Concerning the drug acquisition, the interviews analysis reveals that new initiators obtain their drugs not directly to a dealer, but in all the case, through friends or more rarely to other users. In addition, and as just pointed above, the individuals with 'Detrimental' representation attached to the initiate drugs, only consume small amounts of the new substance. The model encapsulates all these different conditions into a single method, named **initiate**:



It is worth noticing that after the initiation, the use of risk neutralization and management techniques does not cease: the perception of risk is modified accordingly to the period of the drug career and to the different experiences accumulated by the individuals throughout their consumption. In other words, the techniques of risk control evolve with the perception of risks and are adjusted all along the drug career of the recreational polyusers.

The perception of risk is not the only element, which gets modified through these first experiments drug's social representation, and on the social life of the individual. The next section (4.3) examines the impacts of these first intakes on the recreational user's drug career.

4.3. Evaluation of Action and Impact of First Substance Uses on Other Drug Representation

These different initiation and first few experiments increase the stock of knowledge-at-hand of individuals, by adding techniques of consumption and supply, as well as knowledge about the drug's effects and their durations. By evaluating their experiences and their outcomes, their initial representation are either reinforced or modified. Correlatively, these modifications will affect the subsequent decisions and consumption. From a polydrug use point-of-view, it is noteworthy that having experimented with a particular substance could entail modifications in the representational schemes of drugs never used by the respondents. It could also transform the attitude toward global substances use. These different transformations are examined through the process of experiences evaluations (4.3.1), impacts on drugs social representation (4.3.2) and, finally, on the social environment and global drug career of the individual (4.3.3).

4.3.1. Evaluation of First Experiences: Beneficial Effects, Impact on daily-life, and Self-Representation

During the experimental phase of their drug career, the motivation of respondents to test drugs could be found at the interactional level (i.e., social integration, reinforcing bonds between peers). It appears that the evaluation of first intake is based on the outcomes and consequences that this intake had at the individual level. These evaluations consider

several elements and have various consequences that are going to be examined.

The first criterion of evaluation is the level of "*pleasure*" and "*fun*" that the users felt during their first experiences:

[Youssef, A, male, 28, about cannabis] To be honest I did not know what marijuana was. I knew it made you high but I didn't know what that meant really. [After trying] I was actually quite blown away by the drug and really enjoyed it and enjoyed hanging out with friends on the drug, so it felt like it was a really social way of being and made a lot of good friends through sharing a joint or a bong.

or, conversely:

[Diane, F25, female, 31, about cannabis] I quickly stopped because it is one of the things that didn't suit me at all. [*Can you be a little bit more specific?*] I became paranoid, I fantasized [*literally "made movies in my head" French expression meaning that she was imaging oppressive situations and/or unreal events*] it was unpleasant to me. I felt bad. I couldn't handle the high. For me, cannabis is worse than speed or anything else. I don't know how to handle it. For example, driving was impossible, I smoked a joint and I was completely disconnected [she laughs] [*What do you think of the cannabis now?*] For me smoking a joint is really negative, it's something that scares me. I know that if I take a puff, I'll feel super bad after. I will become anxious and sweating, to get myself on a corner and stay hidden, I was really wrong. [...] This is not a substance that interests me anymore. (This extract could illustrate the "Anxious" behavior cf. 2.2.4)

As depicted in the two last examples, pleasurable feelings ("really enjoyed") lead to a "positive" transformation of the representational scheme (here, from a representation that can be qualified of 'Neutral' to a 'Enjoyable' scheme); while negative outcomes ("felt bad") entail a negative modification of the scheme (here, the representation became 'Useless').

The second criterion assesses the *behavioral and physiological effects* induced by the neurological properties of the substance. Individuals

also evaluate the benefits or detrimental results experienced while under the influence of the drug(s) they took:

[LittleDevil, F26, male, 29, about first use of cocaine] It just happened, it was doing the closing [*LittleDevil worked as a bouncer*] one night and [my colleague] told me "You want to try?" and because I had already tried speed and other stuff, I thought "why not", so I told the guy "Let's go". And I liked it, you don't feel tiredness, you get a great self-confidence, you can drink like a loose-cannon, you're still operational the next day when you wake up, you don't have any headache, you're like "This is impossible." I found the effect rather nice, rather exhilarating, not euphoric, but the extra self-confidence is very pleasant.

or, conversely:

[Maggy, F27, female, 31, about ketamine] Ketamine had been the biggest fear of my life, I saw me dying, I was ... In fact, it was like my soul had split from my body, I traveled out of my body and I was seeing myself dying. I won't try this experiment ever again. This drug is pure crap.

Again, if the effects produced by the substance neuropharmacological properties are judged positive (in the first example, the feeling of high self-confidence related to the action of cocaine on the dopamine receptors), the representational scheme will become positive or increase (here, turning to 'Enjoyable'); and conversely, if the particular effects of the drug are considered as negative, the "K-Hole"¹⁶⁵ produced by the dissociative property of ketamine in the second example, the scheme becomes negative, shifting to 'Detrimental'.

The third major criterion of evaluation is related to the aftermath of this first intake and global *consequences on the daily life* of the individuals. If the substance had no negative impact on the "normal life" and individual's social commitments, the representational scheme will become increasingly positive:

[Sony, F28, male, 28, about cannabis] We had the effect of the first moments where we laughed but something crazy!

¹⁶⁵ The K-Hole designates a state of dissociation between the body and the spirit. Frequently describe as near-death experiences or out-of-body experiences, K-Holes are induced by high dose of Ketamine.

We were really rolling the floor laughing, burst on the slab, we were starving. [...] At that time, you're still young, you're at your top form, you haven't been degraded by any substance yet, so you're fresh. You can take a lot. The next day, you're like: "Damn, but in fact, yesterday, we smoked, we were smashed, but now, we wake up today, we are clean, I feel good, we can study, there no problems in fact."[...] At the beginning, at least with my friends, we just saw the recreational aspect, period. It does not stop us to continue our lives or doing anything else.

At this early stage of the polyuser career, no respondents seems to have experienced severe and permanent harmful consequences or seen his/her social life deteriorated after the first few usages, which participate in reducing the global apprehension for future intakes.

The description of some specific cases could deepen the comprehension of the first intake evaluations. It has been claimed earlier that drug initiation is a motivated and intentional action. Nevertheless, if most of the respondents declare having chosen the substances they wanted to experiment, as well as the precise moment of these experiments, some respondents have depicted initiations while in a state of advanced inebriety, which, according to the respondents, seems to have reduced their cognitive and decisional capacities:

[Mike, F29, male, 30, about ecstasy] I think I drank too much that night and it was a kind of booster. And then the next time, you remember that you got the high and it bucked you up, so I think that's why you take it again. So the next time, you know that as soon as the alcohol starts to knock you too much, you take one and drunkenness goes away.

or, conversely:

[Marie, F30, female, 22, about ecstasy] And so we took ecstasy. We drank alcohol with those guys. And, it was a good night, it was okay but then I don't know why, I didn't take it again. Because that time, I think I was way more drunk than anything else and I didn't really remember the effect, or maybe it wasn't a good one, but then I haven't renewed immediately.

Here, in addition to the representation modifications, the assessments of the sensations and effects experienced through this

unplanned consumption have direct impacts on the individual's future intention to use. The two example shows how these two cases of unprepared consumption of the same substance (here, ecstasy), could affect differently the intention and representation associated with the substance: the first example shows that the "balance of drunkenness" obtained by the intake of ecstasy has induced future usage; while the absence of perceived effects in the second example appears as having delayed the next ecstasy use.

Furthermore, few other respondents also describe some of their substance initiation as an accidental form of consumption, due, for example, to friends that forced the consumption, a pill dropped in their glass, or the wrong substance sold as being the wanted one. This type of "unintentional usage" remains uncommon in the early drug career of respondents, but could still highlight some points concerning evaluation and future uses:

[Paco, A, male, 27, about cannabis] I went to a friend's house, who I hadn't seen for a few years and he was smoking this weed. I had never done it before and they were like "you've got to smoke some pot" and I was like "No way man, I'll become addicted. You can't do that" and then they tackled me and held me down as a joke but it wasn't really a joke and they held the bong to my mouth and sort of just held it and like wasted three or four cones but I inhaled enough. Nothing happened for like an hour. I was like "Oh I didn't inhale it. I'll be fine" and then we were walking to a shopping center and halfway to the shopping center I was like "Oh I'm asleep, that's okay this is a dream" and I was like "hang on a minute, this isn't a dream, what the fuck's going on" and I had to sit down and go "oh shit what is happening" [...] Then I didn't do weed again for a few years but I was like - it kind of took the fear off it because I was like "oh, I did it and I didn't become addicted and there was no big problem".

, or conversely:

[Nick, A, male, 19, about speed] It was accidental actually. It was in an MDMA pill. It was mixed with speed, so that was the first time. I didn't realize it was speed until after when one of the friends who had given it to me, explained what was in it. [*What was your opinion on it before trying it?*]

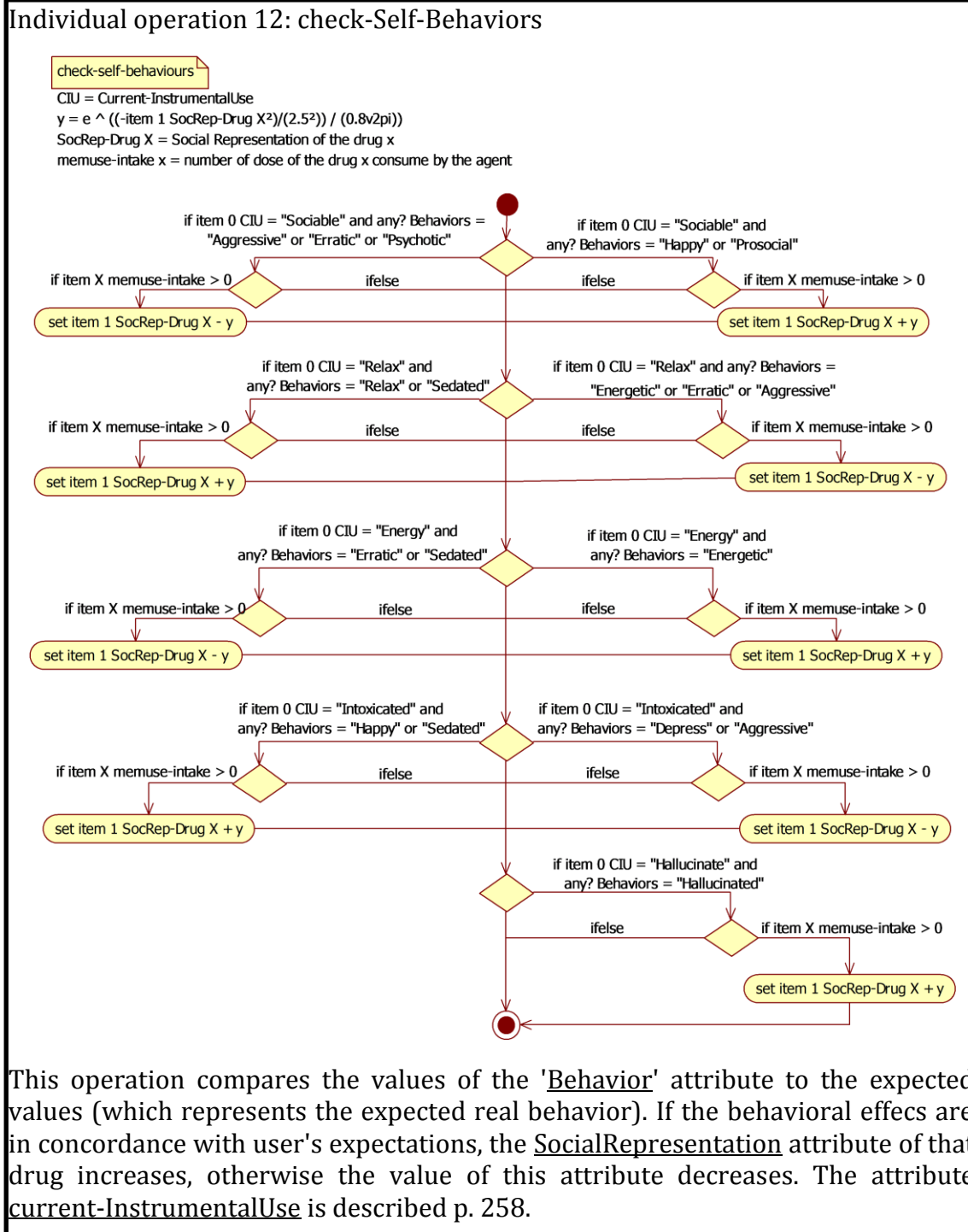
Well, obviously since I wasn't ready for it, I was not positive about it. Just because, well, speed, it has such a stigma, it's renowned as being so dangerous with continued heavy use. So I had no intention of trying it, I wasn't interested in trying it. It was quite negative. [*And after that?*] I find I don't like the effects of it on its own because once or twice I've taken a mix where there's been a lot more speed than I've been comfortable with. I don't like it. [*Could you describe the evolution of your consumption of speed, since you were 16?*] It went from a surprise thing to, at about 17, 18, was when I intentionally got speed to take with MDMA. So it was an evolution from sort of accidentally doing it to intentionally mixing with it to enhance the effect. It's largely intentional now. I would occasionally take speed with MDMA, intentionally for the effect.

These different unwanted and unplanned experiences do not necessarily entail a negative representation of the substance "accidentally" ingested and that despite the conditions in which these initiations took place. The experienced effects, coupled to the "real" evaluation of substance-related risk, appear to outweigh the influence of the conditions of initiation on future uses. However, it does not mean that the individual will be eager to reuse the substance immediately, especially if the setting and/or conditions of use were perceived as unpleasant or if these conditions will not be repeated in a near future.

Overall, it appears that the evaluations of initiation are based on the beneficial/detrimental effects perceived (both pleasure and specific neuropharmacological properties) and on the consequences on the daily-life that the new recreational users have observed. These evaluations have a major influence on the way a drug's representation are modified, and consequently, on the future intention to use. Here, positive outcomes of new practices modify the initial representational schemes to become concordant with the experienced and evaluated practices.

This evaluation (and later on reevaluation) process is modeled in SimUse through the **check-Self-Behaviors** operation. This asks the

users to retroactively judge their Behaviors to establish, if whether or not, the effects resulting of their consumptions were as expected:



Positive evaluations of the first use leads to the continuation of drug intake and to a positive reinforcement of these drugs representational schemes. Respondents continue to use these substances until a problematic situation arises (this point will be developed in Section 5.3).

These transformations of representational schemes can also have a "cross-impact" on the representational schemes associated with other drugs, and so, on their potential experiment. The next section will examine this particular point.

4.3.2. Effect of Polysubstance use: Gateway effect and Social Representation

During the "Starting and Experimenting" stage of their drug career, the respondents did not indicate having intentionally mixed substances, even if some did consume alcohol in combination with illegal substances. Intentional polysubstance use remains a practice mainly associated with the following stages of the polyuser career. However, and as aforementioned in Section 1.4.3, polyuse could be either simultaneous or concurrent, and these first experiences appear to impact this second form.

As just discussed, respondents seem to transform their representational schemes accordingly to the outcomes of their first intake's evaluation. Respondents, who evaluate positively their first experiences, become suspicious about the primary social representation ("Drugs are bad/detrimental/addictive"):

[Bobby, A, male, 25, about amphetamine] At school, they made everything, all these, they made weed out to be really bad for you, that was the thing, and because weed was made out to be really bad when it's not so bad, then it's like, "well what about the other things they make out to be bad. Maybe they're not so bad as well, maybe they're okay". So there's like a lack of faith in what they've taught you.

, or:

[Jessy, A, female, 22, general] Well after I'd already had that idea about ecstasy that it might be dangerous and I realized that it was the media - or someone else's opinion - I didn't really believe anything until I had researched it. So I didn't have an opinion until it was an informed opinion.

The perceived inconsistencies between the primary social representation concerning one element of the global category ("they made weed out to be really bad") and the evaluations of respondent's own experiences ("weed is not so bad") leads to a questioning about the primary representation "Drugs" in its totality ("maybe they are not so bad as well"). This questioning has for main consequence the fragmentation of the central nucleus of the "Drugs" social representation. This fragmentation seems to induce an accrued curiosity toward other drugs. Consequently, the fact of having tested a few substances removes the fear to consume other drugs and, therefore, facilitates the decisions to initiate new ones. The case of ecstasy as a gateway drug to other stimulant substances appears regularly in the interviews:

[Jurion, F31, male, 27, about cocaine] On one hand I didn't really know what it was, but I certainly know what to expect without really known what it would do to me. I knew that cocaine was something that boosts you that made you quite talkative. That it would be a little bit like ecstasy. So I thought "it will be okay, it will not get wrong." I knew it was a drug for rich, so normally it should be something that was pretty cool ... If you prefer, I really took it easy, without fear, saying: "Anyway after ecstasy and mushrooms, it will go smoothly."

, or:

[Diane, F32, female, 31, about speed] Since I had already taken ecstasy I wasn't too afraid to try speed. I thought if I had tried ecstasy, the rest of it I can try. I pass a certain threshold in hard drugs.

As illustrated by the previous examples, the different substances experienced build a "repertory" of sensations with which the polyuser can compare and estimate the effects and potency of untested drugs. Therefore, this extension of the *stock-of-knowledge-at-hand* participates in reducing the apprehension regarding these new substances and their potential effects [286]. However, it appears that these expected effects are based on the actions and dosages of substances already known and consumed, which can lead to inaccurate evaluations of the dosage and to disappointments regarding the outcomes of these new drugs:

[Neron, F33, male, 28, about LSD before first time] And I'm not the only one having this a-priori. At that time, everyone I knew, we were all heavy smokers of cannabis, we had to smoke I don't know how many grams of cannabis to get stoned and here someone presents us something like 1 cm by 1 cm and he said "Don't even take it in your mouth, just keep it between your fingers and you'll get seriously high." [...] So the first time you say, "Look, it is not that thing that's gonna send me to the land of Care Bears or Smurfs."

, or:

[Nick, A, male, 18, about cocaine] First time, I wasn't convinced it worked, only because the only chemical I'd tried before then was ecstasy and when you have one pill of ecstasy, you know about it. When you have the one line of coke, you know, it's pretty mild. So I wasn't too impressed.

The fragmentation of the primary social representation seems to play an important role in the gateway effect, by facilitating intake of new substances¹⁶⁶. Initially, the gateway hypothesis relies on the research concerning adolescent's drug use produced by the Denise Kandel and colleagues [34, 286, 287]. In this research, the authors asserted that adolescent's drug use consists in "a developmental sequence of involvement with different classes or categories of drugs"¹⁶⁷ with legal drugs (alcohol and tobacco) as starting drugs, followed by cannabis, which leads to other illicit drugs.

This theory also argues that this sequence is ordered and that "the use of a drug earlier in the sequence is associated with an increased risk or likelihood of use of a drug later in the sequence"¹⁶⁸. Consequently, "the use of a drug earlier in the sequence, such as alcohol or tobacco, causes the use of a drug later in the sequence, for instance, marijuana"¹⁶⁹. The causal argument is considered by the author as verifiable with difficulty, but could be explained by the accession to new networks with

¹⁶⁶ Valenzuela & Fernandez judged that the level of risk imputed to the various substances impacts the sequence of future uses.

¹⁶⁷ Kandel D.B. & Jessor R. (2002) *The Gateway Hypothesis Revisited, Stages and Pathways of Drug Involvement: Examining the Gateway Hypothesis*. Cambridge University Press, p. 365.

¹⁶⁸ *Ibid.* p. 366.

¹⁶⁹ *Ibid.* p. 366.

new initiators. This accession is theorized as inherent to the different consumption initiated by the individual (this point will be further developed in the next Section).

However, the gateway hypothesis presents the evolution of users as oriented toward "other illicit drugs" without specifying the exact substances or the classes of substances that might be consumed. This research does not pretend to be able to predict the different drugs that an individual may use after cannabis, but it can be hypothesized that the neurological nature of the drugs themselves may play an essential role in the polyuser future decisions. Consistent with this hypothesis, some respondents explain that their previous experiences have created a form of reluctance toward new substances known as sharing common pharmacological properties with drugs that they have negatively evaluated. This reluctance seems to be directly related to a particular neurophysiologic effect perceived by the users during their precedent intake:

[Picasso, F34, male, 34, about methamphetamine] No, meth I forbid myself to do it. You know, when I take some good speed, I already need 12 hours to eliminate my last line and I can't sleep before 12 hours, so something that I smoke and that make me stay awake for three days straight and not even get high, a priori: no [laughs].

, or:

[Ubik, F35, male, 19, about stimulant after speed experimentation] when I was offered MDMA, I knew it was close to amphetamine, but stronger [...] they told me that it gets close to that [amphetamine], but you feel like you come when you're with other peoples, you're utterly happy, but it is the same class as amphetamine. I told the guy "no thank you" because I have a heart that is not very sturdy, so each time I take speed I feel it like [*makes the sound of a frantic heartbeat*] I can't take it anymore, so I told to myself never stronger than that [*NfA: speed*] in this class of drugs. That's why, cocaine, I tried once, not twice.

After their first positive experiences with psychoactive substances, some other respondents wanted to experience new sensations through substances belonging to another class of drugs to feed their curiosity:

[Bobby, A, male, 25, about magic mushrooms] I was just interested in it. It was like a whole new class, everything else is a bit the same. You've got weed, which is different to alcohol, but then like pills and speed, coke, they're all stimulants, they all do the same sort of thing, and then hallucinogens is like a whole different ball game. Like what would that do, what state would that be? It was the curiosity.

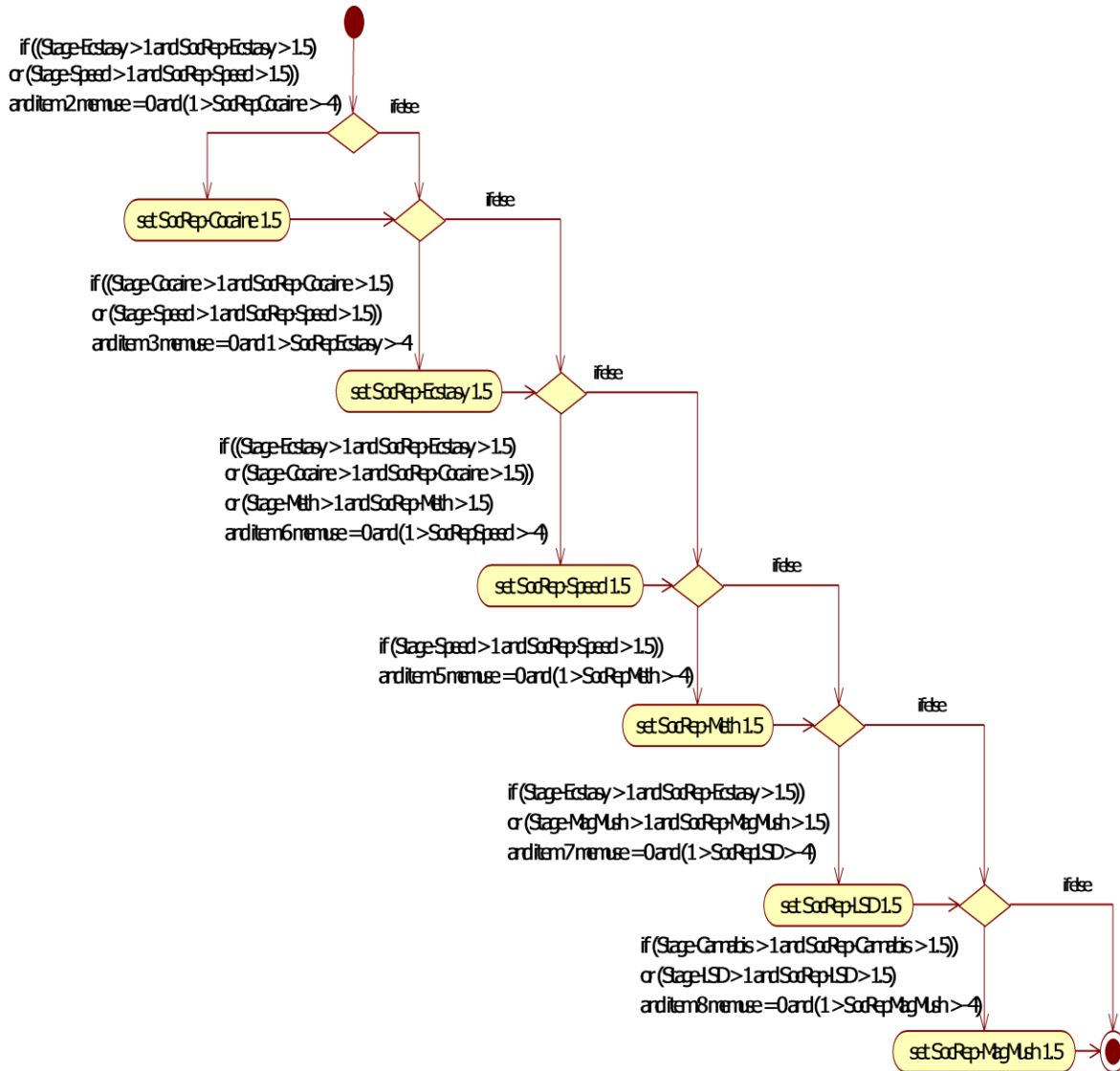
This gateway effect is represented in the model through the **check-Cross-SocialRepresentations**. This operation asks *users* to modify the SocialRepresentations values of substances with similar effects of those already experienced. This method functions as follows:

Individual Operation 13: check-Cross-SocialRepresentations

checkCrossSocialRepresentations

SoRepX: SocialRepresentation of drugX

menuse: menu of use



For example, if a *user* has consumed several times ecstasy (item 3 Stage > 1) and is still keeping a good opinion about it (SocialRepresentation value superior to 1.5), this method asks the *user* to change its SocialRepresentations of Cocaine and Speed (if these one are inferior to 1 and superior to -4) to 1.5. This operation only takes into account positive modifications, mainly because the SocialRepresentations of the majority of *users* at initiation are 'Neutral' or 'Detrimental', and decreasing these values will not have a major impact on future uses.

Nevertheless, the gateway theory considers that this ordered sequence is neither invariant, nor inexorable. Indeed, this sequence appears to be mainly dependent on drug availability and, to some extents, on the specific social context surrounding the individual, as indicated by the

author: "the progression is not inherent in the nature of the drugs themselves but emerges from the social organization of their availability and the social and personal definition of their use."¹⁷⁰ Here, the biographical situation of the individuals and their social environment are, again, fundamental for future use. This point is examined in the following section.

4.3.3. Impact of these first substances uses on the career and social networks of the recreational user

Based on the interview's analyses, two main consequences affect the life of the new users after their first experiences: *peer selection* and *substance "instrumenting"*. If this first step into the drug career of polyusers is highly related to the social aspect of substance use, becoming a consumer of illicit substances could create divergences amongst peers and entail group desegregation. Indeed, divergent attitudes and/or representation on specific substances amongst the different group members could incline some of these members to select peers on their willingness to use specific substance(s). Most of the respondents describe how their primary group of friends split into two categories: on one hand, those with a positive representation ('Enjoyable') attached to the substance, and who are willing to try or continue this consumption; and, on the other hand, peers with a negative image ('Detrimental' or 'Poison') of the substance who generally try to warn their friends on the substance-related possible harm, and who are not inclined to experience those substances.

At that point, the individuals are confronted with a choice: either keep their initial group of friends and change their attitudes/behaviors to the drug(s); or select other groups of peers that share common attitudes and representations toward drugs [34, 288]. The next extract illustrates this last point:

¹⁷⁰ Kandel D.B. & Jessor R. (2002), *op.cit.*, p.368.

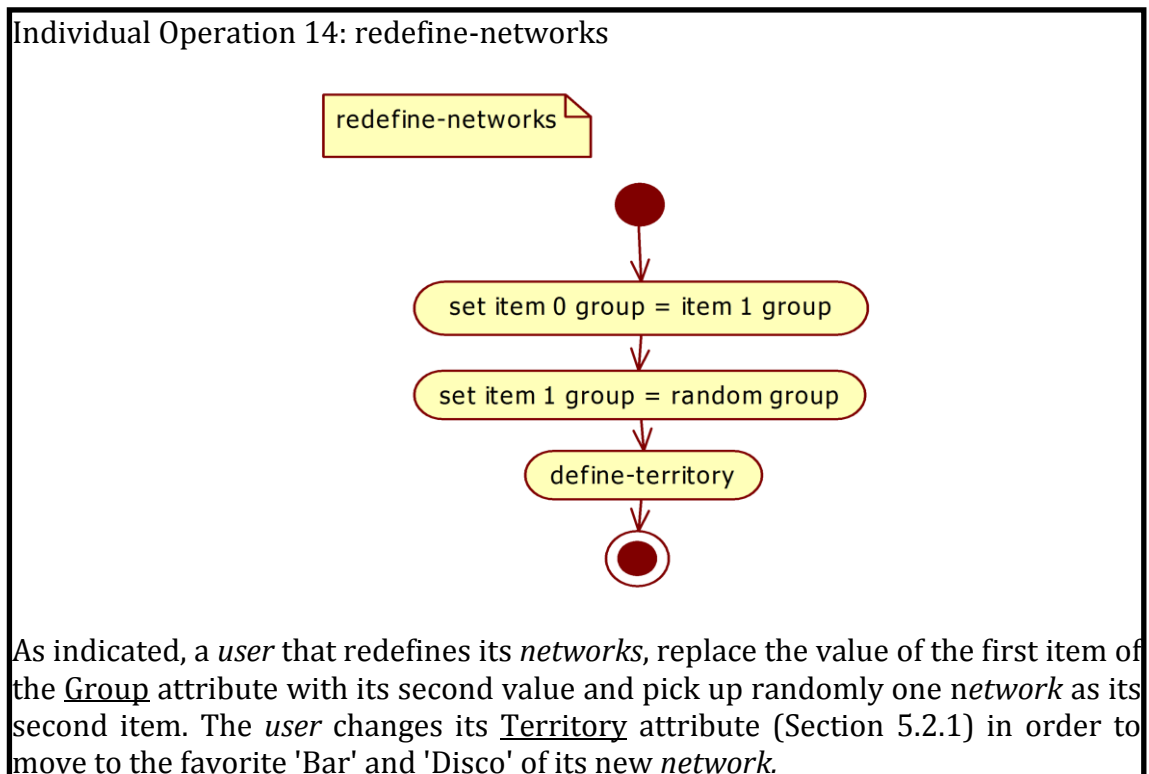
[Maggy, F36, female, 31, general] I had my 'free party' group and I had my group of childhood friends. They didn't know each other. So, my group of childhood friends was the one with whom I had healthier consumption and who found me wrecked and all washed out every Sunday. On the other side, my free party group that were those with whom I was consuming everything. They were all users. [...] My childhood friends, they were really scared for me, when they saw how they picked me up on Sundays, they were scared for me. [*But that didn't incite you to calm down your consumption?*] The fact is that I wanted to have this kind of experiences and I couldn't have these experiences with them, because they didn't want that kind of experience ... [*What were they taking for example?*] Alcohol and weed, some of them didn't smoke, they were eating weed to test... But, you see it was more like nice enough stuff. I wanted to know and try more substances and also stronger ones.

This selection is based on the notion of value homophily: individuals tend to socialize with peers that share common value, norms and attitudes [289]. In the case of drug use, respondents describe how their desire of using and enjoying particular drugs has entailed consumption apart from their primary group or apart from members of the group, who did not want to consume specific drugs:

[Bobby, A, male, 25, about ecstasy] You have a pill, it's the whole night. It's not like just getting stoned and then going and doing something else, or getting stoned and going out with your friends. You have a pill and it's like, it's a 12 hour epidemic and you do it with other people who are doing pills. So suddenly you find your whole friendship group splitting and you get all your friends who are into that stuff, and then your friends from before who aren't into that, and they're against you doing it. They think it's bad for you, they're never going to do it themselves, or they do eventually, all those, and that's hard, they're not going to do it, and you sort of distanced yourself from them a bit because you know that they don't want you to do it, or they're not going to do it, and you want to be surrounded by people who do it. I guess there's this whole social stigma and you want to get validation from other people. So yeah, I had friends that were cool with it, and they were the ones that did it with me, and then the friends that weren't so cool with it, and they're the ones I sort of split from a bit.

In turn, this homophily is strengthened by the experiences shared amongst group's members. But more importantly, this selection of peers will result, as an unintentional consequence, in the reinforcement of the different social representations shared amongst the individuals willing to consume these different substances, increasing, in turn, the level of homophily. Due to their lack of information, peers with 'Neutral' representation scheme toward drugs appear to generally absorb the main representation shared amongst group member, facilitating, in this way, their insertion in the group.

Concerning the modeling, the influence of the *network* on its member has already been discussed above (Section 4.1.1). As already indicated in the **check-Group-Influence** method and considering the previous extract, the model needed to display possibility for the *users* to change of peer's *network*. The **redefine-networks** operation functions as follows:



The second point, substances "instrumenting" — as intentional use of psychoactive substances to achieve particular goal — constitutes the

turning point between two phases of the drug career. As aforementioned, these first experiences allow the recreational polyusers to obtain a better understanding of their own physiology and reactions to the drugs, reducing the apprehension and uncertainty of future drug use. At that point, polyusers also tend to develop a relative mastery over substances of different classes and have learnt to recognize the positive effects associated with these substances:

[Billy, A, male, 22, about ecstasy] [*What make you try ecstasy compared to the other drugs?*] With alcohol, it was peer pressure. With marijuana, it was interest. With this, it was interest again, because peer pressure didn't affect me as much : I felt I was a bit older and I had an idea of how I should act and what kind of person I was, much more than I did a few years ago. So it was the allure of the experience, what I heard from what it felt like.

, or:

[ElPoyo, F37, male, 32, about speed] At the beginning, you take the product and you wait for the effect. After a while, you stop looking for the effects: you let yourself go with the product, and you just realized that "damn, I'm completely fucked". But, you don't look for the effects anymore, you just let it go. [...] You let yourself go with the product, so you do not really analyzes what it is exactly doing to you anymore.

The last quotation illustrates the point where their intakes stop being perceived as problematic. The phase of experimentation and discovery is slowly replaced by a phase where drug use becomes routinized. On top of being able to control and take pleasure from the effects, the new users are able to handle their consumption with autonomy. The different consumption techniques have been acquired and the people, dealers or user-dealers, who can supply the individual on drugs, have been met throughout the various interactions that the individuals have with other experimented users.

During the initiation, the interactional dimension, in the form of social learning, played the main role. This experimentation stage is progressively replaced by a phase, during which the respondents

"instrument" their consumption in order to obtain expected positive effects. This instrumenting phase is described and analyzed in Chapter 5.

Chapter 5.

Instrumenting and

Switching: Functions,

Substances, and Social

Injunctions

[Neron, F38, male, 28, about drugs]
That's the principle of a drug in
general: you need to manage it to try
to be in a better condition or in a
different state from the original one.

In the "starting and learning" phase, the mesolevel (e.g., the sum of interactions and resulting socialization) plays the main role in the decision to initiate first usage. The main elements of this decision process, the different representational schemes and, *because* motives attached to the various substance uses, are built and developed through the interactions that individuals have with their peers.

The next step, called here "instrumenting" phase, is strongly centered on the relation that individuals develop with the psychoactive substances they consume. This does not mean that drug use stops being a social practice and a recreational activity. It means that amongst the different reasons influencing the user's decisions regarding the substances to be consumed, individuals orient their choices toward drugs with neuropharmacological properties that appear to be best adapted to the particular events and settings they are acting in or to the

specific moments of their daily routinized life. This chapter examines this instrumenting step and describes the way these choices are executed. It also explores the underlying reasons of such instrumental uses.

The section 5.1 describes the different functions the respondents give to the psychoactive substances they consume; the section 5.2 examines the choice process by presenting the different elements influencing user's choices and the way these elements interact; the section 5.3 details the reasons a polyuser may "switch" from one substance to another by describing the individual's experiences and interactions influencing the practices at this stage of their drug career; and finally, the section 5.4 presents the reasons and motivations behind simultaneous polysubstances use (SPU), and the related consequences for the recreational users.

5.1. Instrumenting stage: Functions, Substances and Neuropharmacology

During the experimentation phase, polydrug users develop their stock-of-knowledge-at-hand concerning drugs and their practices. The "drug-based stock of knowledge" is formed by the accumulation of experiences and has for main function to orient and facilitate future intake. This stock of knowledge contains information regarding: expected sensations; ways of handling "highs" and "comedowns" of the different drugs; techniques to consume and to acquire the different substances; and, techniques to manage the risk inherent in each substance. Once the different learning processes performed, the curiosity and the feeling of discovering tend to logically disappear, leaving the user in a position where the different substance usage are routinized and their related practices perceived as "unproblematic":

[HandyCool, A, male, 25, about cannabis] I guess initially the drug was surprising and very exciting. The first time I got stoned I just laughed the whole time. I've come to fully understand that drug experience so now there are no surprises in it. It's more of just a relaxant rather than being something exciting or thrill seeking. I guess my first year or two I'd get stoned with a friend and then we'd try and cook something and be retarded. It was fun or go for a walk or freak out in the supermarket. But these days it's just like normal.

This "routinization" appears to be accompanied by the instrumenting of the different substances that the respondents continue to use. Indeed, the analysis of the interviews indicates that respondents consider and describe the different neurophysiologic actions of the drugs as a form of "help". Verbs such as, "allow", "facilitate", "permit", "help", "ease" and "give" are frequently associated with the positive effects that respondents are seeking. This form of help is considered by many respondents as being a "shortcut" to access a physical and/or psychological state(s) that they desire to attain:

[Jurion, F39, male, 27, about cannabis] One thing that really marked me with cannabis use is that it allowed me to really escape all sense of time and live the moment like never before. [...] That's something you can work sober and without taking drugs, it's good to enjoy the present moment when it happens. But with cannabis, it's like that [*snaps fingers*], you're here, you're not thinking about what you're dealing with in 10 minutes or in an hour, you're not going to remember what you did two hours before... You're just there and that's superb.

, or:

[Picasso, F40, male, 34, general] Any drug allows you to reach a certain level easy [*he insists on the "easy"*] because I think they are states that you can obtain by other means, but it'll ask you some work. And I'm outside all that, meditation or breathing techniques, for a lot of things, even a hyper anxious like me can come to relax. Drugs for me and I put medication as drugs, because it is still a matter of dosage [...] but when you take a psychotropic drug, it's super easy to get you going very, very fast in the state in which you want to be in.

Describing the actions of drugs, the respondents attribute some *functions* to the different substances they have consumed and are still using. These different functions are described in the next subsection (5.1.1).

5.1.1. Instrumental Substance Use in Recreational User's Life

All respondents agreed on the fact that they gave roles to the substances they used or were still using. Furthermore, respondents link their drug usage to specific moments and specific expectations:

[Gourou, F41, male, 19, general] [*Do you give functions to different drugs you take?*] Functions.... Hallucinogens are openness, awareness of elements that exist but which you're not necessarily aware. The goal of stimulants is to enjoy, to live fully. To be in, to live intensely for a period. For me, that's it. And the role of opioids, it is calm down, to recover your mind. To recover, rest, breathe. [...] Alcohol and cannabis for me have a sociable function completely. They are stimulant for celebration, euphoria, friendliness, and creativity too.

As pointed in the Section 2.3.1.4, several authors agree on the fact that users subjectively induce functions and roles to psychoactive substances based on the effects they have experienced and that they expect to feel in future uses. In their different articles on the functionality of drugs, Boys and her colleagues differentiate eighteen of these functions (two are related to polydrug use) [73]. They gathered these functions into five main categories: *changing mood*; *physical effects*; *social purposes*; *facilitate activity*; and *manage effects from other substances*. The first four functions will be discussed below, while the last of these functions is the main object of the section 5.4.

Based on the empirical material, it can be conjectured that respondents differentiate one or more roles for each of the substances they are currently (or were) using. This differentiation appears once the

experimenting phase is finished and once the polyusers know the different effects they can obtain through the consumption of particular drugs:

[Jurion, F42, male, 27, global evolution] The more you know drugs, the more you have experiences with them, the more you know how you react, because you react differently to all drugs, and so you know when you should take them and why you are taking them. Anyway, you take drugs for their effects, you don't take them for anything else, you take them because it'll produce something that you are looking for and will eventually go well. Finally, in my perspective, it is very rational, I take drugs to achieve an effect and because the conditions are met for an interesting experience, for a level of relaxation or contemplation or reflection, or whether a level of pure fun and pure energy. In both cases, these are things that I take because it's going to produce a desired effect.

This "rationality" oriented toward particular effects is the main characteristic of the instrumenting step of the recreational polyuser's career. At this stage, substances are used to achieve particular functions, which constitute the *in-order-to* motives preceding drug use. These motives could be grouped into four meaningful categories: "Social", "Relax", "Energy", and "Intoxicated" detailed below.

A) The "Social" Function: get talkative and socialize.

Throughout the interviews, the respondents describe how some substances are used as a mean to facilitate social interactions with unknown persons and/or as a way to increase the "fun" of moments spent with their friends. This function is expressed by terms such as, "disinhibiting", "extrovert", "empathy", "social lubricant", "open to others", "talkative", "socializing", "chatty", "icebreaker", "remove shyness", "increase confidence" or "loosen up" in conjunction with substances used by respondents to obtain targeting this social function:

[Yousouf, A, male, 29, about alcohol] we were so used to having alcohol as the icebreaker with friends that we really didn't engage in meaningful conversations. [*What do you mean?*] Ice breaker. So just to calm the nerves for everyone. So you know when no one knows each other, you have one

beer, by the time you've finished the first beer everyone's starting to get along. Everyone's starting to be mates and then by the third or fourth beer everyone's hugging each other. All the inhibitions disappear as you'd know. So I think that's why there's always drinks because they know that it's just going to relax everyone and then people can have fun. (This extract could illustrate the "Prosocial" behavior exhibited by virtual user, see Section 2.2.4)

, or:

[ElPoyo, F43, male, 32, about cocaine] This is a drug that make easy to go and see people, you are more open, not like an open mind, but like ... In fact, you'll feel better with yourself and you'll have more self-confidence.

As the last extract illustrates, most of the respondents indicate that this "openness" to others is related to an increased self-confidence induced by some of the psychoactive substances (this point will be further developed in Section 5.1.3).

B) The "Relax" Function: chill out and get to sleep.

In the interviews, respondents often associate some substances with the end of their daily obligations. This consumption generally takes place in private settings with close peer(s) or by the individual herself. Respondents consume substances considered as relaxing - cannabis, alcohol, benzodiazepines and opiates - as a mean to rest, to stop thinking of their daily life, or to ease the fact of falling asleep. Terms such as: "lay back", "chill out", "meditate", "go to bed", "peaceful", "zen", "relaxing", "neutralize my brain", "calm my nerves", "decompress" or "fall asleep" are frequently found in conjunction with these "relaxant" substances:

[Blondie, A, male, 22, about cannabis function] I think that's something that I really like about it; it just allows you to fully relax without having to worry about anything else. That's the biggest thing I really like about it and it gives you definitely a very different perspective on the world. It probably makes me a more peaceful person as well, I would say. I'm more at peace with myself in the world. (This extract could illustrate the "Relax" behavior exhibited by virtual user, Section 2.2.4)

C) The "Energy" Function: stay awake and motivated.

Conversely, respondents also depict some of their usage as oriented toward staying awake and extending the time of their leisure activities. The "Energy" function is associated with terms such as, "awake", "energetic", "stay up all night", "get rid of tiredness", "motivated", "total energy", "alert" or "hyperactive" and are linked to stimulant drugs (i.e., amphetamine-type, cocaine, and MDMA-type). In the case of recreational use¹⁷¹, this function refers explicitly to public settings with the presence of other persons and peers:

[Bobby, A, male, 25, about stimulant] I like the energy factor more than anything. I'm quite a lazy person but I like the idea of going and doing things. It's like yeah, I want to do all that stuff but I like to sit here on the couch and do nothing as well. You take speed or Ice and suddenly you've got, bang, energy. It's like having all this energy from nowhere and you're motivated to do all that stuff and all those things in your head that are a good idea, you're actually motivated to go and do them. So whether it's going out, whether it's studying, whether it's going to call someone that you haven't spoken to for a while and have a really long chat with them about something, like catch up. All that stuff is just facilitated by speed. (This extract could illustrate the "Energetic" behavior exhibited by virtual user, Section 2.2.4)

D) The "Intoxication" Function: disconnect and forget.

Intoxication refers to expressions such as "forget about everything", "switch off", "hit the refresh button", "mess myself up", "get wasted", "lose control", "disconnect", "wipe myself off" or "stop thinking". These different terms generally expressed a desire to disconnect with reality¹⁷² and to "take a break" from the problems that the individual might have encountered in his/her daily life:

[ElPoyo, F44, male, 32, about the deceases of his parents]
When I had the experience of the death of my parents, it

¹⁷¹ Contrary to usage related to work or study which are rarely cited and remain infrequent in the data.

¹⁷² During the starting and learning phases, respondents may not be aware of the "right" dosage they should consumed and become "intoxicated", in the sense this term is employed. In that particular case, the intoxicated state is not achieved purposively but is attained due to lack of practical knowledge regarding the control and management of their dosages.

wasn't an easy time and [...] I had a period where I smoked [cannabis] continuously, I couldn't stop the booze, I really got wasted. It was just to get fuck up. This period of thrashes, I can't remember those evenings, it was just to get fucked up and stop thinking. (This extract could illustrate the "Sedated" behavior exhibited by virtual user, Section 2.2.4)

, or:

[Rubik, F45, male, 19, about hallucinogens in general] The role of hallucinogens is to completely lose control. But I think that's the purpose of it for everybody. It is a part of the state yeah; it's losing control, going for another planet.

This function is generally linked to particular techniques of consumption that potentially increase the effects of the substances and/or to higher dosages during substance intake. It also frequently refers to lonely use in private settings, but it could also be related to social events with group of close peers.

The case of hallucinogens needs to be specified. When talking about their hallucinogen uses, respondents explain their willingness to explore another form of reality. This "exploration", induced by substances such as, magic mushrooms, LSA, DMT or LSD¹⁷³, is frequently considered by these respondents as a form of therapeutic use or as a "mind healer". It allows the users to obtain "perspectives" on their lives and to "take a journey" out of their normal routine. In this research, the function allocated to hallucinogens is associated with a form of 'Intoxicated' function, in the sense where hallucinogens are generally used to exit the contemporary and daily social life:

[HandyCool, A, male, 25, about LSD] It's an experiential drug. I wouldn't use it regularly but I would use it for - I find it breaks down contours of my mind and my reality. I find it quite cleansing. It allows perspectives and it sweeps out my mind. Again it was more medicinal. Initially, it was recreational but now it's like definitely a medicinal substance or therapeutic. [*What do you mean?*] After taking it I'll feel good for weeks to months. Not that I don't feel good normally but it's a real refresher. The brain gets

¹⁷³ The list is not exhaustive but refers to the substances commonly used and cited by respondents.

caught up on shit - you get stuck in loops and consider things. Taking this blows that out and just allows you to understand things a lot clearer without all these crap attachments that you create through everyday life.

In SimUse, these different functions are embedded through the attribute InstrumentalUse that aims to represent the different functions targeted by the individual:

Individual Attribute 14: InstrumentalUse, current-InstrumentalUse

Type of value: array of two items

Values: string ("none", "Social"; "Relax"; "Energy"; "Intoxicated")

Employed in: deliberate

check-days

deliberate-drug-searched

consuming

InstrumentalUse characterizes the type of consumption, locations and targeted Behaviors value of the *users*. Each *user* has two InstrumentalUse values, which aims to make possible for *users* to differentiate their usage and increase the randomness of the simulation. The attribute current-InstrumentalUse corresponds to the actual choice of the *user* and is determined through the **check-activity** operation (cf. p.277)

It is worth pointing out that both French and Australian interviewees associated the precedent functions with the same substances. *This convergence regarding substance roles tend to support the idea that these functions are based on the neuropharmacological properties of drugs, more than based on the social and cultural context in which they are consumed.* To clarify this last point, the next section (5.1.2) examines these associations and the underlying role of the neuropharmacological properties of these substances.

5.1.2. Instrumental Choices: Neuropharmacological Means for Social Norms Achievements

As discussed in Section 2.2.1, psychoactive substances act on the brain by binding to specific neurotransmitter's receptors according to

their molecular structure. Depending on the receptors impacted, drug users experience different physiological/psychological sensations and/or exhibit various behaviors. The analysis of the interviews shows that respondents choose drugs based on the specific cognitive effects they want to feel and experience.

At this phase of their recreational polyuser's career, the respondents indicate that their decisions regarding the drug(s) they intend to use are based on a set of effects, sensations and/or behaviors contained in their stock of drug-based knowledge. The respondents' choices regarding the substances that could be consumed to reach a targeted function are consistent with the neuropharmacological properties of the chosen substances. In fact, this research asserts that, during the instrumenting phase and beyond, drug use could be modeled in Figure 5.1.

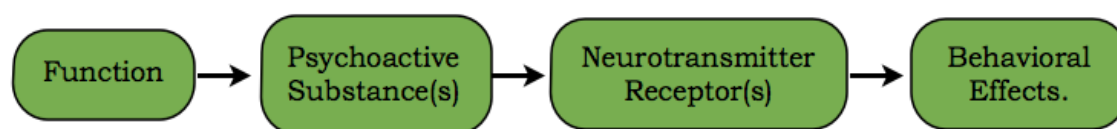


Figure 5.1. In-order-to motives of recreational drug use.

In other words, recreational polyusers decide to achieve a particular Instrumental function and use psychoactive substances to obtain expected behavioral effects. This assertion could be demonstrated by extending the different neurological notions developed in Section 2.2.2 and compared them to interviews extracts as illustrations and empirical legitimations.

For example, the 'Social' function is searched by users, who want to facilitate communication with known or unknown people. In the interviews, the substances found in combination with this function are: alcohol, cocaine, and MDMA-type substances. Cocaine and MDMA-type drugs induce an overall feeling of euphoria and entail prosocial behaviors due to their strong action on the dopamine (DA₂) serotonin (5-

HT_{1A} receptors) [290]. Several respondents describe this prosocial behavior when under the influence of one of these two drugs:

[Kira, A, female, 24, about cocaine] [*What kind of effects do look with cocaine?*] Definitely the euphoric feel, being able to stay awake was definitely - it wasn't something that I specifically wanted from it but it was something good to go with it. But the euphoric sort of feeling I guess. Like if I sit and hear someone's life story for the rest of the night or talk to someone for a really long period of time. It's hard to describe, it's just feeling very sociable. (This extract could illustrate the "Happy" behavior exhibited by *user*, Section 2.2.4)

, or:

[Blondie, A, male, 22, about ecstasy] I like that it really just makes you want to party as hard as you can. Extremely disinhibiting. I consider myself a fairly shy person and ecstasy and to a larger extent, cocaine and alcohol, but ecstasy really just makes you want to talk and know everything about everyone, which I find is fascinating.

Alcohol has a weaker action on serotonin than cocaine or MDMA-type substances, but alcohol remains a strong agonist of Gamma-Amino-Butyric Acid neurons (especially, the GABA_A receptor) [291]. It also has an antagonist action on glutamate neuroreceptors. Because GABA is the major inhibitory neurotransmitter (Section 2.2.2), an excess of GABA in the neuronal system reduces cognitive and motor skills and entails a loss of social inhibitions, facilitating the contact with others:

[Marie, F46, female, 21, about alcohol][*Why are you using alcohol?*] For partying, to be with people, to rave, to be crazy. I'm super shy but when I drink, I'm not at all the same person I am, I would say, more extroverted: it's also a way to loosen up.

Alcohol is also associated with the 'Relax' function, as well as cannabis and opiate-type substances. The main neurotransmitters attached to these substances are the cannabinoid, GABA and the opioid peptides. As just discussed, GABA inhibits the neuronal activity, while the cannabinoids and the opioid peptides (both enkephalins and endorphins) induce analgesic and anxiolytic effects that could induce sedation. This point could be illustrated as follows:

[Blondie, A, male, 22, about alcohol] Not as much as maybe other substances, but yes I think that's why everyone drinks alcohol just to level you out. If you're feeling overly anxious, or you've got to let loose as they say, that's what I view alcohol for. I guess there's no specific state that I'm trying to achieve or anything, but it's more as just an overall relaxant.

, or:

[Cloum, F47, female, 22, about cannabis] I feel relaxed, I feel that my worries are gone ... well, I'm trying to escape a little. I really try to neutralize my brain ... I kinda feel like my brain gets slower so I become more calm.

In this research, cannabis is not categorized as a drug facilitating sociability. Indeed, if it participates to the socialization in the “Starting and Learning” step, several respondents with a long period of cannabis use describe how this particular substance, commonly labeled as being a soft and social drug, could also lead to social exclusion:

[Neron, F48, male, 28, about cannabis function] Most of the people spoke about the social role of cannabis which is a false social role: it is a small world of smokers who curl up over themselves, because smokers only meet smokers, and it is very rare for a smoker to spend evenings with peoples that are not actually smoking or who will also tolerate that you could smoke aside.

, or:

[LadyFly, F49, female, 25, about cannabis function] You're in a bubble, you stay with yourself and, for me, it is not a drug with which you can be sociable. You closed yourself to others, you don't want to talk, you don't want to communicate with people. I still communicate, but when it starts to get a little too hard or when you really feel the effects, then you have a bit of trouble to make the first step and speak to others.

These two quotations also illustrate one of the distinctions between the 'Sociable' and 'Relax' functions. The former tends to be oriented toward extroverted activities and social interactions with known and unknown persons; while the latter takes place in private settings with a small number of known persons or by oneself when its usage is oriented toward introspection.

On the exact opposite to the 'Relax' function, the respondents seeking 'Energy' through their drug uses refer to substances belonging to the stimulant class of drugs. This class is composed of the amphetamine-type drugs, cocaine, and, to some extent, ecstasy. The main neuropharmacological properties of these drugs impact the dopamine, serotonin and norepinephrine receptors. The activation of this last neurotransmitter increases cognitive skills of the user, resulting in a feeling of alertness and heightens senses. Activation of norepinephrine receptors also augments the physical capacities of the individual by increasing heart pulse, blood pressure and glycemic level. These different cognitive and physiologic effects facilitating the "keep going" effect that all respondents seek through these substance uses:

[Jurion, F50, male, 27, about ecstasy] For partying, ecstasy is magic, you can be completely flat, six feet under etc..., You take one ecstasy and in the next 40 minutes, you are at the top of your form as you have never been. This is an impressive boost, so you really take ecstasy to go partying.

, or:

[Gourou, F51, male, 19, about stimulants] Speed is more or less stimulating, it is an everyday boost, it becomes regular, very regular. It's a stimulant that keeps me awake or to counteract opioid or to heighten a hallucinogen trip. Coke is a little bit in the same spirit.

Finally, respondents who are targeting the 'Intoxicated' function generally mention the psychoactive substances used for the 'Relax' and 'Energy' functions, either in higher dose or with a more potent way of administration. In the former case, the high level of GABA_A in the brain generates a loss of sensory motor coordination, a feeling of drowsiness, and deep sedation:

[Picasso, F52, male, 34, about heroin] A feeling of well-being, a real well-being both physical and mental... What I like about this drug relatively to other drugs is that it could mitigate both physical and mental pains. This is not a drug that will make you stack [loop] in your head, you can be in any mindset it will always be stronger than your mindset, even if, for example, you were freaking out for something or another... Finally, I tell you that this is a drug to forget, not

to solve anything, since no drug does that, but yeah what I tell you, this kind of feeling of well-being achieved easily.

Concerning hallucinogens, the most common substances used by respondent belong to the class of the "serotonin-like psychedelic" [160]. The strong agonist action of these substances on the 5-HT_{2A} receptor entails visual, auditory and tactile hallucinations that create a complete loss of daily "reality" marks. This loss of marks either facilitates a form of escapism or leads to a critical questioning regarding day-to-day social reality:

[Sony, F53, male, 28, about hallucinogenic substances] [...] what I really like about them is the introspection. Being freed from the burden of external constraints, this is something very interesting. [...] It allows you to reevaluate a lot of things and it really brought things to me psychologically: your vision of the functioning of things, of people relationship, of human relationships and of society in general changes completely. And the thing is that even when you're comedown from your trip, you haven't forgotten and you could still see things in that way and you always keep this kind of vision. You become outside of these things. That's clear. Or, there are so many things that you will question and then you can be really annoyed by how these things go, how relationships between people work, all the little power games ... finally looking at all that crap, you're like: "(breath) shit, I really have to live in there".

The previous extracts underline the fact that respondents select substances due to their associations with the function they want to achieve. However, the interview findings indicate that a psychoactive substance can be associated with different functions. For example, all respondent differentiate alcohol for being social and alcohol for getting drunk:

[Jurion, F54, male, 27, about alcohol] As anybody else, I know that alcohol disinhibits me; it allows me to talk more easily. Basically alcohol is fun for me, and it is true that it is hard "without alcohol, the night gets crazier", not really¹⁷⁴. I think every time you want to party and have fun, alcohol is still a driving force, a motor, finally. It helps most of the people to feel more self-confident and talk more easily. You

¹⁷⁴ This expression comes from a French advertisement about non-alcoholic beverage.

untighten a little bit your mental controls and your different inhibitions. [...] It can also happen that I drink because I'm sad. I just want to forget, alcohol is also a good way to escape from your problems. Anyway, most of the drugs allow you to get out of the reality for a while. There are moments where I'll get wasted because I do not want to think that my life is crap.

To recapitulate, the Table 5.1 describes these different correlations between the substances, their affiliated functions and the neurotransmitter receptors impacted (described in Section 2.1.3).

Table 5.1 Correlations between substances, functions, and neurotransmitters.

Substance	Function	Neurotransmitters
Alcohol	Sociable	Dopamine ↑ + 5-HT _{1A} ↑ + GABA ↑
	Relax	GABA ↑ + OpioidPeptide ↑ + Glutamate ↓
	Intoxicate	GABA ↑ + OpioidPeptide ↑ + Glutamate ↓
Cannabis	Sociable	Dopamine ↑ + 5-HT _{1A} ↑
	Relax	GABA ↑ + Cannabinoid ↑
	Intoxicate	GABA ↑
Cocaine	Sociable	Dopamine ↑ + 5-HT _{1A} ↑
	Energy	Norepinephrine ↑ + Glutamate ↑
Cocaine or crack	Intoxicate	Dopamine ↑
MDMA-type	Sociable	Dopamine ↑ + 5-HT _{1A} ↑
	Energy	Norepinephrine ↑ + Glutamate ↑
Opiate-type	Relax	OpioidPeptide ↑
	Intoxicate	OpioidPeptide ↑ + Dopamine ↑
Amphetamine-type	Energy	Norepinephrine ↑ + Glutamate ↑
Hallucinogens	Intoxicate	5-HT _{2A} ↑

The functions associated by the respondents with their drug practices and the different roles given by them to the substances consumed are

consistent with the concept of functions and expected effects developed by Boys and colleagues. However, Boys, Mardsen and Strang [73] distinguished 18 functions that extend from "Help you to concentrate or to work or study", "Help you to relax", "Help you to sleep", "Help you to lose your inhibitions" to "Help you to keep going on a night out with friends". These authors argued that the six psychoactive substances - namely, alcohol, cannabis, ecstasy, cocaine, LSD, and amphetamine - covered by their survey "had been used to fulfill all the functions measured, despite differences in their pharmacological effects."¹⁷⁵ Findings from this present research indicate that respondents do not associate all the substances with these four functions. For example, amphetamine-type substances were never attached to the 'Relax' instrumental use; conversely, heroin or opiates are not generally linked to 'Social' or 'Energy' functions, and; hallucinogens were never associated with the 'Social' function. Consistent with the literature regarding drug choice (cf. Section 2.3.2), the present results confirm that substances are chosen in consideration of the expected effects they normally procure, and that these effects inherently come from their neuropharmacological properties.

If substances are used as tools to modify at will the psychic and/or physic states of an individual, it can be assumed that these drugs are chosen accordingly to the link between a specific chosen function and the neuropharmacological properties of these selected psychoactive substances. However, if these assumptions help to identify and understand the *in-order-to* motives behind drug choice, it does not inform the reasons, the *because* motives behind these decisions. The section 5.1.3 aims to clarify this point.

¹⁷⁵ Boys A., Mardsen J. & Strang J. (2001) Understanding reasons for drug use amongst young people: a functional perspective, *Health Education Research*, 16(4), p.466.

5.1.3. Psychoactive substances as social self-medication: norms of the late modernity and integrative drugs

Although respondents choose their drugs accordingly to their neuropharmacological properties, they also tend to explain that their usage helps them to adapt to specific situations and to abide by what they perceive as being social norms:

[Picasso, F55, male, 38, about drugs in general] I told you at the beginning it was rather curiosity and then after that, I think really quickly, I used drugs to put me in specific states. I thought with drugs, it was easier to do certain things whether social, whether sleeping or anything else [...] The thing with drugs is that, you take the little blue pill, you'll get going again, you take the red, you'll go sleeping. It is a little bit the problem of our time, which goes with what the society is now, you are asked to always be fresh and ready, not only in your work, but socially: I think that someone who is a little depressed, he will still force himself and go to have a drink, go to a party, or I don't know what ... Even from your close friends, you must have the compliance of being fresh and ready. You must be rather grinning, actually.

, or:

[Albie, A, female, 19, about alcohol] I don't really drink it so I get drunk or anything. Half the time or a lot of the time it is just because it's like the social norm. It's like expected. You know, if you're in a bar and you're not drinking and everyone else is drinking they're like: "Why aren't you drinking?" It kind of makes everyone else feel uncomfortable and they feel like you're not on the same level as them and stuff. So I just have a couple of drinks just to fit in. [...] Because if you don't, like it's not like I don't feel any effects from it. I just have two maybe three, you know? But just so other people see you drinking and you fit in. That's the difference between socialize and being social: the first one helps to get sociable enough, the second corresponds to an activity.

The last quotations are along the same lines as what Alain Ehrenberg described and defined as *usage of integrative drugs* [292, 293]. Such practices allow polyusers to adapt to their social context, its values and norms. These norms express latent and informal behavioral injunctions,

which respond to specific expectations shared amongst groups of peers or, to a larger extent, to the global society. In his series of books dedicated to the condition of the individual in modern societies, Ehrenberg points out that the weakening of traditional institutions in contemporary western societies has been accompanied by an increase of social actors' *autonomy*. As argued by Anthony Giddens [215], the traditions stemming from these institutions used to "offer an organizing medium of social life specifically geared to ontological precepts."¹⁷⁶ The disengagement of the religious and political institutions creates particular contextual circumstances in which individuals are required to create their own 'life project': "[...] anyone should exposed himself in the personal action to produce and show his own life instead of relying on the institutions that act in his place and speak in his name"¹⁷⁷.

Echoing this observation, Ehrenberg defined the contemporary individualism as the "social requirement [...] to behave as individual"¹⁷⁸; [this expectation is] an impersonal process, a socialization mode that pushes everyone to become visible and constrain to *autonomy*.¹⁷⁹ In other words, the social actors have to manage their own life and self-define a project of life: "each individual has to find imperatively a project and act for himself to not be excluded from the [social] link, regardless of the weakness of his cultural, economic or social resources."¹⁸⁰ In this particular context, the consumption of psychoactive substances (both legal/illegal drugs and psychotropic medications) could be considered as being techniques of self-management palliating the pressure inherent in the social injunction to autonomy:

"The issue of drugs is the locus where converge all the pressures of the modern condition: the sovereign individual, free and equal to all others, artificially alters through the consumption of a substance is state of consciousness by using his own freedom. [...] The substances altering states of consciousness and mental

¹⁷⁶ Giddens A. (1991) *Modernity and Self-Identity*, Standford University Press, Standford, p.48.

¹⁷⁷ Ehrenberg A. (1991) *Le culte de la performance*, Hachette, Paris, p.279. Free translation.

¹⁷⁸ Italic is used here to underline words of the original text.

¹⁷⁹ Ehrenberg A. (1991), *op.cit*, p.280. Free translation.

¹⁸⁰ Ehrenberg A. (1995), *L'individu incertain*, Hachette, Paris, p. 14. Free translation.

perceptions multiply the individuality in various ways: they initiate in the knowledge of another world, increasing performances of everyone, allow exploring the field of consciousness, numb anxiety, promote social exchange in disinhibiting, but they are likely to pay a retrenchment in itself: haven or private hell."¹⁸¹

This conceptualization of drug use could be coupled with the notion of self-medication initially conceptualized by Edward J. Khantzian [294]. This author considered that through their drug uses "addicts are attempting to medicate themselves for a range of psychiatric problems and painful emotional states."¹⁸² In the case of the recreational polyuser population, the different psychoactive substances are not necessarily consumed to heal a particular disease or numb an emotional pain, but could be conceived as participating in the realization of the drug user's 'life project', facilitating the adaptation to the contemporary societal norms [295, 296]. Therefore, the reasons of such self-medication, and by extension the *because* motives of recreational polydrug use, should be searched in the social norms, as products of the late modernity [297].

Indeed, several authors consider psychoactive substances in their modern form of use as "[substances] doping individual actions and [they] are now the chemical assistants of the individual from who it is required to be the entrepreneur of his own life."¹⁸³ This claim is supported by Michel Hautefeuille, who depicts some drugs as playing the role of "social shock absorbers" allowing individuals to continue their daily activities by getting relief from social imperatives. This idea converges with the notion of "comfort use" described by Fontaine & Fontana [277]. They define "comfort use" as: "[...] the occasional use of medications, cannabis or alcohol to relax, control sleep, be more efficient, but also in the long-term as use to prevent a crisis, to reassure

¹⁸¹ Ehrenberg A. (1995), *op.cit*, p.63. Free translation.

¹⁸² Khantzian E.J. (1985), The Self-Medication Hypothesis of Addictive Disorders: Focus on Heroin and Cocaine Dependence, *American Journal of Psychiatry*, 142, p.1263.

¹⁸³ Ehrenberg A. (1995), *op.cit*, p.125. Free translation.

or to sustain durably an acceptable mood."¹⁸⁴ These different points are perfectly illustrated by Sony when this one was talking about his consumption of opiates:

[Sony, F56, male, 28, about opiate and heroin] Take some opiates, it really calms you down and it really allows you to blow things over [...] this is what is traitorous with heroin and opiates in general, you don't need anything else. In fact the context that surrounds you doesn't really matter, this means that even if you haven't got a girlfriend, even if you have no money, even if your social and material conditions are not good, you feel good both physically and psychologically. You're well and the remaining other things are secondary [...] you see, usually I lie down and I daydream. Anyway, the goal is not thinking, the goal is just "Damn I need a break because there are many responsibilities in my life."

This extract suggests how substances with a neuropharmacology propitious to the 'Intoxicated' function, such as alcohol, cannabis and opiates, help recreational users to cope with their everyday life or, even more, with painful situations (both physical and psychical) inherent to changes in their biographical situation.

Furthermore, Hautefeuille also considers the consumption of psychoactive substances as being "techniques of daily doping"¹⁸⁵. According to him, the drug user "[...] in addition to ameliorate his performances, [...] uses these substances to be more adapted, to comply with the expectations made by the society."¹⁸⁶ These "expectations made by the society" takes several forms. The most common of this form is the injunction to performance [292]. This injunction requires from the individuals to be at the maximum of their capacities, at their best, even during social interactions:

[Jurion, F57, male, 27, about cocaine] Cocaine is pretty good, because it's a drug that you can take on many occasions. With cocaine, you are you in your best day.

¹⁸⁴ Fontaine A. & Fontana C. (2004) Usage de drogues (licites, illicites) et adaptation sociale, *Psychotropes*, 10(2), p.14. [Free translation].

¹⁸⁵ Hautefeuille M. (2009), *Dopage et vie quotidienne*, Petite Bibliothèque Payot, Paris, p.85. [Free translation].

¹⁸⁶ *Ibid*, p.85. [Free translation].

Cocaine is not as violent as ecstasy, it's really nice because it makes you more beautiful, stronger, more confident, it really is a drug that boosts you at all levels. A guy who takes cocaine, you won't necessarily find it out because you don't talk crap when you're on cocaine, you tend to be even more intelligent. It's really a drug that boosts you in all aspects: like speed and ecstasy, you're not tired, you feel a lot less alcohol and, moreover, you'll be much more social, you'll be very self-confident, you in your best days.

As stated in the previous example, cocaine appears to favor a "boosted" presentation of the self during social interactions. In a period where "networking" and developing one self's social capital, are subjectively perceived as essential for employment promotions and social activities, the presentation of the self, as an open, friendly and talkative persons, requires from the individual to be "you in your best day". Drugs, such as cocaine, participate in ameliorating the individual capacity acting optimally in social situations, by giving a higher self-confidence to its users:

[Neron, F58, male, 28, about cocaine] This little bright pep side, this little shiny side where you're pumped, you want to go out and socialize, you want to show who you are... This is what people showed with coke, I was a bit in the rehearsal, in the reproduction of this kind of thing, partying all night, smile all the time, live at 200 kilometers an hour, have a blast. [...] It reassures you, you feel good inside, you're good, you want to have more fun, you want to give everything.

This "reassuring" function imputed to cocaine by Neron could also be linked to the "social lubricant" role of alcohol that, according to respondents, facilitates the interactions with unknown persons by decreasing apprehension and shyness:

[Jacko, F59, male, 31, about alcohol] Here, a great example with alcohol: I have a new girlfriend and recently, she celebrated her birthday, it was 15 days ago, with 35 people I did not know at all. And I know that I had a drink with her before going, with the thought that "it will save some time (laugh)". The links will be more easily loosened. So, in that sense, I think there are many people doing like that and it isn't about forgetting problems: there, functionally, it's

really interesting to be connected to other people around you who have drunk too.

, or:

[Cloum, F60, female, 20, about alcohol] Because I think that the consumption of alcohol, especially during parties when you don't know these peoples, it helps to talk more easily, be more open. Really, I will perhaps confine to someone more easily if I have drunk a little bit before.

According to Fontaine & Fontana [277], these boosting and doping substances are also employed in the working sphere. The interviews were oriented toward the recreational aspect of drug consumption without any particular questions concerning the use of psychoactive substances during work and/or study. Nevertheless, the semi-directed interviews have permitted, in some cases, to capture both dimensions (work and leisure). If most of the respondents seem to consider "not using drugs for working" as a major rule¹⁸⁷, using substances just after working hours appears to be a regular pattern amongst them. Indeed, one of the most salient *because* motive enunciated by the respondents is to "exit" the public life (e.g., work, study, daily activities) and to easily access the private sphere (e.g., leisure, "free" time).

The two main objectives of this consumption consist of creating a distinction between the public/private spheres, and, in some cases, to extend the duration of the private part [76]. This is essentially the case of substances used for their relaxant properties. These one are generally found in situation related to the end of a public activity (work or study). These substances facilitate the transition between these two spheres by inducing a "slowing down" effect due to their neuro-pharmacology, and by creating a symbolic separation, a break between these two moments of the everyday-life, as shown in the following extracts:

[LittleDevil, F61, male, 29, about cannabis and work] When you work for 14 hours a day, you see what I mean, a little joint, you chill. It's simple as that. When I worked [*NfA, in a restaurant*] on the Grand Place of Lille, I smoked a lot, I

¹⁸⁷ This particular question will be extensively developed in chapter 6.

started at 10am, I had a half hour break and I worked until 1am. So you go back home, you've got 8 hours. You get to your place, you rolled a joint, you get in front of the TV, and you fall asleep with your joint. Because when you get back home, you're still in your job. You're still thinking about your job, so if you haven't got something to do, I don't know like a hobby, an activity that can really absorb you, you think about your job all the time. You're in, you're never out of it.

, or:

[HandyCool, A, male, 25, about cannabis] I use marijuana as sort of like a relaxant. I'll use it at home just to chill out... So I guess it brings me down and I use that to calm myself and to have time out from my regular life. I suppose it's a bit escapist in some ways.

As discussed in the previous sections, the relax function is also linked to sleep. The sedation generated by most of the depressant drugs allows the recreational polyusers to rest whenever they consider it as needed. This also permits individuals to avoid the detrimental effects of sleeplessness due either to general anxiety or the consumption of other psychoactive substances, especially stimulant drugs¹⁸⁸:

[Paco, A, male, 27, about alcohol] It helps me sleep. Because I think too much sometimes it's hard to fall asleep, but if I drink two glasses of wine I sleep deeper and better and I feel better in the morning than if I hadn't. [...] I really enjoy having two glasses of red wine before going to bed. It helps me go to sleep and relax. I also like the feeling of just having like a shot or like a glass of something strong and coming home. It just gives your brain a little bit of a relaxation and that's why I do it.

, or:

[Jessy, A, female, 22, about cannabis and benzodiazepine] *[If cannabis was not available, would you replace it, and if yes by which substances?]* If I needed to get to sleep - if I had an important exam the next day which sleep was crucial to - yes I would replace it with a benzo [NfA benzodiazepine].

In a different way, the 'Energy' function is also associated with the notion of time. When asked about their reasons to consume stimulants

¹⁸⁸ This particular point will be detailed in section 5.3.

drugs, respondents refer to the increased energy by depicting the number of hours they have been able to stay awake or by specifying the hour of the day (mostly related to the morning) they went to sleep. As indicated above, this ability to keep going and stand up all night is inherent in the particular neuropharmacological of psychostimulants. This deregulation appears as the main goal of users who want to stay awake for an extended period:

[Ursula, F62, female, 25, about speed] What effect do I want? Being unable to sleep. This is really something I like with drugs, not sleeping in general. [...] This is something great: it opens more possibilities and above all, you can take your time with your mates, I find it interesting, spending so much time with people is amazing.

As just suggested by the previous quote, the main objective of stimulants consumption consists in extending the time spent inside the private sphere. But it is also related to the capacity of staying longer in a physical state in adequacy with the particular "ambience" of the setting, or to live the event "entirely", at its "maximum", such as illustrated in the next examples:

[LadyFly, F63, female, 25, about cocaine and private sphere] It gives energy. Let's say it's Friday night, you've worked all week and then you still want to go out but you feel tired. Then you take a few lines and then it's gone ... You forget all your tiredness, you're happy, you're happy to have taken it because it puts you in a state where you feel comfortable, where you feel self-confident. This is more related to the energy and adrenaline that it gives you. [...] I'm going to do all the party and I will have fun throughout the night, I'm not freaked out because I'm tired.

, or:

[Cloum, F64, female, 20, about speed and clubbing] It was really to keep going all the night because I'm getting rapidly tired, and also, I realized quite quickly that using cannabis does not really help to keep going. Added to that, I know that I'd have stayed there until 7am so I needed to be able to stay up [...] and I also needed to manage being in the mood for the club, to be really into it. But when I take speed, I know the way I am, and I am not at all like I usually am, I'm normally pretty quiet. While with speed, I am really energetic and I can stay on the dance floor for 4 hours straight.

Stimulant uses are associated with the notions of extended time and performances. These performances remain mostly physical and are neither linked to the social dimension as the drugs labeled 'Social', nor to an extension of the consciousness allowed by the hallucinogenic drugs.

To summarize, the different *because* motives shaping recreational drug usage seem to find their roots in the contemporary social norms as presented by Ehrenberg [292, 293, 297, 298], while the in-order-to motives are related to the neurophysiologic effects known and expected by the polyusers. At this moment of their drug career, the rationality of recreational polyusers is instrumental, targeting specific substances to adapt to the societal norms of the late modernity. The four instrumental functions presented in the previous section could be connected to the different faces of these social norms:

- The '**Social**' function is associated with a better presentation of the *self* and to increased self-confidence, allowing the individual to interact "freely" with random individuals;
- Substances facilitating the '**Relax**' function are in most cases used to create a breach between the daily public sphere and the private life of the users;
- The '**Energy**' function permits extending this private time and to get rid of the tiredness inherent in the public life, and, finally;
- The '**Intoxicated**' substances are used as "societal shock absorbers" to release daily anxiety, pain, and overwhelming stress induced by human condition in the late modernity.

Considering the previous developments, the model presented in the previous subsection (Section 5.1.2) needs to be augmented to acknowledge the primary importance of late modernity social norms on recreational polydrug use. However, one of the most important social

norms abided by the respondents — the necessity to control both consumption and public behaviors — is not presented in this section, but will be extensively developed in Chapter 6.

If the adaptation to social norms appears to be the main *because* motive initiating and influencing drug's decision, such choices still depend on the substance's social representation developed by the polyusers throughout their past intakes. Furthermore, if these functions indicate the rationales of use, they do not inform the different moments, settings, and social environment in which these consumptions might happen. In the interviews, the biographical situation, peer's network, and social status of recreational polyusers at the moment of their decisions appear to play a major role regarding these decisions. This process and its different moments are described in the next section (Section 5.2).

5.2. Anatomy of Drug Use Global Process: Decision, Action, and Reevaluation

As just discussed, the global decision process regarding drug use is not only based on the substance's potential effects. Consistent with the findings of Boys and colleagues [73], the examination of the decision process in the interviews reveals that at least eight factors influence drug use-related decisions. These factors — namely, *functions*, *social representation*, *peers*, *availability*, *finances*, *physical/psychological state*, *settings*, and *social commitments* — shape the user's decisions at different levels and at different moments during the drug use process. Furthermore and according to the theoretical developments presented in the Chapter 2 and consistent with the empirical data collected, three

main moments can be distinguished during a drug use session: decision, on-going action, and experienced use/evaluation.

For being able to capture drug use in its entirety, the four following subsections investigate these different moments and the roles of the above factors on each moment. Sections 5.2.1 and 5.2.2 provide details of the decision process at play concerning the recreational drug practices. As already indicated in Section 2.3.1.1, the *on-going* moment could be subject to externalities perturbing the planned and taken-for-granted course of the substance's consumption. The Section 5.2.3 examines the various elements that could influence *on-going* consumption and modify its normal course. The evaluations of the drug user's actions and their potential consequences on future uses are developed in Section 5.3.

5.2.1. Social Commitments, Functions, and Settings: When, What, and Where to consume

Even if some consumptions can arise during the course of the session — these ones are generally induced by external factors (Section 5.2.3) — the interview analysis reveals that participants tend to select the substances they intend to use before intake session starts. Before getting to the description of the core of the decision process, it is noteworthy to specify that the respondents entering the "instrumenting" phase were either in the educational system (late years of high school or undergraduate years of university) or at an early stage of their *professional* careers. It is important to underline this point because the interviews analysis indicated that the *biographical situation* of recreational users — as the professional occupations, social status, and personal sedimented experiences, Section 2.3.1.3 — influences their choices concerning the functions they target and the moments of uses.

This research assumed that depending on their life circumstances, the recreational users have a certain number of social commitments, which represent their weekly obligations (e.g., work, daily-life activities, and study). These daily obligations shape the schedules of individuals and, correlatively, their substances usage. For example, it appears that the respondents, who were student or unemployed at the moment of the interviews were more inclined to consume psychoactive substances during week's days than the respondents having a part or full-time employment. These latter appear to concentrate their usage during the weekend waiting for a "day-off" to consume.

Nevertheless, the importance of life circumstances on respondents' decision varies importantly from one interviewee to another. Unfortunately, the analysis of the interviews does not allow drawing precise patterns concerning the frequency of use, or on the nature of the instrumental usage targeted¹⁸⁹. Furthermore, several respondents have declared that they may engage in social activities and consume psychoactive substances depending on their peer's initiatives, which could influence the choice of users regarding the functions they want to attain, and, therefore, modified their preplanned actions.

There are only few and general constants concerning the functions choice: most of the respondents indicate that the "Relax" and "Intoxicated" functions appear to arise from an individual decision, while "Sociable" and "Energy" functions are generally associated with network activities involving peers and/or acquaintances. The "Relax" function is generally found in conjunction with work and so, with week days. "Intoxicated" uses remain confined to weekends or may arise during the week, due either to an individual will to "get disconnect" from daily life or forget about personal circumstances. Respondents who were students at the moment of the interviews indicate that they can "get

¹⁸⁹ A quantitative survey over a larger number of recreational polyusers may be able to capture this kind of information.

wasted" for particular events (e.g. birthdays, end of exam session) during the week. As already specified, the respondents using drugs related to the "Energy" instrumental function, restrict their uses to the Friday and Saturday nights (more rarely the Thursday night) or, again, for special occasions (e.g. festival, celebrations). "Social" usage does not follow any regular patterns and could be related to both week and weekend days. The interviews have not been conceived to precisely capture the schedule of the respondents, it is, therefore, difficult to precisely model the way recreational polyusers choose their type of instrumental use and the days to consume.

To compensate for this lack of data, the model attempts to capture the type of function and day of use by integrating the most common patterns of use just described (e.g. "Energy" function during weekend days, less chance of using for employee) and by adding some randomness to the model. The impact of these two last points — biographical situation and network-oriented activities — regarding the decision to use are represented by the **check-activity** operation:

Individual Operation 15: check-activity

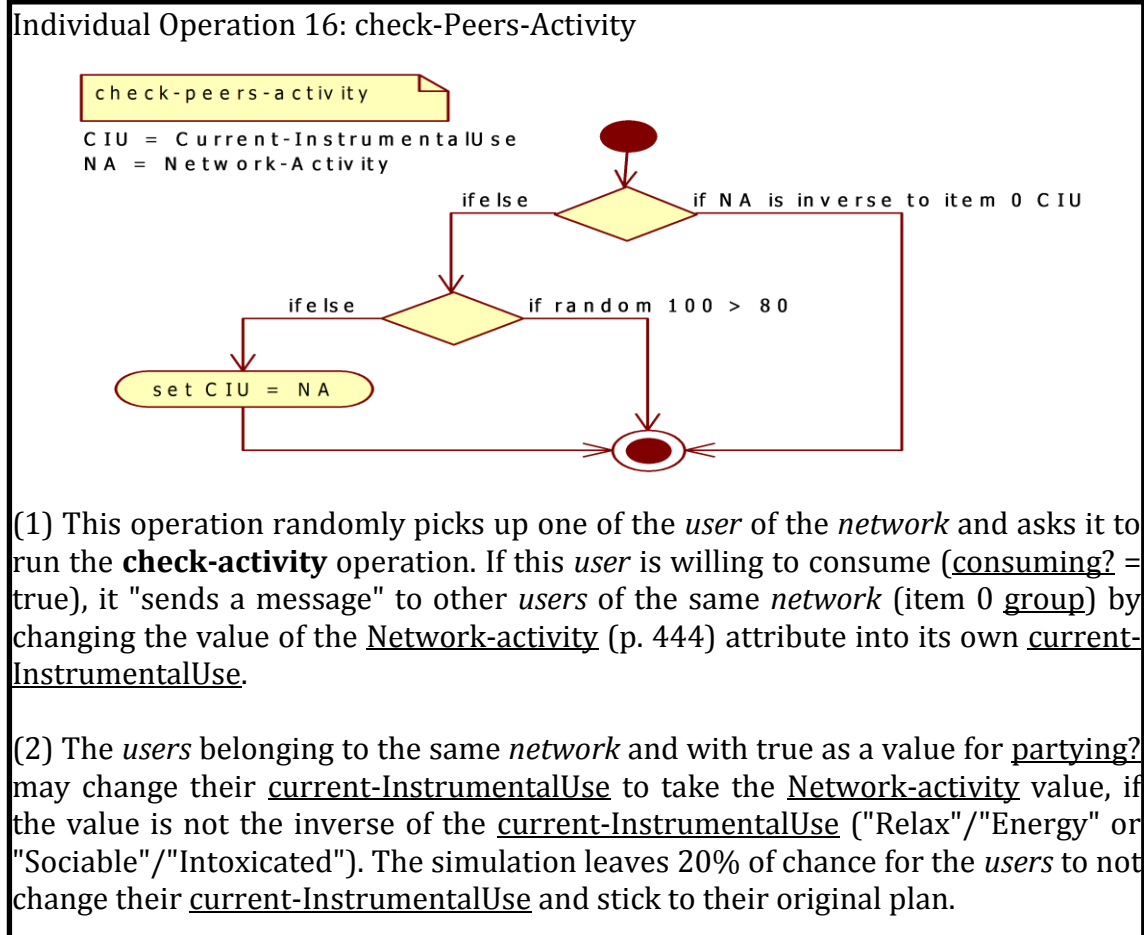
Due to the size of the diagram, this one is presented in Section 7.1.2 (p.462).

(1) Depending on the "Day", on its SocialStatus and on a randomized probability, the *user* will define its two current-InstrumentalUse items. The first item could be (a) either one of the two InstrumentalUse of the *user*; (b) the 'Intoxicated' function (to mimic the fact that *users* may be in a depressive mood and want to forget their problems); or, (c) 'None' indicating that the *user* does not target any particular function and will not consume drugs on that day. The two items of the current-InstrumentalUse attribute are used to specify the kind of substances the *user* looks to acquire (see **deliberate-Drug-Searched**);

(2) Then, the *user* is asked to check if other *users* in its *network* have planned a specific activity through the **check-Peers-Activity**;

(3) Once the current-InstrumentalUse items define, the *users* with consuming? equal true run the **check-States** operation described p.284.

The **check-Peers-Activity** method aims to represent the possibility of drug use amongst peers. This operation functions as follows:



The type of activity determines the different functions to achieve, and correspondingly, the settings in which these activities take place. Indeed, the respondents associated the chosen substances with particular settings and type of activities:

[Youssef, A, male, 29, about drugs and settings] Alcohol is pretty much everywhere. Weed is pretty much, now it's more at home or at a friend's home, say a house party or corporate party, which was last night. [...] If I was going to take LSD or mushrooms it'd be at a festival, outdoors with a group of friends so no one's freaking out and just small quantities. Pills and MDMA, definitely at a club. Sometimes at people's houses. It's actually some of the best times I've had on pills has been at people's houses, but not at a pub or anything. Cocaine would be one of those ones where it would be preferred at the house, just because there's a bit or work involved. It's hard in a club but wouldn't say no in

a club situation as well but definitely not in a pub. Maybe in a pub, depends.

, or:

[Jurion, F65, male, 27, about drugs and settings] Alcohol: everywhere. I use it in all the classical sites of alcohol, whether bar, pubs or clubs. I use it at home or when I have guests, I drink even in the street, which I don't usually do, but I like it. [...] Ecstasy, you cannot sit still, you talk to someone for more than five minutes, because then you want to talk with someone else. So Ecstasy is a drug that works very well in a club, especially because you need music, that's the other thing. Ecstasy, if you get in the situation or in a place where there is no music, is not bearable, it really is not bearable ... so it's really a drug for club or festival. [...] Cocaine, you won't use it if you spend a night alone, but you could, you won't get into a bad-trip, but you'll still want to socialize. You use it at home, in club or bar. [...] You use cocaine when you go out, when you're preparing to have a night out...

Some of the respondents consider their drug choices as "not calculated" or performed depending on their "feelings", on "the global atmosphere", or the "ambiance" of the setting. However and as illustrated above, these respondents also specified that some drugs need to be consumed into specific settings (for example, ecstasy in 'Club/Disco').

Considering the interviews, the following substances are associated with particular settings:

- Cocaine and alcohol are used in any kind of places, both public and private, even if cocaine remains more difficult to consume as openly as alcohol in public locations. In the interviews, these drugs are associated with locations such as "my home", "friend's place", "house party", "pubs/bars", "concert", and "night club/disco";
- Cannabis is generally consumed in private settings or, more rarely, in pubs and bars. This substance is found in conjunction with settings like "my home", "friend's place", "bush/nature", "pubs/bars", but could

be also found in conjunction with special events such as "rave/free party" or "concert";

- MDMA-type drugs appear to be consumed during musical events and rarely in private house party (only three respondents seems to have used ecstasy in private settings). The locations related to ecstasy are "festival", "night club/disco", "rave/free party", "concert", and "house party";
- Hallucinogens (i.e., the respondents refer to LSD and magic mushrooms) are generally used in private places, in the wild or more rarely in clubs. Indeed, respondents refer to "my home", "friend's place", and "bush/nature" when questioning about the place where they generally consume hallucinogens. LSD appears to be also used in "festival" and "night club/disco";
- Speed is often associated with nightlife and musical environment. But, contrary to ecstasy, speed amphetamine could be used for a working purpose. Locations where interviews used speed are "night club/disco", "festival" (music event during several days), and "rave/free party";
- Methamphetamine is used in the same context than speed, but could be also consumed alone or with a small group of methamphetamine users in a private setting (e.g. "my home" and "friend's place") to become intoxicated;
- The few respondents who have used heroin and other opiates, always consumed this drug in a private context (e.g. "my home" or "friend's place"), alone or with a limited number of peers/other users. Cocaine crack follows the same pattern of use as heroin and other opiates.

To capture the importance of the settings on polydrug use, SimUse needed to integrate these different settings into a geographical

environment. This has not been conceived as an interface containing precise data regarding distance and coordinates, but as an organized space, in which the *users* could gather and "interact" accordingly to their routine. SimUse displays a range of different settings embedded into specific locations. Each *individuals* has a repertory with the coordinates of specific “patches” (basic spatial unit in NetLogo), which constitutes the known locations of the *individuals* (that correspond each to a pair of coordinates). This repertory corresponds to the Territory attribute:

Individual Attribute 15: Territory
 Type of value: array of 14 elements
 Values: integer
 Employed in: schedule
 move
 consume-InstrumentalUse
 get-back-home

Each pair of elements corresponds to one location on the simulated urban context (cf. 7.1.4) known by the *user*.

- the first pair corresponds to its 'Home'
 - the second to 'Pub' patronized by the *user*;
 - the third also to a 'Pub' location which corresponds to the favorite 'Pub' of the affiliated *network* (item 0 group);
 - the fourth corresponds to 'Disco' locations;
 - the fifth pair to the favorite 'Disco' of the affiliated *network*;
 - the sixth to a 'Bottle-Shop' and;
 - the seventh to a 'Home' location representing the place where the *user* works.
- Note that *user* with the 'Student' SocialStatus all goes to the 'University' location. Those values are set during the setup of the simulation by asking the *user* to randomly pick up one location corresponding to each pair and copy their coordinates into their Territory.

Comparing functions and settings attributed by the respondents to each drug allow drawing the following associations:

- Recreational users targeting the 'Intoxicate' function consume in their personal home or in the house of known users ('Home' patch);
- Drugs associated with the 'Relax' function mainly take place in private settings, with the user by himself or with a few known users, or more rarely, in pubs and bars with peers ('Home' or 'Pub' patches);

- 'Energy' drugs are taken into clubs or musical events, and are rarely consumed during house parties. They are always taken with a group of acquaintances ('Disco' or 'Home'¹⁹⁰), and;
- 'Social' consumption could take place in any types of environments with a preference for house parties and bars, and are always done with peers ('Home' patches).

The *users* are consuming drugs accordingly to a routinized sequence of consumption and move from one patch to another depending on their current-InstrumentalUse and the activity of their network. These routinized sequences of use are depicted in the **consume-function-drugs** described in Section 7.1.2.

As just discussed, the place and time of the different functional use mainly depends on the biographical situation of the individuals. However, respondents indicate that their decisions to consume are also determined by their *physical and psychological states*, which appears as consistent with the findings of Boys and colleagues [73]. The function targeted reinforces the importance of these two factors. Indeed, the respondents consider that certain practices, and their related substances, are more "intense" in term of effects (during the intake and/or as for their consequences) and, therefore, are more difficult to manage than others. This particular point could be illustrated by the crucial role played by the psychological state and global mood on the decision to consume hallucinogens. All respondents, who have already used hallucinogens, indicate that they would rather not consume this kind of substances if their current psychological state was bad or if they were feeling depress:

[LittleDevil, F66, male, 27, about magic mushrooms] You must be serene to take mushrooms, because this is the kind of drug with which you must be okay with yourself. If you have stuff that bugs you or if something goes wrong in your life, you can quickly slip and get into a big bad-trip.

¹⁹⁰ SimUse also displays an option to create special 'Events'. One of them consists in creating a 'Festival' of a few days that takes place in the middle of a block.

I've seen guys who felt persecuted, and who felt bad. Result: in their hallucinations, the walls of the apartment were getting closed on them, they could not stand in enclosed spaces, they felt that people looked weird at them, they felt oppressed...

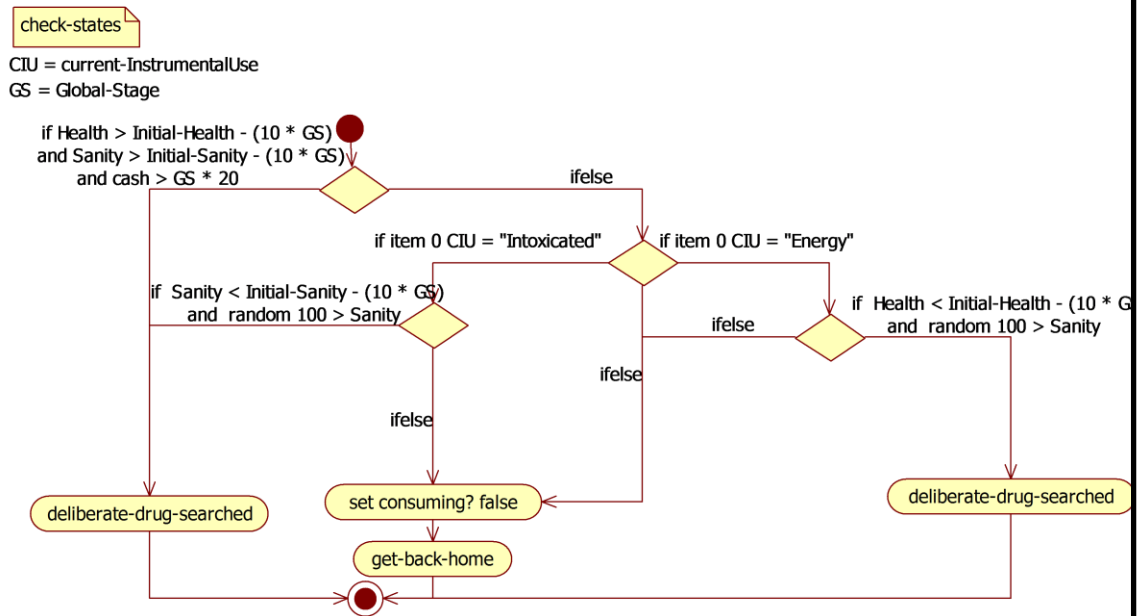
However, if most of the respondents consider that a state of "serenity" is needed for most of the hallucinogenic drugs, they also use the 'Intoxicated' function in a depressed mood to forget their actual situation and/or to obtain a temporary relief from their current problems.

In the same way, most of the respondents explain that they will not consume substances, either if they have health issues or if they are too tired. However, several respondents indicate that they may use stimulant drugs to get rid of their tiredness (as indicated in the precedent extract from LadyFly, cf. p.272) and be able to "lead their lifestyle" and have a night out:

[Kira, A, female, 24, about cocaine and tiredness] For me it just actually more got to the point of being able to stay awake. Because I was working so much I was pretty much tired all the time and I should have been at home going to bed but I wanted to go out and lead the lifestyle I had been leading. I felt like I needed it to be awake and interact with people.

In SimUse, these two precedent factors are represented by the attributes Health and Sanity (Section 2.2.4). Based on these values, the *users* run the **check-States** operation to decide if whether or not it will consume substances on that virtual day.

Individual Operation 17: check-States



(1) The **check-Means** method condenses 3 elements of decision: a) the Health value of the *user*; b) the Sanity of the *users*, and; c) the Cash they own. Cash represents the amount of virtual money the *user* is able to spend on psychoactive substance(s). The economical aspect of drugs choice is described below (Section 5.2.3). As indicated in the diagram, *users* with 'Intoxicated' or 'Energy' functions as current-InstrumentalUse could still decide to use drugs under certain conditions.

(2) If they fit these requirements, they set their consuming? to true and continue the decision process by running the **deliberate-Drug-Searched** operation.

(3) If they do not fit the requirements in terms of level of Health, Sanity and/or Cash, they set their attribute consuming? to false and run the **get-Back-Home** operation.

Overall, the type of use in which an individual can enter seems to be framed by the individual's weekly schedule, the social norms, as well as his/her perception on both their current physical and psychological states. The interactions between these different elements could be illustrated in Figure 5.2.

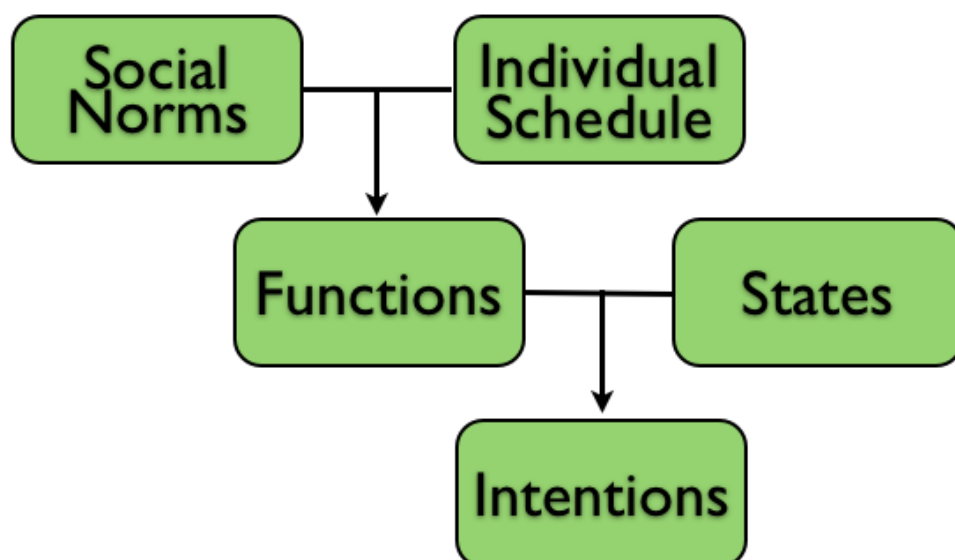


Figure 5.2. Modeling of the decision process regarding drug use.

If the previous developments clarify the moments, places, and functions targeted, they do not give indications regarding the way users choose drugs, nor the way they have access to these chosen drugs¹⁹¹. These points and their influential elements are examined in 5.2.2.

5.2.2. Representation, Preferences and Connections: substances selection and acquisition

As described in Section 5.1.2, the psychoactive substances, due to their neuropharmacological properties, permit the users to achieve specific functions. If the choice of drugs depends primarily of the function targeted by the individuals, the drug-based *stock-of-knowledge-at-hand* plays a major role in the substance choice. Indeed, the respondents indicate that they select drugs because they know the effect(s) these substances will have on them. Furthermore, the analysis of the decision processes indicates that the representational schemes linked to the various substances play a major role in the drug choices. For example, the respondents indicated that they will not select substances not

¹⁹¹ This last point may appear irrelevant considering the topic of this research, but its investigation is required because it is a data needed for the agent-based simulation.

producing an effect related to the function they are motivated to achieve:

[Bobby, A, male, 25, about heroin] [*Why didn't you try heroin?*] It's like I tried morphine, which is very similar. I guess those sorts of drugs don't appeal to me really. I like downers for going to sleep at night. I like drugs for the social aspect, I like talking to people, I like being out and about.

In the same way as described in the preceding chapter (Section 4.2.2), the substances connoted by a negative representational scheme are not selected by the respondents, even if their neuropharmacological properties would permit reaching the targeted instrumental function. Conversely, drugs with positive representational schemes could be chosen to achieve the same function:

[LittleDevil, F67, male, 29, about 'Energy' drugs selection] It depends, if it's going to be a long, long night that we won't move back until 8-9am, it will be coke, because I'd want it. And if it's more a dancing stuff, like disco or club, it will be ecstasy, same thing for festivals, it is more E because you know that you have your tent not so far, in case you're completely hammered. [*And speed?*] No, only ecstasy, I'm not... I don't like speed, well I already took some, but I don't like it, it doesn't suit me well...

This process of substance selection could be described in Figure 5.3:

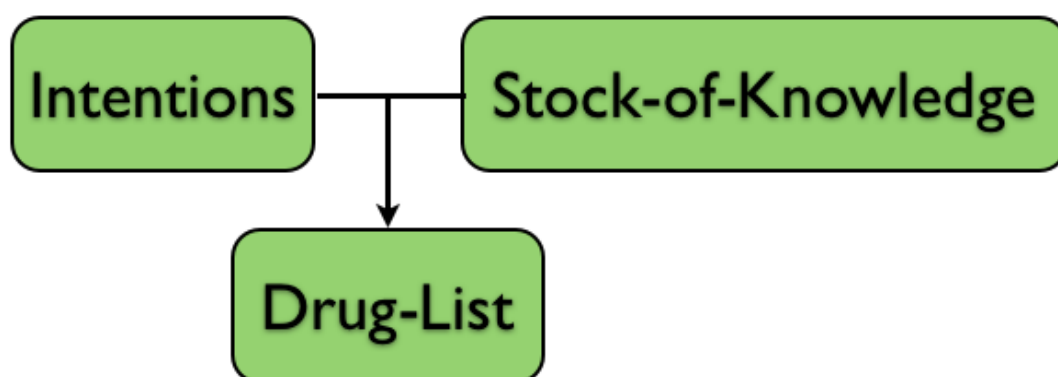


Figure 5.3. Means-Ends reasoning for recreational drug use as modelled in SimUse.

The model intends to represent this process of selection, first, by creating a drug-searched list attribute and, second, by employing two

methods — **deliberate-Drug-Searched** and **check-**

SocialRepresentations — described below:

Individual Attribute 16: Drug-searched

Type of value: array of 9 items

Values: character ["Alcohol", "Cannabis", "Cocaine", "Ecstasy", "Heroin", "Meth", "Speed", "LSD", "MagMush"]

Employed in: deliberate-drug-searched

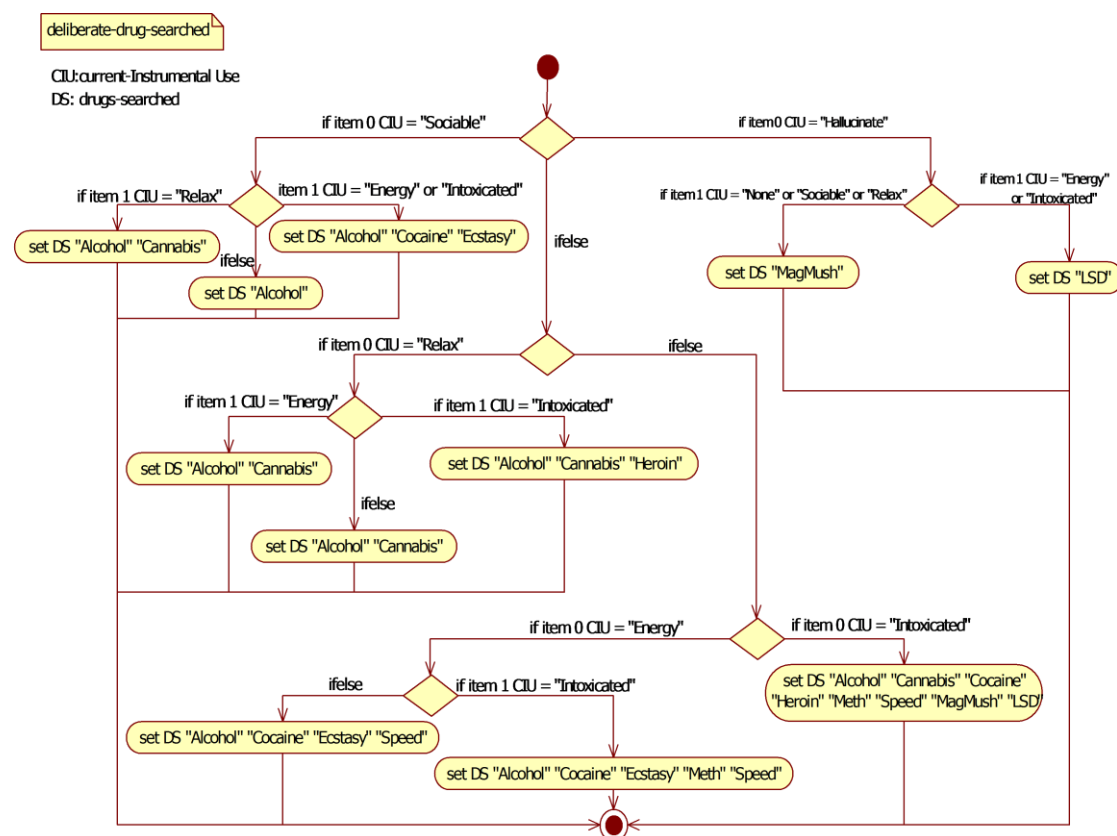
consume

buy

more?/more-drink?

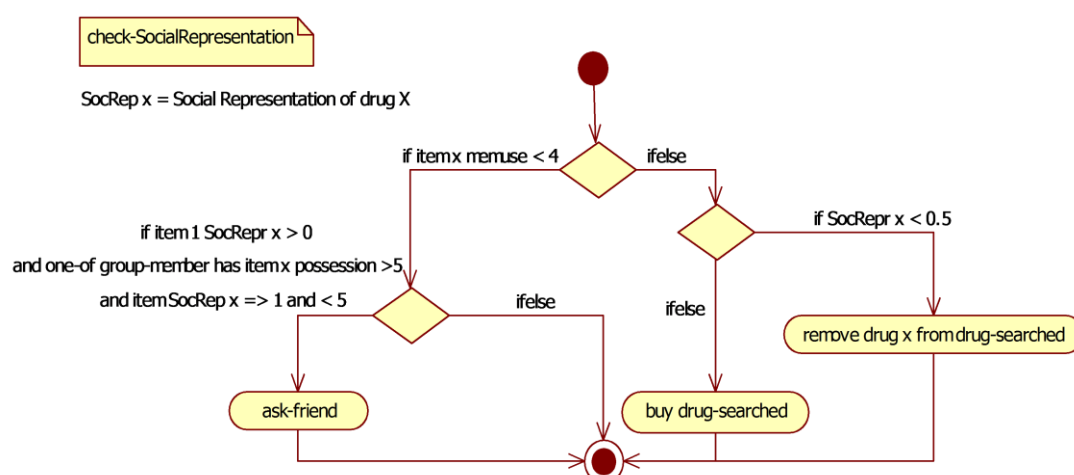
This list describes the different substances the *user* is looking after. Each substance has a specific rank on the list. For example, if the *user* is looking for Alcohol and Cocaine, its drug-searched list will be like: ["Alcohol" 0 "Cocaine" 0 0 0 0 0 0].

Individual Operation 18: deliberate-Drug-Searched



As indicated by the activity diagram, *users* select a range of substances able to fulfill their targeted functions; then, they compare this list of substances with the SocialRepresentation values of each substance in the list with the **check-SocialRepresentations** operation (cf. below).

Individual Operation 19: check-SocialRepresentations



Each drug in the drug-searched list is screened through this operation. As by the diagram, the substances with a negative social representation (item 1 SocialRepresentation) are discarded from the drug-searched list.

The decision process does not stop with the comparison between the function targeted by the user and the representational schemes associated with the substances. The interview analysis reveals that users consider the pleasure and positive effects induce by these drugs, as well as the potential side effects they may experiment during the subsequent comedown. Almost all the respondents explain that before buying a drug, they evaluate and ponder the beneficial/detrimental effects induced by the consumption of each substance:

[PBoy, A, male, 39, about decision] You know, whenever I do my drug consumption, I always do a cost benefit analysis. So I weigh up the pros and cons of what would the benefits of this be and what would be the disadvantages of doing this, of my actions.

, or:

[Nick, A, male, 18, about speed a few weeks after a brawl] I started using it again in smaller amounts. So I sort of reevaluated the effect that I was looking for, how much I was comfortable taking, how aggressive I was willing to risk being to get to the euphoric state that I wanted to be in.

Both components are based on the previous experiences contains in the stock-of-knowledge-at-hand of the users. The "benefits" appear to correspond to the realization of the instrumental function targeted:

respondents based these benefits on the expected effects (i.e., the effects they have already felt) that the substances can procure. The detrimental and negative outputs are progressively formed throughout all the reevaluation process following the past intake and, correlatively, affect the social representation attached to the drug (Section 5.3). If the detrimental outcomes of a substance exceed the beneficial effects, the respondents indicate that they will not engage in the consumption of this particular substance, and may look for a substitution.

These beneficial and detrimental effects could be captured by analyzing the neuropharmacology of the substances chosen, and, as proposed by the opponent-process neurological theory, by considering the level of tolerance built up by the users, altering the effects felt during both intake and comedown (Section 2.2.1). Therefore, the substances' neuropharmacology and the user's history of consumption have to be integrated as influential factors in the decision process. The second part of the means-ends process consists for the individuals of choosing how to achieve what was decided during the deliberation process. In the case of polydrug use, this second part consists of acquiring the different substances chosen. During this means-ends part, two important factors influence the achievement of user choices: *availability* and *finances*.

A) Availability of psychoactive substances

The topic of availability asks to differentiate the access to alcohol from the access to illicit drugs. Alcohol is described by the respondents as the most readily available psychoactive substances, which is frequently considered as a "refuge substance" when other drugs are not available [299, 300]. In SimUse, *users* can buy alcohol in "Bottle-shop", "Bar" and "Disco" patches. The price of alcoholic beverage varies accordingly to the type of location the *users* acquire their alcohol: from 'Bottle-shop', the price of alcohol is equal to the 'Price-Alcohol' value chosen by the modeler; in 'Bar' this price is increased by 3, by 2 in 'Disco'.

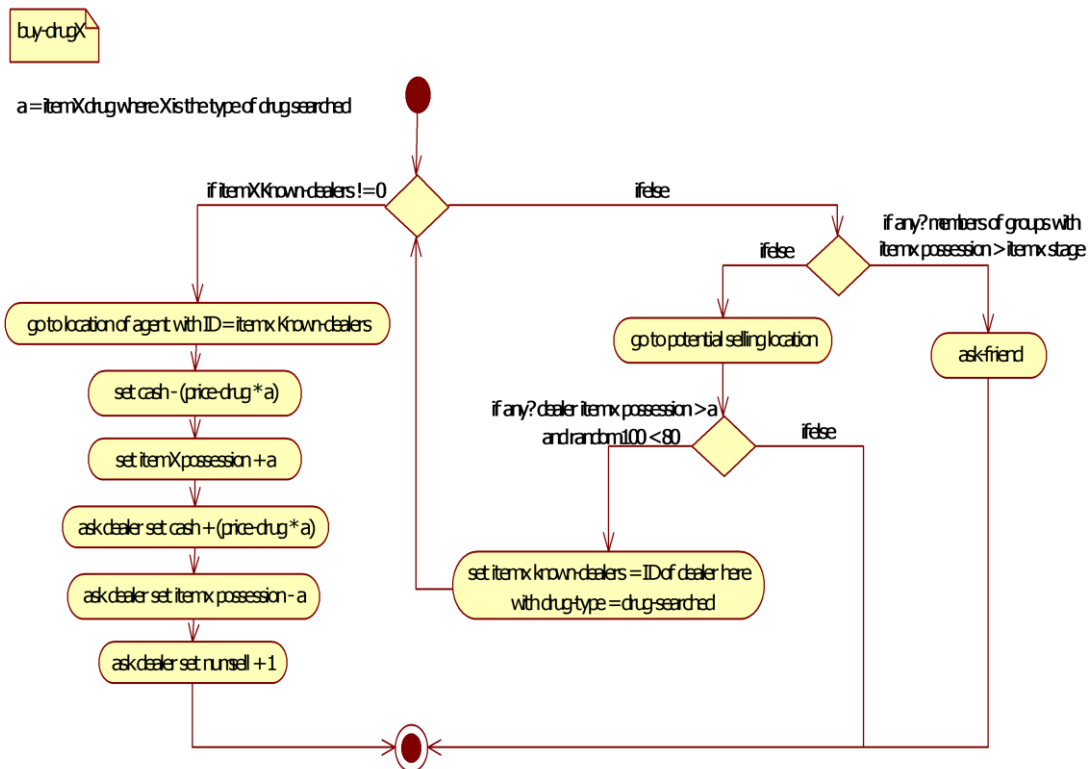
Illicit substances availability is totally dependent on the structure of the drug market and on the drug-related connections in the individual's networks. Because this research was not oriented toward the topic of drug dealing, the information extracted from the interviews on that subject is limited. Nevertheless, the respondents gave clear indications regarding the way they got access to illicit substances. The way respondents obtain illicit drugs is, in most cases, by way of peers ("friend of mine" or "friend of friend"), who know drug dealers and act as a *tertius gaudens*¹⁹², or; directly through their own connections with drug dealers. This point is consistent with statistics data from NDARC [128]. According to its latest statistical survey, approximately two-third of the users obtains their cannabis, ecstasy, amphetamine-type or cocaine from a "friend/acquaintance", while almost 20% go directly to a "dealer". Heroin is in 65.4% of the case bought directly to a "dealer" and 28.8% to a "friend/acquaintance" (in these two cases, the remaining fractions are divided between "relative/spouse" and "other")¹⁹³.

SimUse integrates this information by providing *users* three possibilities to acquire their drugs. The **buy** method allows the *users* to: a) buy directly to a *dealer* they known and who sells their chosen drugs (the *dealer* number must appear in their known-dealers list Section 4.1.3); b) acquire the substance by asking their peers if one of them possesses enough drugs to "offer" a part of its stash through the **ask-friend** operation; and, c) try to find drug by going directly into locations where a *dealer* is supposed to sell the selected drugs.

¹⁹² Literally, the "third who enjoys" in Latin, *tertius gaudens* (also denominated as "broker") forms, in social network theory, the unique node that connects two separated networks.

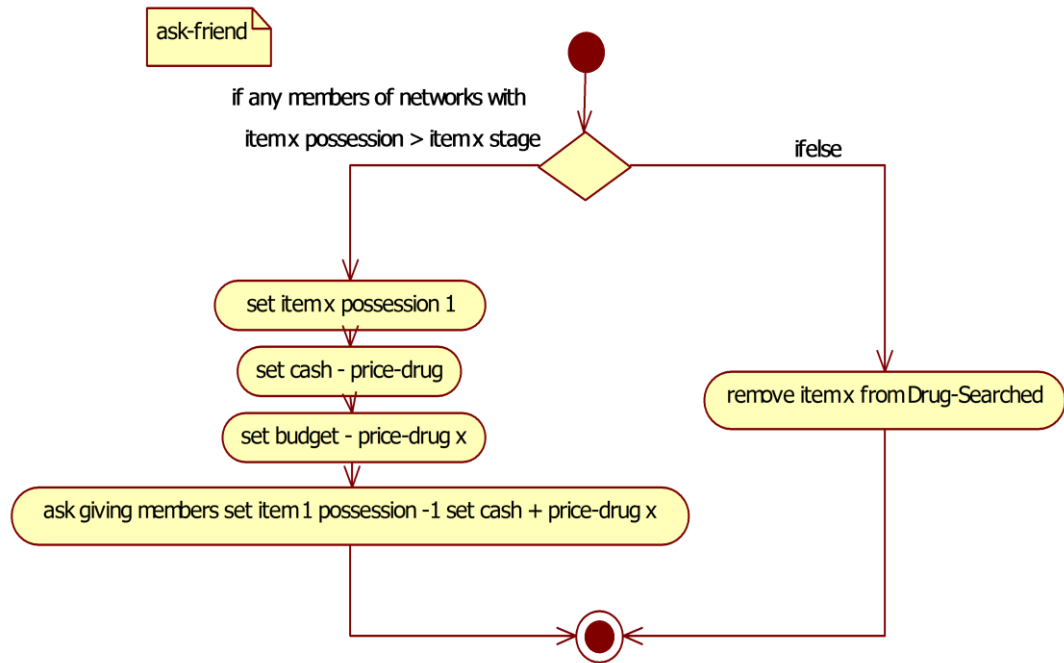
¹⁹³ Australian Institute of Health and Welfare (2011). 2010 National Drug Strategy Household Survey report. Drug statistics series no. 25. Canberra: AIHW.

Individual Operation 20: buy-DrugX



As indicated, this operation shows the three different possibilities for the *user* to acquire their chosen substances. For the last solution, the "potential selling location" depends on the type of substances the *user* is looking for. These locations are described in the **sell** diagram. If the *user* finds a *dealer* selling the desired substance at that location, it will modify its known-dealers repertory to add this *dealer ID*.

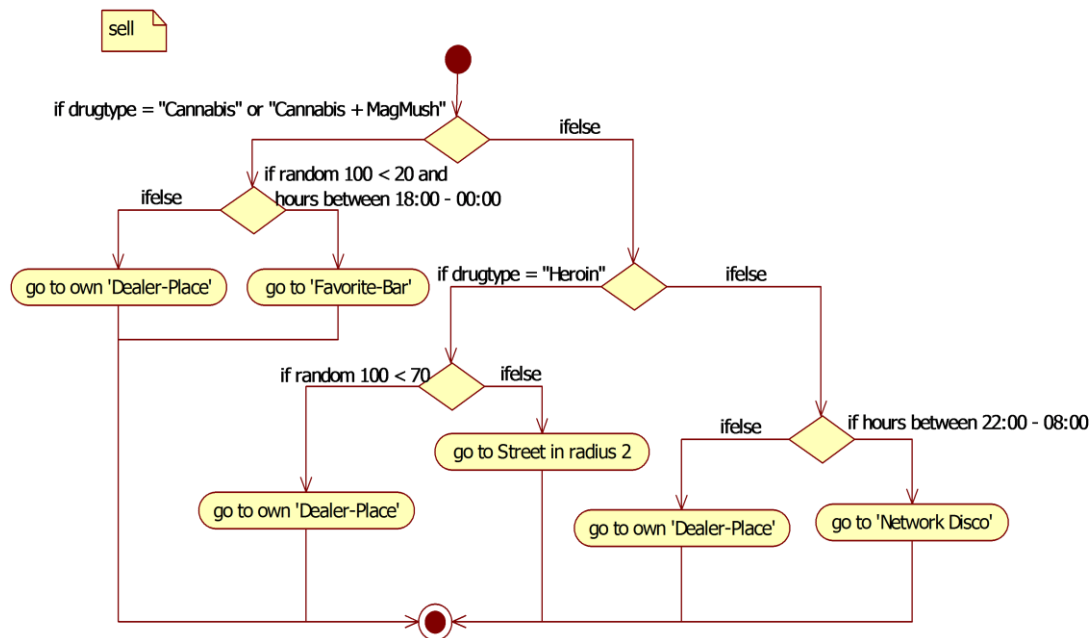
Individual Operation 21: ask-friend



As indicated, the *user* looking for specific substances ask to the different members of its networks if one of them have more than what it needs (“giver” needs to have its possession greater than its substance Stage. If so, the “asker” will receive one unit of the searched drug and lose some cash (equivalent to the price of the substance) and the “giver” will receive the same amount of cash and reduce its substance possession by one. There is no possibility for the giver to refuse.

Concerning the last possibility (searching for a specific substance from an unknown dealer), *dealers* follow their own routine of actions embedded in the **sell** method:

Individual Operation 22: sell



The location of the *dealer* depends mainly on the time of the virtual day and on the type of substances sold by these agents. The *dealers* with 'Cannabis' or 'Cannabis+MagMush' drugtype generally stay at their "Home" patch or rarely go to a Bar in the virtual evening; *dealers* selling stimulant drugs (drugtype 'Ecstasy', 'Cocaine', 'Meth', 'Speed', 'PolystimSocial' or 'PolystimEnergy') stay in their "Home" during the day time and go to "Disco" at night; finally, 'Heroin' *dealers* stay at their "Home" patch or have 30% chance of moving to a close "Street" location to deal Heroin.

Respondents generally employ these various possibilities and can switch from one sourcing solution to another:

[Yousseuf, A, male, 29, about cannabis] So it's either through a friend who purchases a lot of weed and then sells it off to his friends just to pay for his habit or it's direct dealer. Also someone who is a dealer and doesn't use or uses a little bit and that's pretty much the main two. Or on the street, occasionally, very rarely. Or friend of a friend of a friend. It depends how desperate you are. You're the key.

The majority of the respondents indicated that they could try to "source" the substance(s) by directly going to the locations where they assume these substances are sold. If a "source dries up" or if respondents have no constant direct/indirect connections with drug dealers. For example, respondents can look for cannabis in specific suburbs renowned for their drug traffic or, as shown in the next extract, by searching for drug dealers inside pubs or nightclubs:

[Jurion, F68, male, 27, about ecstasy] I get ecstasy because I'm going to a party where I like the music and because I'm going to see someone close to me who will take some and I would thought, "Well why not taking an ecstasy?" or because I meet someone who will offer it to me. [...] Anyway, ecstasy is something that you find very generally in clubs, if you go to a club that puts electro music, you ask around you, you will rapidly find someone who sells some.

According to several respondents, some drug dealers, due to the dense interconnections structuring the dealing networks, can buy and sell several types of substances at once and on demand. This could influence the polyuser to try new drugs (see Section 5.3). Indeed, knowing the "right persons" could offer access to substances normally not consumed by the individual:

[Sony, F69, male, 28, about heroin first use] Heroin is the kind of thing, I never wanted to venture too far and I never had the chance too. But when you know the right people and you're looking for a substance, you may struggle for a month to find some, but anyway, if there is something, you will eventually find it. [...] If you know the right people, it can be unlocked. Especially when there is money involved, there will always be a winner. If there is demand, there is supply.

Ultimately, the availability dependent on drug market in the geographical area in which the users live. This availability will not change the function aimed for, but will have an impact on the choice of substances that could provide the desired effect:

[Jacko, F70, male, 31, about ecstasy/speed] Was I purposely taking speed for its effect or was I taking ecstasy instead? I wasn't that "technical". I was taking what we could get. [...] There was a guy who could have drugs in Seclin¹⁹⁴ so we depended on him. If he had pills [ecstasy] and if he had a stock, he needs maybe like two or three months to clear his stash, so for two or three months, we took ecstasy when we were partying. If it was speed, we took speed.

In the precedent extract, the instrumental function targeted (Energy) is not modified by the lack of availability of one substance or another.

¹⁹⁴ A town situated 20 kilometers from Lille.

Respondents generally switch to another drug with expected similar effects, if they cannot acquire their favorite one:

[Nick, A, male, 18, about alcohol/MDMA] Probably MDMA or something similar to mimic the sort of friendly and social aspects of it. Because that's the driving force behind why I drink alcohol anyway. I try to mimic those positive effects with another drug such as MDMA.

On this availability topic, it is interesting to look at the differences existing between the drug markets of Lille and Sydney, through a short presentation of their geographical and specificities.

Lille is the most important city situated north of Paris with a population of approximately 233.000 inhabitants (the urban area surrounding Lille, named "Lille Métropole", is populated by approximately 1.1 million inhabitants). Formerly a bastion of the steel and textile industries, Lille is now the prefecture of the Nord-Pas-de-Calais region and a place of international exchange due to its geographical situation at the intersection between London, Paris, and Brussels (Lille Métropole shares a common border with Belgium). Its proximity with an important number of Belgian "mega-dancings" (discotheques open for an interrupted weekend that can welcome thousands of club goers) and with several border towns of Netherlands makes Lille a crossroad in European drug trafficking¹⁹⁵. This situation made of Lille a town where almost all psychoactive substances are readily available [301]. However, according to TREND¹⁹⁶, experimentation rates of illicit drugs (i.e., persons of more than 17 years old who have ever used in their life) in Lille remain, for all substances (except ecstasy), inferior to the average French statistics.

¹⁹⁵ Seizures of large quantities of illicit drugs with destination such as Spain and Paris are recurrent in the immediate region of Lille.

¹⁹⁶ TREND is the acronym for "Tendances Récentes Et Nouvelles Drogues" (recent trends and new drugs). In partnership with OFDT, this organization is implanted in the seven most important cities in France and has for mission to "identify and describe the evolution of trends and emergent phenomena" linked to psychoactive substances.

On the other hand, Sydney, capital of the New South Wales (NSW), is a harbor town composed of 649 suburbs for a population of more than 4.6 million (Sydney is the most populated city in Australia). Despite its relative isolation, Sydney remains one of the most important financial and economical place in the Asian Pacific, as well as a touristic destination. Its low rate of unemployment (4.5% in 2012¹⁹⁷), attracts a large cultural diversity of immigrants (in 2006, 31.7% of Sydney residents were born overseas¹⁹⁸). NSW has one of the lowest rates of recent consumption of illicit drugs by people of more than 14 years old in this country (except cocaine with 2.7% recent users compare to 2.1% for Australia).

Most of the classic illicit substances can be found in both cities, but the particular geographical situation of these two cities is translated into a few differences concerning drug availability. The most important differences concern crystal methamphetamine (current street name is "Ice") and powder cocaine. Methamphetamine differences are on both availability and price. As aforementioned, Sydney has a relative proximity to South Eastern Asian countries producing ephedrine, which facilitates the access to pseudo-ephedrine, the chemical base of methamphetamine. According to NDARC [128], in the New South Wales, 1.6% of the population above 14 years old had used methamphetamine in 2010 (2.5% for Australia). Conversely, if amphetamine powder, "speed", is readily available in Lille, reports concerning crystal methamphetamine consumption are extremely rare (two cases have been identified in Toulouse¹⁹⁹ for 2011), as in most of the French regions [302]. The rare users in Lille declared spending approximately 75€ for a gram of crystal methamphetamine (90-95AU\$). This price remains lower than the price in Sydney (approximately AU\$145 for the crystal methamphetamine).

¹⁹⁷ Department of Education, Employment and Workplace Relations (2012) <http://www.deewr.gov.au/lmip/default.aspx?LMIP/LFR/NSW/Sydney>

¹⁹⁸ Australian Bureau of Statistics (2007) *2006 Census QuickStats*.

¹⁹⁹ Major town in the south west of France.

Concerning cocaine, the OFDT indicates that 0.9% of the French population above 18 years old have recently (i.e., in the last 12 months) used cocaine in 2011 [303]. In NSW, this percentage gets to 2.9% (2.3% for Australia) indicating a significant difference in the drug use practices between France and Australia. The second major difference concerns the price of cocaine powder between these two locations. If the purity and the quantity purchased at once remain equal in both towns, the price varies importantly: one gram of cocaine costs 50 to 80€ (AU\$62.5 to AU\$100) in Lille, while the same gram costs from AU\$200 to AU\$500 (160 to 400€) in Sydney²⁰⁰. The price and prevalence of the other substances are indicated in Table 5.2:

Table 5.2 Comparative table of substance prevalence and related prices between Australia and France.

Substances	Recent Use/Experimentation Australia ¹	Recent Use /Experimentation France ²	Price Australia (\$AU per gram) ³	Price France (€ per gram) ⁴
Alcohol	80.5%/87.9%	85.6%/N.A	N.A	N.A
Cannabis	10.3%/35.4%	7.8%/32.9%	20-30	6.5
Cocaine	2.1%/7.3%	0.9%/3.8%	250-400	68
MDMA-type ⁵	3.0%/10.3%	0.4%/2.7%	20-35	15
Heroin	0.2%/1.4%	N.A/1.2%	200-450	40
Amphetamine-type	2.1%/7.0%	N.A/1.7%	600/200 ⁷	15.5 ⁸
LSD	1.4%/8.8% ⁹	N.A/1.3%	20	10
Magic Mushrooms	1.4%/8.8% ⁹	N.A/3.5%	N.A	N.A

¹ Percentage of persons aged 14 years or older that have used in the last 12 months (in 2010) [NDARC, 2013]

² Percentage of persons aged 16 years or older that have used in the last 12 months (in 2013) [OFDT, 2013]

²⁰⁰ Respondents from both cities were blindsided by the difference of price existing between the two cities when the interviewer explains the difference of prices.

³ Australian Crime Commission, [208] number for NSW

⁴ TREND [302].

⁵ Prices are indicated for one pill of ecstasy, no information were available concerning liquid or crystal MDMA.

⁶ LSD tablet, no information regarding hallucinogenic mushrooms

⁷ Methamphetamine (Ice)/Amphetamine (Speed) prices [127]

⁸ Amphetamine (Speed) price only [127, 129]

⁹ The 2010 National Drug Strategy Household Survey report does not differentiate LSD from magic mushrooms.

B) Budget of recreational polyusers

Despite these differences, respondents from both countries seem to share similarities concerning the way they spend and distribute money on their recreational drug consumption. As indicated by the interviews, the financial factor acts as a major constraint on both choice of drugs and frequency of recreational consumption, which is consistent with the findings of Boys and colleagues [73]. The amount of money allocated to drug use appears to depend on the social status of respondents: while answering the question of their budget for a "normal" night-out, students with no employment (11 respondents) declare spending approximately AU\$20 or 15€; students with a part-time or full-time activity (7 respondents) spend on average AU\$50 or 30€; part-time workers (2 respondents) AU\$80 or 60€; full-time respondents (16) spend approximately AU\$120 or 80€, and; unemployed respondents (2) 40€. The range of budget varies from one social status to another, but the minimum amount cited in the extract was 10€ (AU\$15) for a maximum of AU\$200 ("couple of hundreds"). Again, the limited numbers of interviews and the large diversity of what a participant can understand by a "normal" night-out do not allow drawing any reliable or accurate conclusions on the finance factor and would require further investigations. Nevertheless, these approximations give approximations regarding the impact of the professional/social status on drug user's budget²⁰¹.

²⁰¹ Furthermore, the fact that respondents were paid for their time could induce a form of bias on this particular question: polyusers with high income may not have been interested by spending a couple of hours being interviewed on their illegal activities. Hence, in this research data concerning global income are limited and cannot be used to impute hypothesis.

Individual Attribute 17: budget

Type of value: Integer

Values: 3 to 350

Employed in: schedule

all buy operation

check-preferences

The value of the budget attributes is calculated as follows: $\text{item 1 social-status} \wedge \text{Pbudget}$. Pbudget has been set to 1.8 to give budget within a range from a minimum of 3 and a maximum of 350 (mean is 55). These values do not match the amounts cited by respondents, but considering that the interview process was unable to reach some strata of society (from the poorer to the richer), this range permits encompassing a broader number of financial situation.

To implement this previous point, the model asks all *users* to settle a "drug budget" (simply, named budget in SimUse). Considering the information provided by the respondents, the budget of each *user* will be based on the SocialStatus of the *user*:

Individual Attribute 18: SocialStatus

Type of value: array of 2 items (String; Integer)

Values: from 2 to 26

Employed in: update-SocialStatus

deliberate

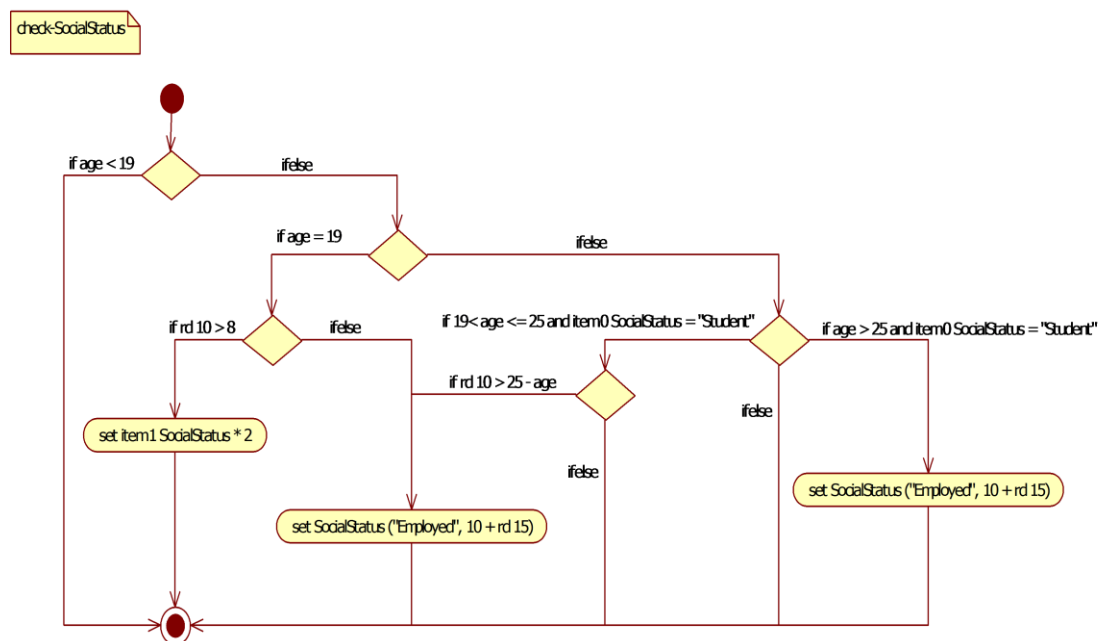
be-paid

check-days

update-rules

SimUse displays only three different SocialStatus: "Student", "Employed" and "Unemployed". These statuses differ on two points: the income and the last pair of the Territory attribute (cf. 5.2.1). 'Student' *users* have an income from 2 to 12, while 'Employed' *users* income ranges between 10 and 26. Student *users* go to patches with 'University' type (*users* with an age below 18 go to the 'HighSchool' patch). The evolution of the social-status attribute is handled by the **check-SocialStatus** method described below.

Individual Operation 23: check-SocialStatus



Changes in SocialStatus have been constructed arbitrarily and aim to create a simple evolution concerning the working career of the *users*. Aging induces a shift from the "Student" to the "Employed" status and an increase in the fortnight income of the *users*.

However, the economical arm of drugs choice is not limited to the budget an individual may spend on drugs. Respondents frequently indicate that the price they are willing to pay is also based on the effects they would experience. The analysis of interviews demonstrates that the users fix the money they are willing to pay depending on the duration and intensity of the drug effects (accordingly to the function they wish to achieve). The comparison between cocaine and other stimulants (amphetamine-type, speed and Ice, or MDMA-type) is the most current example in the interviews:

[Diane, F71, female, 31, about cocaine] I never got into cocaine. This is a drug that does not last long. You see with ecstasy, you've got for 3 or 4 hours of boost; with speed, ten hours; cocaine, fifteen minutes... And you have to pay it 50 € per gram, no way... [laughs] so no, I got disillusioned immediately. This is not a drug that lasts and it is too expensive, I think it has no interest except emptying your wallet.

, or:

[Paco, A, male, 27, about his opinion on cocaine after a stay in Southern America] Coke's too hard to get. It's way too expensive. It's a way crappy high. It's just another fashion drug. I mean if you had some right now again I would have some, but I'm not going to go look for it. I have no interest in it because I don't think it's really that interesting or worth it. [...] I did it while I was traveling because it was really cheap and easy to get, but again the high is crap: the high per dollar value is not worth it so I'm not interested in it.

This ratio does not only concern the stimulant class of drugs. It affects the choice of drugs that could potentially achieve the same projected instrumental function. For example, the respondents frequently compared cannabis to alcohol for the 'Relax' function or LSD and hallucinogen mushrooms in the case of 'Intoxicated' usage. During the instrumenting phase, this *"high by dollar value"* appears as representing the specific form of economical calculus regarding drug's choices.

It is asserted here that recreational polydrug users tend to take their decisions based not only on the financial cost of the substances, but also on the neurological properties (in terms of effects and duration) of these ones. For example, the previous extracts concerning the comparison between cocaine and other stimulants could be explained by using a basic notion of neurophysiology. The amphetamine-type stimulants have a half-life of twelve hours. They remain active in the brain for a longer period than cocaine, which has a half-life of approximately thirty minutes (Table 2.1). This difference of half-life explains why most of the amphetamine users targeting the 'Energy' instrumental function refer to cocaine as a "costly" short-term acting drug²⁰² and tend to prefer amphetamines that last longer. It seems that the recreational polyusers are assessing the beneficial/detrimental effects of each substance (based on their *stock-of-knowledge-at-hand*) and balanced that ratio by the value of the substance.

²⁰² This last point will be discussed in the chapter 6: this criterion of effect durations may be inverted for the following step of the recreational user careers.

SimUse represents this mode of calculus by creating an ordered list of preferences between the drugs that the *users* will buy and use to achieve a particular instrumental function. This ordered sequence of values is calculated based on the ratio between expected effects, price, and representation (interviewees often spoken of their "favorite" drug amongst several possibilities). This ratio is modeled in SimUse through the **check-Preferences** operation. The **check-Preferences** operation is not presented as a UML diagram because it consists of a two distinct mathematical operations: (a) calculated for each drug in the drug-searched list a value (value-drug) representing the user's willingness to pay for the substance and (b) ordered these different values in a preferred-drug list:

Individual Attribute 19: value-drug
 Type of value: integer
 Employed in: check-preferences

A value-drug is calculated for each substance presents in the drug-searched list. This calculus is based on the equation just below.

Individual Attribute 20: preferred-drug
 Type of value: list of 9 integers
 Employed in: check-preferences
 buy
 more?/more-drink?

This list represents the order in which the *user* will buy substances until its budget reaches zero.

As aforementioned, these different value-drugs depend on (a) the "beneficial" effects of the drugs according to the function targeted; (b) the different side-effects induced by the drugs; (c) their prices, and; (d) the social representations attached to them. They are calculated as follows:

$$V(x, S_x) = \frac{\sum_{i \in \mathcal{B}} (S_x + 1)^{-1.35} R_x}{\sum_{i \in \mathcal{D}} D_x (9 - S_x)^{-1.35} P_x}$$

, where $V(x, s_x) = \text{value-drug}$ of substance x for an agent of Stage S_x ;

B_x = sum of the substance's beneficial effects accordingly to the function targeted (cf. below);

S_x = Stage (tolerance) of the agent for the substance x ;

R_x = value of substance x SocialRepresentation;

D_x = sum of the different detrimental effects caused by the comedown of the substance (regardless of the function targeted);

P_x = price of the substance x .

The effects (both B_x and D_x) are based (a) on the neurological action provided by the substance (Section 2.2.2), which depends on the tolerance built by the *user* (Stage attribute), and; (b) the function targeted by the *user* (its current-InstrumentalUse). Concerning (a), for example, a *user* with the 'Sociable' value for its current-InstrumentalUse may have in its drug-searched attribute, 'Alcohol', 'Cocaine' and 'Ecstasy', but if the Stage of the *user* shows a higher value for the Ecstasy than for Cocaine, this *user* may rather consume Cocaine to avoid the side effects inherent in the built-up tolerance to Ecstasy.

Concerning (b), the B_x value for one particular substance is based on the NeuralAction of the substances, and is calculated accordingly to the current-InstrumentalUse targeted by the *user*. Table 5.1 specifies the neurotransmitters that serve as inputs for B_x value, depending on the current-InstrumentalUse targeted by the *user* (Section 5.1.2). Conversely, the comedown effects are not evaluated based on the functions targeted, but on the discomforts caused by the lack of neurotransmitters needed for the "normal" physiological functioning. Therefore, the D_x value integrates all the potential discomfort created by all the lack of neuroreceptors bounded by the substance.

Considering the previous points, the *user's* drugs choice during the instrumenting phase could be understood as follows: the *users* operate

a ratio between the beneficial and detrimental effects they are expecting. If the ratio is negative, they will not spend their money on that substance. If the expected beneficial effects are higher than the detrimental, this ratio is then balanced by the money *users* need to spend to get these drugs. If the "high" appears worth the expense, the *users* will try to buy the substance (cf. **buy** method). Otherwise, they will not purchase the drug and may look for a substitution. This last part of the decision process could be schematized in Figure 5.4.

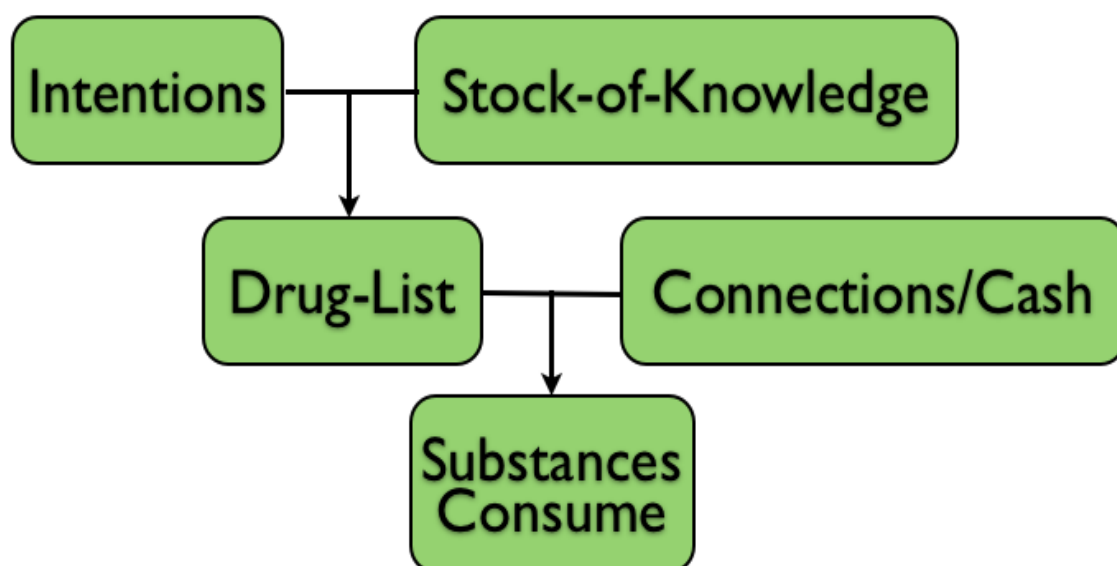


Figure 5.4. Process of Selecting and Acquiring selected recreational substances.

This last step completes the means-ends step of the drug decision. However, these beneficial and detrimental effects, as well as the effect durations of each psychoactive substance, are based on the user's previous experiences. This implies that this ratio is gradually built and updated all along the user career. The reevaluations of consumption serve to refine this ratio and to make it more adapted to the current situation of the user, in terms of neurological tolerance, finances, and social obligations.

As discussed throughout this section, the decisions related to drug use and substances choice are complex and result from the interactions between several factors acting at different steps of the decision process

and on-going consumption. Despite this complexity, decisions concerning the choice of drugs become rapidly routinized, while the decisions regarding the moments of use depend mainly on the current biographical situation of the individual. This thesis proposes to represent drug users' choice as indicated in the Figure 5.5.

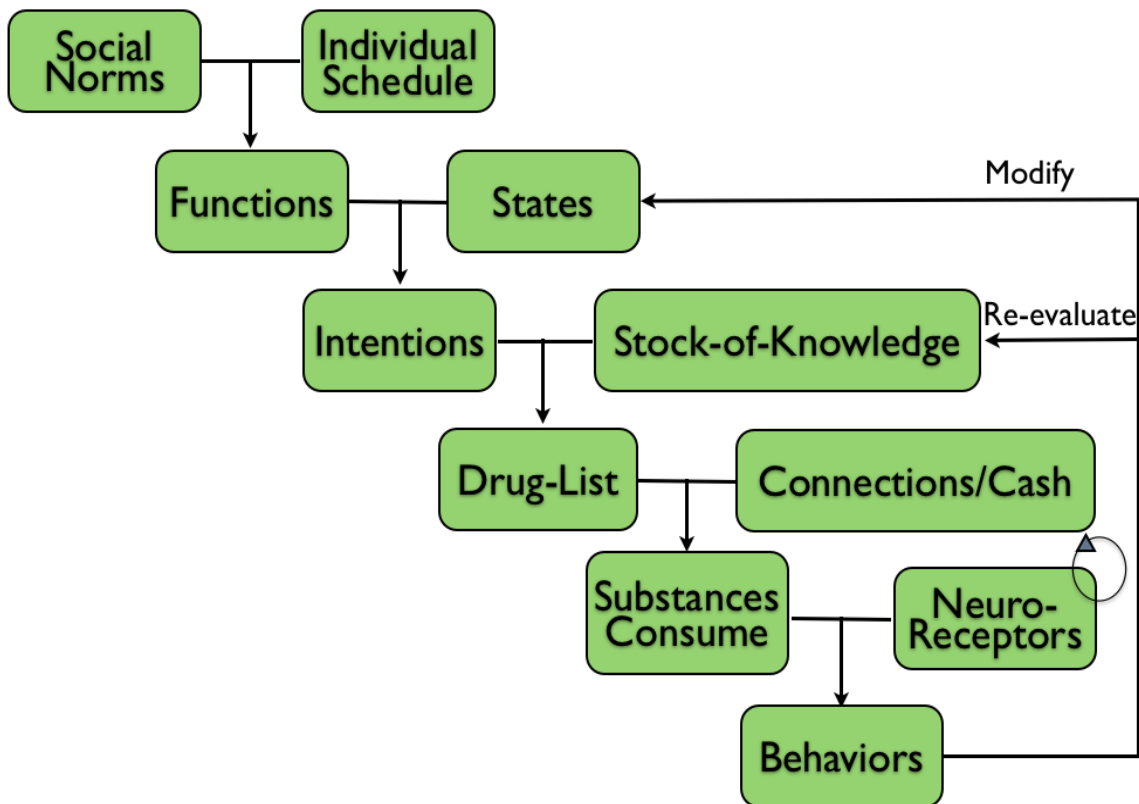


Figure 5.5. Global Decision Process regarding Recreational Polydrug Use.

During the instrumenting phase, the two decision processes ("when to consume and what drug to choose") are practical reasoning. The deliberation phase ("what to achieve") ask the users to compare the different substances known and considered as adapted to the function targeted, and to compare these substances with their respective representational schemes, allowing the users to select substances accordingly to their social representations. After this deliberation, recreational users operate a means-ends reasoning ("how to achieve") by choosing amongst the drugs they can access, those that are the most beneficial in consideration of their pre-established budget. This means-

ends choice is based on a ratio of the beneficial/detrimental effects expected by users. These beneficial/detrimental effects depend on the neuropharmacological properties of the substance(s) and the related level of tolerance developed by the users. This practical reasoning is a projection of drug use (Section 2.3.1.2). However, these projected actions could deviate from their normal course due to a set of external elements that are described in section 5.2.3.

5.2.3. External Factors affecting drug use

As discussed in the theoretical chapter (Section 2.3.1.1), action such as drug taking could be subject to externalities influencing the current course of a well-planned and/or routinized action. Amongst the factors that could influence this course of action or further sessional actions, the level of inebriation is one of the most important. As explained by many respondents, drunkenness could be a precursor to the consumption of other substances:

[Robert, A, male, 21, about alcohol] Usually just like whenever you drink alcohol and the situation is that you have a drug that is around you, that's it. You take the drug because your inhibitions are down so you are less likely to go with what you believe because your inhibitions are down so you don't really care. You just want to feel as good as possible.

, or:

[Bobby, A, male, 25, about alcohol] Alcohol is a massive factor. When I'm drunk then I'll start searching out other things. So I'll be a bit drunk and I'll realize that I like feeling a bit loose and out of it, I should see what else I can find. I should find some speed or some pills or whatever. So often when I get drunk I'll take it, I'll look for more. Usually I'm out, when I'm at a party then there's alcohol so it's a bit hard to avoid that ultimate conclusion when I go out, that at some point I'm going to look for drugs, but not always, depends on the circumstance.

As indicated in these extracts, respondents considered that alcohol influences some of their uses, due to a diminution of inhibitions and impaired judgments. The question remains how to know in which case

alcohol plays the role of a justification concerning a lack of control by the individual or if the "loss of inhibitions" and "looseness" due to the neurophysiologic action of alcohol is the real cause of further consumption. Nevertheless, alcohol recurrently appears in the interviews as an "immediate" gateway influencing the decision by neutralizing negative representational scheme and/or "techniques of control" linked to these substances (these techniques of control are detailed in Section 6.2.2).

The second most important factor impacting polydrug use as an *on-going* action of *peers' influence*. As already pointed out in Section 1.1.2.1, peer pressure and peer influence have been extensively studied and are considered as major factors regarding first drug experience and drug use in general. In the context of polydrug usage, peer influence could also induce consumption of unplanned substances. This point could be also reinforced by the degree of drunkenness of the users. Moreover, peers could also play the role of a readily source of illicit substances, influencing the way the choices of the users, and can lead to unplanned consumption:

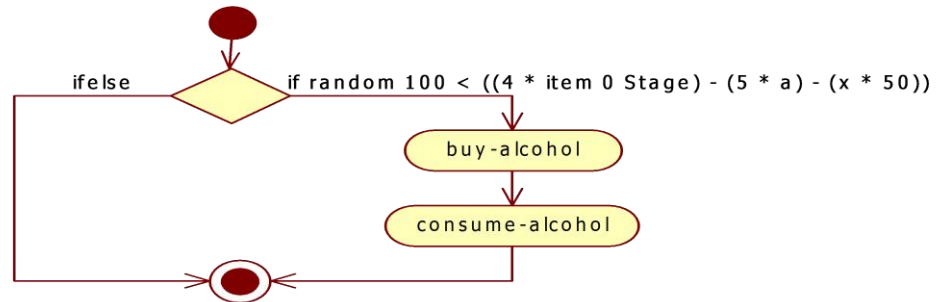
[Bobby, A, male, 25, about peer factors] Friends, yeah, friends become a big play. I don't really look for it myself. It's often I'll be talking to someone and then they'll say "oh, I had this good speed, I had this really good pill last night" and I'll be like, I want to get some. It's like I've got an ear out for it. If I hear it's available I'll try and get it. I'm not really a seeker, well I'm a seeker in that sense but more it finds me, sort of. Rather than calling up everybody and asking, which I also do occasionally, if I'm really drunk.

In order to model this kind of influence, the *users* in SimUse check if they want to consume more substances in consideration of the factors just described. The **more?** and **more-drink?** methods have been designed to capture these different factors:

Individual Operation 24: more-drink?

more-drink?

a = number of agent belonging to the same networks
present on the same location
x = item 3 NeuralBox - item 3 Tolerance-Threshold

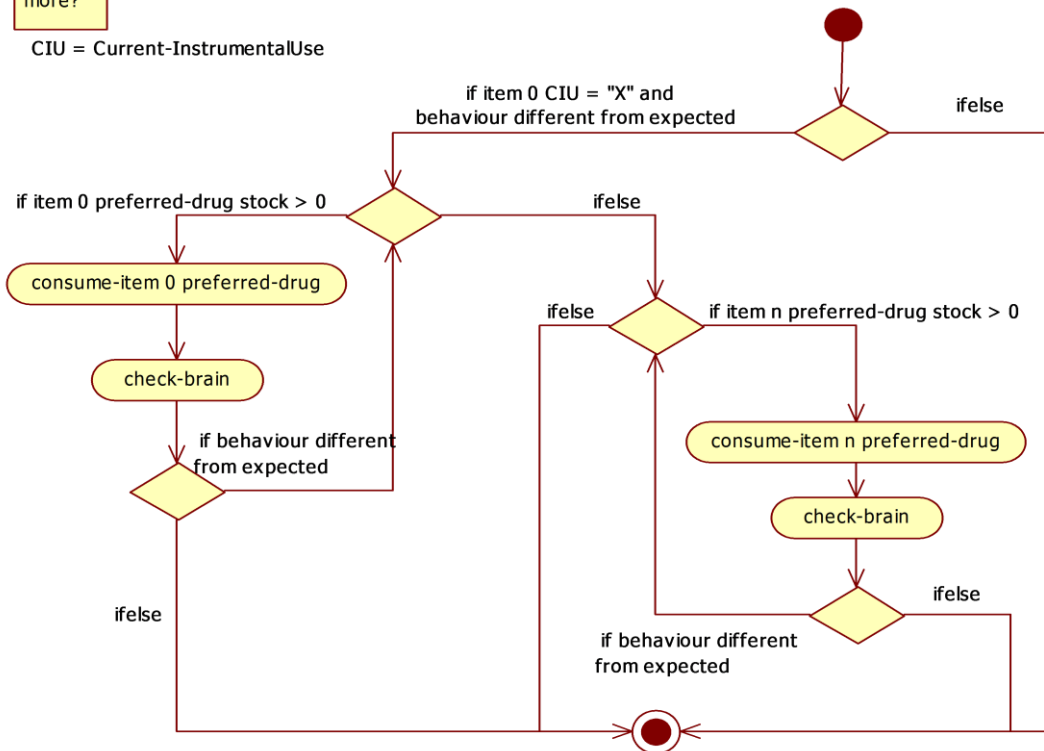


This method was conceived to capture the influences of three factors on the decision of the *user*: (1) its habits of consumption (characterized by its item 0 Stage); (2) the number of closed peers present on the same patch, and; (3) its degree of inebriation (represented by the GABA level: item 3 NB).

Individual Operation 25: more?

more?

CIU = Current-InstrumentalUse



Expected Behaviors vary accordingly to the current-InstrumentalUse targeted by the *user*:

Social: "Happy" or "Prosocial" values for their Behaviors attribute;

Relax: "Happy" or "Relax";

Energy: "Energetic";

Intoxicated: "Happy" or "Sedated";

Hallucinate: "Hallucinated".

Users do not display these expected behaviors can, under specific conditions, ingest more of their preferred substances as shown above.

It has to be noted that the **more?** and **more-drink?** operations do not take into consideration the budget variable, which, in other words, means that these extra consumptions could exceed the initial budget, but cannot exceed the amount of cash own by the *users*.

Conversely, some adverse physiological or psychological reactions, such as "vomiting", experiencing "intense headaches", "passing out", "greening out", or "bad tripping" are factors that can stop the planned uses of respondents. These reactions are generally caused by excessive consumption, or more rarely, by substances with high potency or bad chemical composition. If they remain occasional, these adverse

reactions have a limited influence on future decisions. But if these negative experiences become regular, the routinized practice changes into a problematic one. Indeed, as presented in Section 5.3, these adverse reactions, which can be understood as "problematic situations" (cf. Section 2.3.1.2), could entail reevaluations of the different representational schemes of the substances associated with these problematic situations. In turn, this could potentially lead to the cessation or a reduction of the substance use.

In SimUse, these adverse reactions, expressed in the model through the **hazardous-acts** operation asking the *users* to stop the normal course of the drug session and entail revisions of the representational schemes attached to the drugs used:

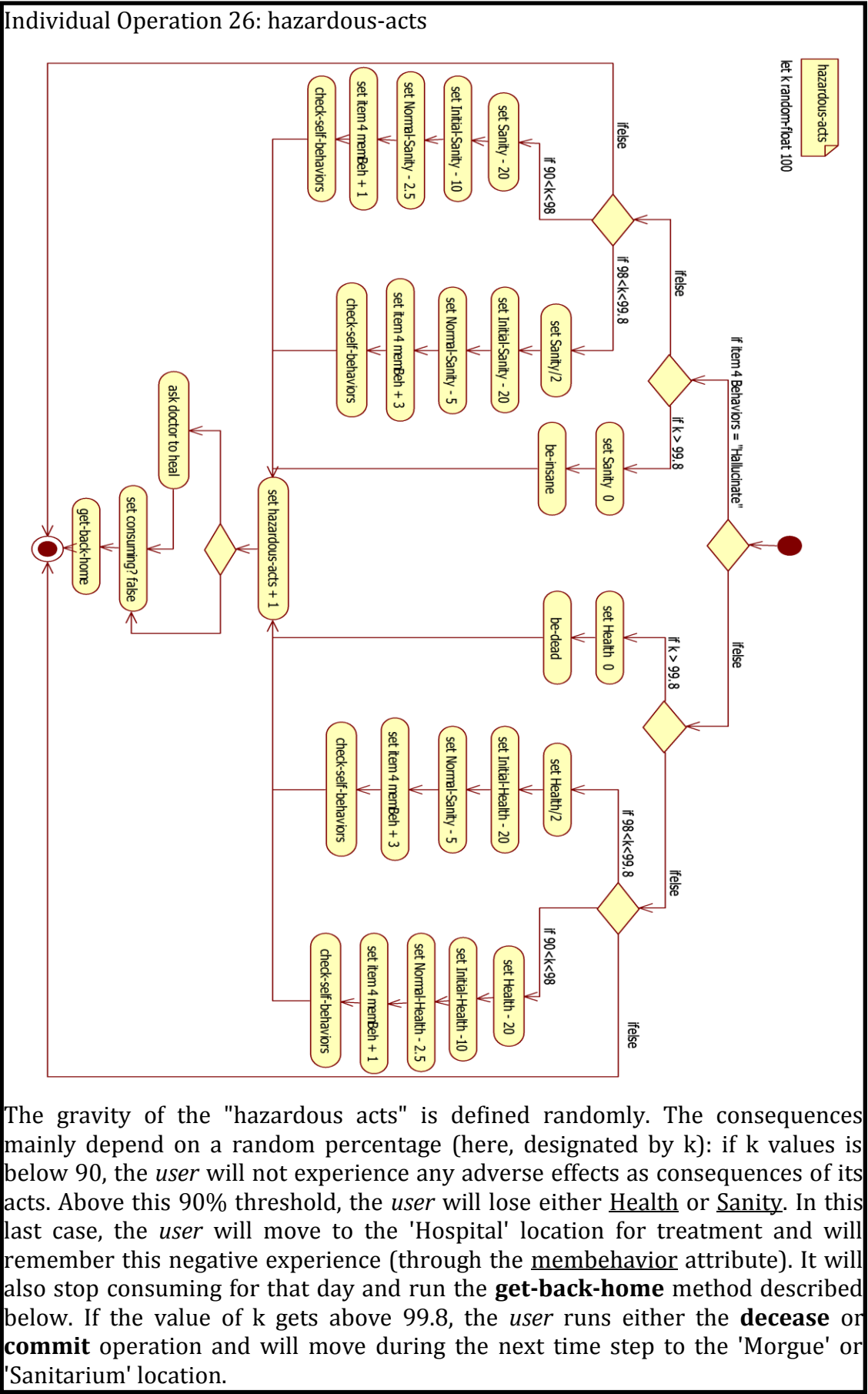
Individual Operation 26: hazardous-acts

hazardous-acts
let k random-float 100

```

graph TD
    Start(( )) --> D1{if Item 4 Behaviors = "Hallucinate"}
    D1 -- if k > 99.8 --> S0[set Sanity 0]
    S0 --> BInsane[be-insane]
    BInsane --> SH1[set hazardous-acts + 1]
    D1 -- if 98 < k < 99.8 --> S2[set Sanity / 2]
    S2 --> SI20[set Initial-Sanity - 20]
    SI20 --> SN5[set Normal-Sanity - 5]
    SN5 --> SI43[set Item 4 memBeh + 3]
    SI43 --> CSB1[check-self-behaviors]
    CSB1 --> SH1
    D1 -- if 90 < k < 98 --> S3[set Sanity - 20]
    S3 --> SI10[set Initial-Sanity - 10]
    SI10 --> SN25[set Normal-Sanity - 2.5]
    SN25 --> SI41[set Item 4 memBeh + 1]
    SI41 --> CSB2[check-self-behaviors]
    CSB2 --> SH1
    D1 -- if k < 90 --> SH1
    D1 -- ifelse --> D2{if k > 99.8}
    D2 --> S4[set Health 0]
    S4 --> BDead[be-dead]
    BDead --> SH2[set hazardous-acts + 1]
    D2 -- if 98 < k < 99.8 --> S5[set Health / 2]
    S5 --> SI20H[set Initial-Health - 20]
    SI20H --> SN5H[set Normal-Sanity - 5]
    SN5H --> SI43H[set Item 4 memBeh + 3]
    SI43H --> CSB3[check-self-behaviors]
    CSB3 --> SH2
    D2 -- if 90 < k < 98 --> S6[set Health - 20]
    S6 --> SI10H[set Initial-Health - 10]
    SI10H --> SN25H[set Normal-Health - 2.5]
    SN25H --> SI41H[set Item 4 memBeh + 1]
    SI41H --> CSB4[check-self-behaviors]
    CSB4 --> SH2
    D2 -- ifelse --> SH2
    SH1 --> D3{ask doctor to heal?}
    D3 --> SCFalse[set consuming? false]
    SCFalse --> GBH[get-back-home]
    GBH --> End(( ))
    D3 --> SCFalse
    SCFalse --> GBH
    GBH --> End
  
```

The gravity of the "hazardous acts" is defined randomly. The consequences mainly depend on a random percentage (here, designated by k): if k values is below 90, the *user* will not experience any adverse effects as consequences of its acts. Above this 90% threshold, the *user* will lose either Health or Sanity. In this last case, the *user* will move to the 'Hospital' location for treatment and will remember this negative experience (through the membehavior attribute). It will also stop consuming for that day and run the **get-back-home** method described below. If the value of k gets above 99.8, the *user* runs either the **decease** or **commit** operation and will move during the next time step to the 'Morgue' or 'Sanitarium' location.



Individual Operation 26: hazardous-acts

hazardous-acts
let k random-float 100

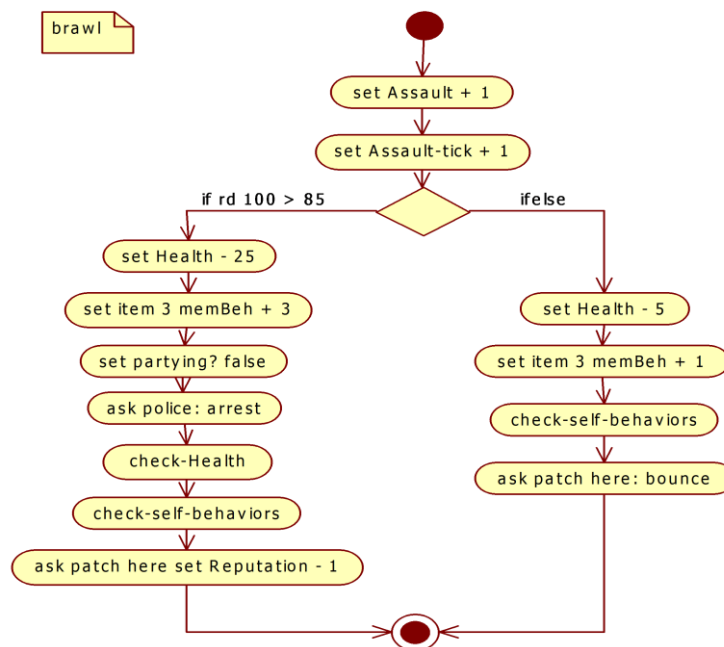
```

graph TD
    Start(( )) --> D1{if Item 4 Behaviors = "Hallucinate"}
    D1 -- if k > 99.8 --> S0[set Sanity 0]
    S0 --> BInsane[be-insane]
    BInsane --> SH1[set hazardous-acts + 1]
    
    D1 -- if 98 < k < 99.8 --> S2[set Sanity / 2]
    S2 --> SI20[set Initial-Sanity - 20]
    SI20 --> SN5[set Normal-Sanity - 5]
    SN5 --> SI43[set Item 4 memBeh + 3]
    SI43 --> CSB1[check-self-behaviors]
    CSB1 --> SH1
    
    D1 -- if 90 < k < 98 --> S3[set Sanity - 20]
    S3 --> SI10[set Initial-Sanity - 10]
    SI10 --> SN25[set Normal-Sanity - 2.5]
    SN25 --> SI41[set Item 4 memBeh + 1]
    SI41 --> CSB2[check-self-behaviors]
    CSB2 --> SH1
    
    D1 -- if k < 90 --> SH1
    
    D1 -- ifelse --> D2{if k > 99.8}
    D2 --> S4[set Health 0]
    S4 --> BDead[be-dead]
    BDead --> SH2[set hazardous-acts + 1]
    
    D2 -- if 98 < k < 99.8 --> S5[set Health / 2]
    S5 --> SI20H[set Initial-Health - 20]
    SI20H --> SN5H[set Normal-Sanity - 5]
    SN5H --> SI43H[set Item 4 memBeh + 3]
    SI43H --> CSB3[check-self-behaviors]
    CSB3 --> SH2
    
    D2 -- if 90 < k < 98 --> S6[set Health - 20]
    S6 --> SI10H[set Initial-Health - 10]
    SI10H --> SN25H[set Normal-Health - 2.5]
    SN25H --> SI41H[set Item 4 memBeh + 1]
    SI41H --> CSB4[check-self-behaviors]
    CSB4 --> SH2
    
    D2 -- ifelse --> SH2
    
    SH1 --> D3{ask doctor to heal?}
    D3 --> SCFalse[set consuming? false]
    SCFalse --> GBH[get-back-home]
    GBH --> End(( ))
  
```

The gravity of the "hazardous acts" is defined randomly. The consequences mainly depend on a random percentage (here, designated by k): if k values is below 90, the *user* will not experience any adverse effects as consequences of its acts. Above this 90% threshold, the *user* will lose either Health or Sanity. In this last case, the *user* will move to the 'Hospital' location for treatment and will remember this negative experience (through the membehavior attribute). It will also stop consuming for that day and run the **get-back-home** method described below. If the value of k gets above 99.8, the *user* runs either the **decease** or **commit** operation and will move during the next time step to the 'Morgue' or 'Sanitarium' location.

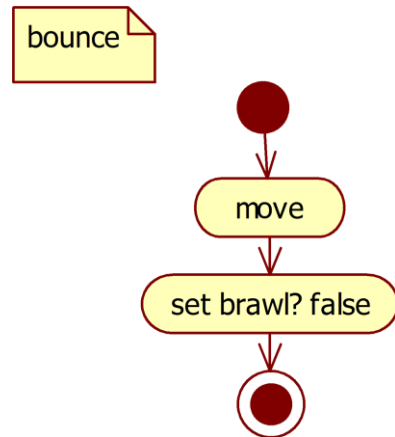
In the occurrence of such events, the *users* execute the **get-back-home** subroutine asking them to move to their 'Home' related patch (corresponding to the first pair of their Territory attribute). Nevertheless, on their way back home, these agents can still get involved into a **brawl** or have an accident. The **hazardous-acts** and **brawl** methods determine if whether or not the *user* will get involved in a fight or if its level of intoxication will lead to adverse consequences, this based on the values of *user's* Behaviors attribute:

Individual Operation 27: brawl



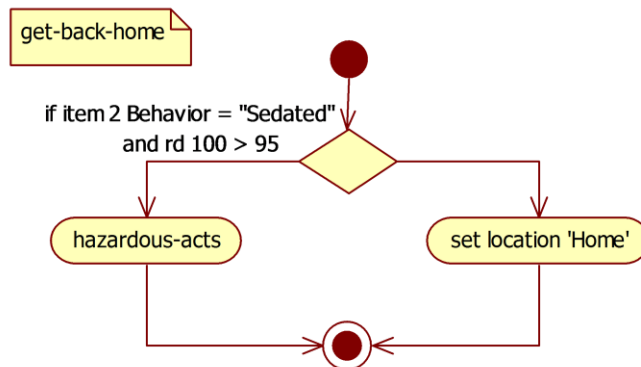
The gravity of the "fight" depends on the result of random percentage. In the worst case (random 100 above 85), the *users* may go to the PoliceStation or Hospital, if their Health get low. In the other case, the *users* are "kick out" of the location they were through the **bounce** method.

Individual Operation 28: bounce



This method is straightforward: *users* with brawl? equal true move to the nearest "Street" location. It has to be noted that fight could still happen on 'Street' patch when the *users* are running the **get-back-home** operation (cf. below).

Individual Operation 29: get-back-home



This method aims to represent the possibility for *users* to be involved in a fight or in an accident if they are in a "bad shape" (represented by the "Sedated" Behavior) while going back to their "Home" location.

In both cases, all *users* will reevaluate their actions and interactions as well as the behaviors of other *users* at the end of each consumption time step through the **check-Self-Behaviors** (Section 4.3.1) and **check-Other-Behaviors** (Sections 4.1.3). If these reevaluations entail modifications in the representational schemes of the *users*, the future decisions regarding their drug consumption will be affected in turn.

As just developed, several externalities can transform routinized practices into problematic actions. These could arise occasionally during recreational sessions, or as consequences of long-term consumption, leading to problematic situations. These latter and their consequences are developed in Section 5.3.

5.3. Problematic experiences and Switching: Reasons, Reevaluations, and Risk Denial

A switch corresponds to a moment when an individual decides to stop her consumption of a particular substance and starts or increases the consumption of another one. Switching does not mean the cessation of recreational polyuse drug career or a constant reduction in the psychoactive substances consumption, but refers to a modification in the routinized use of psychoactive substances. To describe this process, Sections 5.3.1 and 5.3.2 review the reasons and consequences that can induce a "switch" from a substance to another. Considering the increasing number of negative experiences lived by the individuals, these need to develop arguments to legitimize their conducts. Section 5.3.3 examines the different neutralization techniques that recreational users tend to develop during the instrumenting phase to facilitate the continuation of their polyconsumption.

5.3.1. Reasons of Switching

Based on the analysis of the empirical material, switching from one drug to another seems to be induced by six main causes: (1) tolerance; (2) increasing side effects; (3) other's misbehaviors; (4) noticing long-term effects; (5) availability, and; (6) substance composition/purity.

Tolerance, the most common cause, occurs when one drug is continuously consumed for an extended period of time (Section 2.2.3).

Tolerance is built gradually depending on the user frequency of consumption. But in all cases, the main consequence of tolerance is the desensitization of the neurotransmitters receptor's responses to the presence of the drug. This results in a diminution of the concentration of neurotransmitters in the synapse and to a decrease in the effects felt.

This neurological phenomenon is common to all drugs and is illustrated in all the interviews when respondents were asked to describe the evolution of their consumption. This reduction of responsiveness entails an increase in the drug dosage for the user to be able to achieve the same targeted positive effects, as explained by Mike and ElPoyo:

[ElPoyo, F72, male, 32, about cocaine] But, gradually, with the experience, you notice that snoring too regularly you don't feel the good effects anymore. You see, if you snort coke from time to time, you only have the good effects, you gonna smile immediately and you will be immediately fit. While if you snort large quantities super regularly, you'll have paranoia crisis, you'll be less comfortable, you react badly to the substance and you'll get the opposite effect.

, or:

[Mike, F73, male, 31, about speed] I would say in a year, it started small, it started really small, with one or two lines per night, when I was smashed on alcohol, it was just to calm down the alcohol that was it. And then it started to become more and more because you really get accustomed quickly. So after that period, you need much more and it ended with two to three grams per night. [...] And the more the weekend passed, the more I reduced the time between the lines.

As illustrated by the precedent extracts, the tolerance reduces the potential beneficial effects of the drugs. But conversely, and as asserted by opponent-process theory (Section 2.2.3), larger doses taken to compensate the built tolerance, in turn, increase the side effects that the recreational users experienced during comedown:

[Bobby, A, male, 24, about ecstasy] I don't like when you do it constantly, when you're doing it every weekend then you get to this sort of stage where the weekend is alright

because you sort of get a bit of a high from it and the whole week you're getting over it. Then that weekend, about Friday or Saturday you're feeling good again, you're ready to tackle the world and do it again and then you're out for the whole week. So I didn't like that. I was in that sort of rut for maybe a year but I didn't, I stopped that, I got out of that because it just becomes not worth it anymore, and the comedowns from Ecstasy can be really bad. It's like, if I've ever felt depressed when I come down, it's from Ecstasy. [...] The comedowns, like taking it's not worth it. The come down outweighs the high.

, or:

[Kira, A, female, 24, about cannabis] Nowadays if I smoke it I just feel awful. I just feel paranoid and crazy. I just worry that everyone's looking at me and stuff, it's horrible now. It's lost its magic. I must say that I kind of plateaued after about two and a half years. It just wasn't the same, it didn't have the same effect. It wasn't just like just ha ha, giggles and everything's hilarious. I guess maybe it was the darker side to it.

Correlatively, higher dosages *increase the side effects* modifying the balance between beneficial/detrimental effects associated with the substance during the reevaluation process. As discussed in Section 5.2.2, the cessation of a substance could reflect the moment when this ratio becomes negative and when the substance stops perceived as being pleasurable and useful:

[Bobby, A, male, 25, about cocaine] I'm that sort of person, when it stops becoming fun, I get over it. I'm sort of addictive to the fun that you get out of it, rather than the chemical. Like the chemical leads to the fun, but once it stops being fun it's quite easy for me to say no, I don't want anymore.

The tolerance and related side effects are neurological mechanisms that turn routinized practices into problematic ones. This modification in the drug-related routine induces self-reevaluations and could lead to a potential change of substance. But problematic situations are not limited to this intra-individual level.

On the interactional level, when respondents are confronted to comportments qualified as "erratic", "horrible", "despicable", or "disgusting" coming from other consumers (who can be close peers, acquaintances or unknown persons), most of them seem to transform their representation of the drug and, retroactively, their practices:

[HandyCool, A, male, 27, about ecstasy] One of the big factors in me stopping taking it when I saw a friend from school on ecstasy in the gutter and she looked so disgusting that I decided I didn't want to take it anymore. Swollen jaws and black eyes and covered in sweat and she was rubbing herself in the gutter saying how good she felt that she was like a slimy fucking toad. I was just like, I don't think I want to be that bad.

These *other's misbehaviors* — uncontrolled consumption, erratic movements, nonsensical speeches, aggressive comportments, and harmful behaviors — are evaluated by the individual and impact her future decisions (this point will be examined in the Section 5.2.3). This evaluation is based on empathy: others act as a "mirror" reflecting users own actions and behaviors when under the influence of the same drugs. This point could be illustrated by the following extracts:

[Batman, F74, male, 19, about alcohol] I don't like the aggressiveness, I don't like when others drank too much because it reminds me of the way I am when I drank too much. This is because a drunk guy could be really clumsy. They talk crap, you can be in a serious discussion with someone and then he landed right in the middle and then just spoke non-sense. It really forces you to think about yourself, you know what I mean? This is a bit of a mirror and then I say: "damn, I'm like that sometimes?" (sigh) It makes me want to slow down even more!

, or:

[Neron, F75, male, 28, about LSD continuation] I started again within the three months that followed. But after I backed off because I realized that I was going right in a wall. I had mates who were right in front of me to show it to me. So after that, I enjoyed watching myself when I was stoned, when I saw the way my friends looked ... Because that's what afraid me most, to see the faces of other peoples that were using it, I thought "No way, I can't have the same face

as them." When I saw their craziness, I thought: "Wait, I can't continue like that, I must stop: we just look like a big mess."

These same misbehaviors exhibited by the participants are generally the object of peer's judgment and affect similarly the perception of other peers (as developed in the previous sub-section). This judgment could also lead to self-awareness from the individual modifying his perception on his own practice.

Along the same lines, *noticing long-term effects* (in term of harm or social position) on peers or witnessing directly the dangers inherent in drug consumption could affect the future decisions of the users. Respondents describe an upheaval in their attitudes toward these specific substances. This change is operated, again, by empathy; respondents imagine that they could have been the one in this situation:

[Cloum, F76, female, 20, about cannabis after] I saw several people who use cannabis over the years and I've seen them becoming really violent when they couldn't smoke. So, I think this is a really bad drug because I can really see the craving amongst others.

, or:

[Neron, F77, male, 28, about LSD] It is super dangerous to take LSD, I could have completely lost my mind and had that "one party too much" because I've known people who did it, it was their last party, after they finished at an outpatient clinic. They'll never be the same anymore, they're COTOREP²⁰³. And then you realize that this is something very dangerous because, despite the fact that you're not an addict, that you don't have the profile of an addict, you just need to try it once, it may be the one time too much [...] I saw people tear their hair out, I saw people talking to bushes, stealing cars, while they were son of a good family. They were completely possessed, insane. It is a drug that makes you lose control. Anyone under LSD can act irrationally.

²⁰³ COTOREP: COmmission Technique d'Orientation et de REclassement Professionnel. Organization which had for mission the reinsertion into the professional world of physically or mentally handicapped people. This term is employed here pejoratively to designate a handicapped person.

Witnessing addiction, irremediable mental/physical harms, or social disqualification conduct, in most cases, to drastic changes in the opinions of the respondents. By being confronted to one of these situations, the risk inherent in these particular drugs becomes a tangible danger due to the direct exposition of the individual to this risk. Indeed, in these different situations, the ratio between invisible risks and visible goods [284], which normally leads engaging in risky actions, is inverted: the drug-related long-term risks become visible (respondents use several time the verb "see" or "watch" in preceding extracts), while the immediate goods tend to fade, overwhelmed by the potential harms. This inversion incites most of the recreational users to cease their consumption, because, again, the individual considers that the potential detrimental effects surpass the beneficial ones (exceptions exist and will be described in Section 5.4).

Finally, the last two reasons, *availability* and *composition/purity* of the substances, constitute "structural factors" modifying the practices and can lead to a switch to other substances. In the former case, the unavailability of one substance regularly used does not induce its complete cessation, but entails a transformation of the drug "routine" (the respondents try to substitute an unavailable substance). Conversely to this last point, it is worth to note that, for synthetic drugs (MDMA-type, amphetamine-type and in some extends hallucinogenic substances), the hyperavailability context (cf. Section 1.3.1) reduces the impact of unavailability, as Diane suggests in the following extract:

[Diane, F78, female, 31, about mephedrone and future substitutions] Right now, I have no more left. I had re-ordered on the Internet but the guy had to close his website because it became illegal so now, it's no more available, so I don't take it anymore. But I know there are other gears that are coming out soon, so ... [*Are you just waiting for other substances of the same type?*] Yes of course.

For the "classic" substances (cannabis, cocaine, heroin), the respondents indicated that disruption of availability is always

temporary and generally related to the arrest or the activity cessation of a drug dealer. Accordingly to the respondents, a new dealer will soon after replace the previous one or other users in the respondent networks will temporary give them a part of their stash or introduce them to a drug dealer of their own acquaintances.

Still on the same topic, most of the respondents showed some concerns concerning the composition of the synthetic drugs, in terms of "additive" or excipients (added by drug dealers to increase the weight, and, conversely, the benefits of their selling). Indeed, most of the respondents affirm that if they knew the real composition of these synthetic substances, they would certainly cease their usage. However, only one of the respondents has bought a "pill tester" and constantly checks the composition of her ecstasy pills. Although most of the respondents do not test the composition of the drugs they buy, they all assert that if the concentration of the primary chemical molecule becomes too low to furnish the "normal" expected effect(s), they would repeat their intake a few times, but will stop using the substance if this one remains ineffective:

[HandyCool, A, male, 25, about ecstasy purity] I've bought some pills which was supposedly being that [ecstasy] in the past year and the quality is like so shithouse that it makes me not want to even try anymore. Yeah incredibly bad - not bad experience but just - having six shots of tequila and you're in fact having a shandy. It's like weak as piss. So that leads to further disengagement I guess. You need it at a certain potency to truly enjoy it I think. [...] When I started taking it I could just take half a one for the whole night or a whole one and that was really strong. But these days, I'd take the same dose and nothing would happen. My friends, who I'm taking it with, who does it regularly will take three or four to get high. It just seems ridiculous.

Overall, except for the precedent structural factors, a single reason appears as being insufficient for the users to entail a modification of their practices, mainly because they can employ one or several denial techniques to continue their uses (see below). However, when several

reasons of switching are combined, the weight of detrimental decision elements tips the scale toward the cessation of the consumption:

[Paco, A, male, 27, about speed] After a while I stopped liking it because were so fucking obsessed with getting speed all the time. So weed and speed went hand-in-hand and sometimes it was good but yeah it was just like - and people got really angry if they couldn't get any and just the come down - the high wasn't that great and the come down was shitty. So value for money to experience it was just a poor economic choice. So that's why I stopped doing it and because I didn't enjoy the come down.

Considering the different reasons previously described, a "switch" in the substances routinely consumed occurs when the subjective ratio between beneficial/detrimental effects become null or negative, and/or when the individual is exposed, directly or through interactions, to the objective and tangible dangers of that substance. The next Section (5.3.2) examines the consequences of problematic situations and substance switches on the drug career of recreational users.

5.3.2. Consequence of problematic experiences on social representation and practices

A first and direct consequence of preceding experiences or events is the modification of the representational schemes. During the "honeymoon" period that follows initiation, the representational schemes of the different substances consumed by recreational polyusers get increasingly positive (if the first experiences bring positive outcomes). This period seems to end when the routinized actions become problematic, and are subject to reevaluation. As a result of reevaluation, the representational schemes attached to the substances are transformed to reflect the changes of perception concerning the usefulness and pleasure obtained by one or several substances.

Respondents who have experienced the consequences of tolerance generally employ terms, such as, "lose interest", "useless", "not

interested", or "not essential" to modify the qualifications of the related drugs. By using these terms, respondents express that the beneficial effects induced by the drug have disappeared, entailing a reject during the decision process. These terms could be regrouped in a category of representational schemes that could be named "Useless":

[Marie, F79, female, 21, about alcohol after] Before I could not imagine going out without drinking, it was really impossible. And now, because of too much abuse, I realize that it gives me more troubles than anything else, so I began to drink less. And my opinion now is that it is no longer essential to me and that I enjoy as well by being aware and remembering things.

Respondents who have witnessed others uncontrolled or compulsive behaviors, or who have suffered long-term acute side effects, are generally using qualifiers such as, "negative", "dirty", "muck", "crap", or "bad" to label these drugs. In that case, these terms reflect the situation where the detrimental effects of the substances surpass the beneficial one. These qualifications could be encompassed into the category "Detrimental":

[Mike, F80, male, 31, about ecstasy after] It's crap. I think this is the worst. It changes your mentality, it changes a lot of things. And then, there are too many side effects. And even when you're under it, you're too devastated.

Finally, in the case where immediate or long-term events of a dramatic nature have occurred to close peers, respondents modify their representation schemes to reflect the potential dangerousness of these substances by using terms such as, "addictive", "unstable", or "dangerous". These expressions could be grouped into the category "Detrimental" that has already been described in Section 4.1.1. The extract from Neron concerning LSD (cf. p.220-221) is a good illustration of this representation modification.

The second main consequence of these problematic experiences is a *modification of the routinized practices linked to drug use*. Assuming the principle that the social representations and social practices influence

each other reciprocally [228, 232], it appears logical to observe modification of drug use practices when the representational schemes are modified. As most of the preceding interview quotations have illustrated, the different problematic situations have led to modifications of the representational schemes that, in turn, entail a cessation of the practice concerning drugs perceived negatively.

In the model, these points are already embed in the different operations presented above: 1) the modifications of the different levels of neurotransmitters presented in Section 2.2.3 entails a tolerance and, according to the Opponent-Process theory, a reduction of the positive effects and an increase in the side-effects; 2) the **check-Self-Behaviors** and **check-Others-Behaviors** operations reduce the value of the different SocialRepresentations, if the behaviors exhibited or observed become judged as inappropriate. In turn, the practices, in terms of drug decision will be negatively impacted. In other words, the more a *user* will consume one or several substances, the more it will feel negative effects, which will reduce the value of its SocialRepresentations attributes and, therefore, will entail the cessation of the incriminated substances.

As it could be expected, the representational scheme attached to drug, that turns out to be unavailable, does not change, but still implies a forced cessation of the consumption patterns. Drugs judged by the individual as having equivalent effects are generally substituted to these substances. Starting a new cycle, their consumption follows the same pattern of decision that described in Section 5.2, will perhaps get routinized, and may lead to other problematic situations:

[Jurion, F81, male, 27, about alcohol and cannabis] I never said that it would be a problem of dependence, I thought "Anyway, I smoke, I can do without easily" because it was not something that I appreciate more than that and especially also because I smoked joints. So, I quickly distinguished that if I smoke joints I don't need to drink alcohol, especially because they don't work great together.

So because I was smoking a lot, alcohol was really something that was really casual. Now that I no longer smoke [cannabis], alcohol becomes something much more regular and something I appreciate much more, and I realize now that this is something that I will have to manage because it is something that I am, that I can become dependent.

However, problematic experiences due to the neurophysiologic evolutions of the interaction psychoactive substance/individual do not necessarily result in a cessation of the substance for another one. In some cases, a switch could also consist in the consumption of other drug(s) to counterbalance the tolerance or side effects of the problematic substance, entailing a palliative form of polyuse. This particular point is extensively detailed in Section 5.4.

The other cases are related to the problems or dramatic situations perceived or experienced by peers or other users. Indeed, before starting the interviews, the author used to consider that immediate and irremediable negative events, such as, car accidents, death of a peer, or get caught by police, would have led to the cessation or to a massive decrease in the consumption of substance(s) causing such events. Considering the preceding developments, such incidents should have modified the representations and/or practices associated with these drugs. However, some respondents seem to continue their normal consumption and "neutralize" these events through several forms of legitimizations. The description of these legitimizations is the object of the subsequent subsection (Section 5.3.3).

5.3.3. Risk perceptions, neutralization techniques, and risk denial in the instrumenting phase

This section aims to describe the neutralization and risk denial techniques developed by the recreational polyusers during the instrumenting phase. To do so, the major risks perceived by polyusers

need to be identified in order to capture the consequences and behaviors that users want to avoid, as well as the main dangers and problematic situations against which users need to legitimize their practices. Identifying the targets of these techniques also creates the opportunity to determine the contemporary social norms that recreational users are transgressing.

In the first step of their drug career, recreational users employed risk denial techniques to palliate their apprehension regarding short-term immediate adverse effects and justify their decisions to take risks (Section 4.2.4). During their instrumenting phase, the respondents tend to consider short-term problems (schizophrenia, death, and overdose) as manageable and/or improbable. At that step, the two main risks that can be identified in the interviews are addiction and long-term physical/psychological harm. Before getting to the description of these techniques, it is worth noting that these latter are employed in two different types of situations: first, the techniques could be employed to legitimize routinized and patterned practices; and, in the second case, they are used to justify intake continuation despite the appearance of problematic situations (as described in Section 5.3.2).

The analysis of the empiric material suggests that the respondents employ four main types of neutralization or risk denial techniques:

Denial of injury (denial of danger)

Denial of injury is one of the neutralization technique employed by delinquents or criminals, who considered that their actions did not entail any real harm [64]. This technique, adapted to drug use, consists for the users of considering that their practices are neither dangerous, nor harmful for themselves or others. The dangerousness and harmfulness of practices are negated by the respondents by pointing to the absence of potential addiction of their usage or by denying the denomination "drug" to some substances:

[Ubik, F82, male, 19, about hallucinogens] I don't think that salvia is a drug. For magic mushrooms and salvia, I never use the word drug. I always use the word "hallucinogenic plant" because, at the end, I think that this is not a drug. It is strong, you should know what it is and what you are doing, but it isn't dangerous. Well, it can be dangerous if you used in a wrong way, like many other things. So, for me, nothing to be worried about.

, or:

[Sammy, F83, male, 36, about speed] Dangerous? Not more than E or LSD. But in everything you consume, it remains dangerous in the extent of how you use it. Dangerous, but no more than anything else. There is no addiction, your body doesn't claim for more, your mind will not ask you to get some more.

Comparison between risks

Respondents generally use this risk denial technique when they want to justify the impact of their usage on their health. Respondents tend to diminish the long-term harmfulness of their own practices by comparing their substances usage with higher risks inherent in other forms of consumption:

[Bobby, A, male, 25, comparing alcohol and other drugs] The way I think about it is, you're drinking the whole bottle of Scotch there's a lot of substance going into your body, a lot of stuff your body has to metabolize. Whereas drugs, for example, small bits of powder, whatever. It's only that much, how much damage can it really do compared to a whole bottle of Scotch. That's a simplistic way of looking at it but I'm sure that effect comes in play as well, and then people get brain damage and the alcoholics that throw their lives away and throw everything onto.

The next quotation is unique in the corpus of interview, but remains interesting to illustrate the suspicion concerning the overwhelming quantity and constantly updated scientific knowledge concerning healthy versus risky practices:

[PBoy, A, male, 39, about alcohol and other risks] I do the quality of life, I shouldn't drink, and maybe I should just have one or two glasses a day rather than maybe a bottle. But every time you turn on the television, one day the tomatoes they give you cancer. You turn it on the next day,

the tomatoes are the healthiest thing for you to eat. It drives me bananas, it's just crazy.

By making every common objects and practices potentially dangerous, the risk society transforms the consumption of drug as "another" danger in the diversity of day-to-day situations that are labeled as risky.

Self-confidence

Furthermore, the respondents could exhibit a certain degree of self-confidence concerning their usage. This risk denial technique is mainly related to the potential risks of addiction and consists, for the users, in overvaluing their capacity to "control" the addictive potency of the psychoactive substances:

[HandyCool, A, male, 25, about cannabis] I never smoke it to proportions where I have problems from it. I can regulate my usage of it. I know if I smoke it I'll have like a bit of a hangover of two days in which I'll be a bit emotionally and mentally dull. So I time it and regulate it in my life so as not to have adverse effects. I don't really have any problems with it.

, or:

[Bobby, A, male, 25, about cannabis] Health wise, yeah, you know sometimes I think it's bad for my lungs but that's not enough reason to quit. There are lots of things that are bad for me. I've never felt like if I keep smoking I'm going nowhere with my life, like I'm going to end up in the gutter. I've never thought that way and because I don't think that way I'm not going to be like that.

In the same way, respondents consider that by controlling the frequency of their consumption and/or the dosage of their intake, they are able to "regulate" their usage, and, therefore, to stay away from addiction or possible long-term harm induced by this long-term usage:

[Jessy, A, female, 22, about meth] I know that I don't want to be inhaling dangerous chemicals into my lung and destroying my brain and body, which is why I don't do it anymore. But I don't think that doing it occasionally has had long term effects on me.

, or:

[D., A, male, 19, about cocaine] I don't think it's dangerous. I know it's dangerous in high quantities but the quantities that me and my friends have are not dangerous at all. So I think if I use it responsibly I don't think many things would go wrong.

This self-confidence can be enhanced by the use of specific substances, especially cocaine, which confers on its consumers a feeling of "totipotent" regarding their faculties to control their uses and to handle any problematic situations. One interviewee explains that being under the influence of cocaine makes her feel that she could handle cocaine addiction, creating a vicious circle and leading to a period of compulsive intake (Section 6.3.3).

Scapegoating

Finally, scapegoating remains the risk denial technique the most widely employed by respondents. In the case of recreational polydrug users, scapegoating could take different forms by targeting different entities (individuals, groups or substances). The first form of scapegoating corresponds to the situation where respondents designate particular substances or dosage as "really" dangerous, and compare — in term of harmfulness and impact on everyday social life — these latter with the substances they continue to consume:

[Bobby, A, male, 25, about alcohol after] I think it's, you know, everything in small doses is fine. I think doctors will agree with me, it's — a good bit of alcohol's good for you. It's a good way to relax, unwind. It's a social thing to do, like have a drink with your friends, you know something to do. You go to your friends, let's go and sit in the park, it's unlikely that people are going to want to do that, but if you say let's go grab a beer, then you go grab a beer, sure let's go. That's something that everybody does and you get a chance to be sociable about it, and it's not really bad for your health. You're only, go and have a glass of red wine with your friends and that's probably good for your health and it's good for your social life. Obviously people who drink in excess, not real — it's very bad for you, probably one of the worse things you could do in excess.

The second form of scapegoating does not target a particular substance, but a particular form of practice. By using this technique, the respondents designate and label the practices of other users as more dangerous than their own, explaining in what proportion their own form of consumption reduces the risk of addiction and long-term harms:

[Soph, A, female, 23, about cannabis] I don't smoke bong, that's mainly for health reasons. I just know that it can really fuck up your lungs. I think when you start to smoke bongs, it becomes more addictive.

, or:

[Paco, A, male, 27, about alcohol/cannabis] I think alcohol is a much more dangerous drug and I think it can also lead to addictive lifestyle patterns. I think it can create some serious health effects in people, but I think it's a necessary evil that has also got a lot of positives and I think it's really great for helping people lose their inhibitions and communicate and relax and enjoy themselves. So I really support cannabis and alcohol intake, but I don't think everybody can deal with them maturely. I think they're completely double-edged swords. I think they're both very much in the same category and I think that if done appropriately they are potentially very beneficial and enjoyable.

Even if a certain degree of addiction is noticed in users consuming the same drug, the respondents could still legitimize their usage by orienting their justifications toward the lack of real societal problems entailed by this particular substance addiction (this case remains mainly related to cannabis and hallucinogens):

[HandyCool, A, male, 27, about cannabis] I don't think it's that bad. I certainly see less negative side effects of it in people's lives than I do with alcohol. For instance the people I know who are heavily addicted still maintain jobs. They still maintain their regular life functions. They might have some adverse mental effects of just like not wanting to go out so much or something. But they still meet the obligations of their life while the friends with alcohol will lose their jobs. They'll lose their house. They'll lose their friends. Marijuana doesn't do that.

Respondents also compare their own physical/psychological state with the one of other users considered to have problems with their

consumption. By designating a practice as harmful and by distancing themselves from those practices, this neutralization technique helps respondents evaluate the dangerousness of their own uses, but it is more likely to reassure the latter about their own consumption, facilitating, this way, their continuation:

[Kira, A, female, 24, about cannabis] I've got friends that used it a lot more than me, who I look at and I think my memory's bad and stuff like that. Then I look at them and I'm like, theirs is a lot worse, you can see it when you interact with them and talk with them and stuff. [...] You always look at them and it makes you usually just feel better about what you're doing.

The last form of scapegoating is employed to justify the continuation of a particular substance in spite of the fact that the respondents had witnessed dramatic or harmful consequences due to drug use. When confronted with these situations, most of the respondents impute these consequences to the substance itself and change their representation and practices accordingly with these events (Section 5.3.2). However, some respondents consider that these forms of compulsive behaviors and/or harmful outcomes result from user's practices: large dose, addictive and dangerous ways of consumption, or high frequency of use are the type of practices designated as responsible of these outcomes. By distinguishing the practices from the substances, these respondents create a clear demarcation between their own practices, controlled and managed, and the usage of those who have experienced problems, due to their "excessive" and "careless" form of usage:

[Diane, F84, female, 31, about speed] I've had friends who have died because of speed. [*What was your reaction after this?*] It never really affected me, because I always thought that I managed [my consumption]. I didn't have an excessive consumption unlike some people who were taking plenty of stuff and were not paying attention to the doses.

This distinction between controlled and uncontrolled usage facilitates the justification of consumption continuations by reducing the impact of the cognitive dissonance induced by the difference between their

representational schemes and the serious damages that they have observed. The labeling performed by the recreational polyusers on problematic users will be extensively discussed in the Section 6.3.

To recapitulate, the justifications of drug usage could either target the practices or the representation attached to these practices. Neutralization and risk denial techniques provide users with justification to disobey two contemporary societal norms: health and autonomy. This last notion is subjectively built on opposition to the notion of addiction and requires from users, the ability to control their usage. A practice is considered controllable if it does not lead to a loss of the individual autonomy regarding the substance. As it will be discussed in Chapter 6, the question of control and the related risk of losing control are fundamental for the construction of the recreational status.

Respondents generally cease the consumption of a substance when its representational scheme becomes negative ("Poison", "Detrimental", or "Useless"). This scheme's transformation is induced by six reasons from three different levels: on the micro-level (drug-individual), the neurologic adaptation to the substance, *tolerance*, and experiencing acute short-term or long-term *side-effects*; on a meso-level (interactions with other users) *noticing temporary stigma* (e.g., erratic movements of jaws, deep bags below eyes, grinding teeth...), short-term misbehaviors (e.g., vomiting, fighting...) or long-term *detrimental effects on others*; on the macro-level (drug market and global society), *lack of availability* and *bad composition or low purity* stop the consumption, but do not modify the representational schemes linked to these substances.

Switching results either in the initiation or increasing use of other substances having similar effects or, in the case of intensification of side effects, the consumption of another psychoactive substance for palliating these side-effects. This last case constitutes one of the forms

of SPU. It will be described with the rest of the polyuse consumption are detailed in the subsequent section.

5.4. Polysubstance use: Managing Functions, Timing, and Well-being

As discussed in Section 1.4.3, polysubstance use could be either *concurrent* (during the life time) or *simultaneous* (during a limited period of time). The present section aims to describe the different forms of SPU (simultaneous polyuse) in terms of functions and neurologic mechanisms, and to analyze the underlying motives influencing these practices.

5.4.1. Conditions and motives of polysubstance use session: learning, order, and intention

The Section 5.2 detailed the processes at play relative to the decisions of the moment to consume, the function targeted by a particular drug use, and the choice of substances related to that function. However, polyuse does not necessarily correspond to the realization of a single instrumental function and so, to the consumption of drugs belonging to the same class. This does not mean that the conclusions drawn throughout this chapter are not adapted to SPU. It means that in order to understand the particular reasons and consequences of polysubstance use, a deeper examination of the different characteristics of this practice is needed. On this topic, the analysis of the respondents' polyuse practices has permitted distinguishing four main characteristics of SPU.

First, the respondents indicate that, at this stage of their drug career, SPU does not proceed by chance, but is *intentional*. There is still "accidental" polyuse, but these remain infrequent and are generally

associated with the case of excessive alcohol consumption (see below). The interview's respondents appear to target specific outputs through a rationalization of the different neuropharmacological effects of substances they combine:

[Jessy, A, female, 22, about polydrug use] Alcohol tends to produce a drowsy and sleep inducing effect and lack of coordination - that sort of thing - and lack of clarity in thought and cocaine tends to counter that. So whilst you can still achieve the desired effects of alcohol like loss of inhibitions and perhaps relaxation - on the other hand cocaine counteracts that. Ecstasy is fun to do and that's fun to be followed by marijuana to give you an experience of transcending barriers of space and time - that sort of thing.

The previous extract illustrates a common point shared by all the respondents: SPU corresponds to the interaction between several substances *in-order-to* achieve an increase, a reduction or a combination of instrumental functions (the different in-order-to motives of SPU are described in the next subsection).

Second, all interviews converge on the following point: the *quasi-constant presence of alcohol* in the different forms of polysubstance use, confirming the “centrality” of alcohol in the polysubstance usage [80, 304]. Indeed, the majority of the respondents consider alcohol as the “basement” or as “essential” for their consumption²⁰⁴ and the majority of the polyuse combinations contains alcohol:

[Mike, F85, male, 30, general] Alcohol is always there during parties. I like alcohol and cannabis when I drink at home with friends and when I know I won't move after. You enjoy a drink and you can smoke a joint. Alcohol and ecstasy, alcohol / coke, it generally happens because there is always alcohol, because during the evening, I drink. This is generally after drinking alcohol that I use drugs to regulate alcohol.

As already mentioned in Section 5.2.2, alcohol plays a major role in the unintentional or unplanned consumption of other psychoactive

²⁰⁴ Cannabis is cited as “basement” for three respondents, but alcohol remains frequently cited as a substance used during their sessions.

substances. The fact that alcohol is always present in the extracts concerning polyuse sessions leading to further substances confirms its role of a polyuse "inducer":

[PBoy, A, male, 39, about alcohol and cocaine] Like if I went to lunch and we were just having mineral waters I mean no one would bring out cocaine. Like we wouldn't have cocaine, so I guess alcohol is kind of prevalent, the start of, the root of all evil.

Third, all the respondents consider that the mastery of SPU requires a specific *form of learning*. Indeed, the respondents explain that polyuse asks a particular form of "knowledge", a form of "appreciation" of the different effects that substances can have on their own physiology:

[Sammy, F86, male, 36, about cannabis and alcohol] The danger with joint and alcohol is that is either makes you not want too much of alcohol, or it gets you too much high and you get sick. It really depends on the moment where you smoke, if you smoke at the beginning of the party, alcohol won't get you too smashed. You drink first, and then you smoke, you'll be sick. You should know your body and the drugs you take. So [the polyuse] is just as I feel it and with my substance knowledge. [...] This is a machine that you need to operate with different kind of fuels.

This learning does not only concern the different effects obtained through the combinations, but especially the "right moment" and "right dosage" to take in order to avoid being in an undesired state:

[Albie, A, female, 19, about alcohol/cannabis] I have mixed alcohol and cannabis intentionally because I just kind of like that feeling of a small amount of alcohol and then some cannabis. But the first couple of times I smoked alcohol and cannabis together I felt really, really sick. That was really horrible. But then, I don't know why I tried it again but it was good and it has been since then.

The necessary "knowledge" about the interaction substances/body can only be gradually obtained with the iteration of experiences. This is one of the main reasons why narratives of routinized and intentional sessional polyuse are rarely found during the starting stage of the user's drug career.

The last characteristic concerns the *intentional forms of polydrug use*. Consistent with the work of Fontaine et al. [80], two main non-accidental patterns can be distinguished in the interviews. Some respondents explain that their polyuse is "unplanned", mainly depending on the way they "felt" at the current moment of their session, and on the "ambience" of the context or setting in which they are consuming. The SPU of these respondents merely depends on the availability of substances in the current setting and/or from the stock of drug of other present users:

[Paco, A, male, 27, about polydrug use and availability] I don't mix them on purpose; it's just a case of what we're having, like what's there. I don't make a shopping list of let's get this, let's get that and combine them; it's more like if you've got marijuana, you've probably got beer. Like those two are just obviously there I suppose. They're omnipresent. If you're with someone who's having ecstasy or is having speed or is having acid, odds are they have marijuana on them. So marijuana's always going to be there and it just like helps sort of balance it and gives you something to do and if you're out, odds are there's going to be alcohol there. So they're just always there I suppose but I don't mix them. I don't have a cocktail. I know people do. I'm sure there are people who have refined it but I don't. I just know a couple of basic mixes that work.

Nevertheless, the respondents also explain that their polyuse is linked to the effects they want to feel in consideration of the physical/psychological state they are in. Their decisions regarding the different drugs are still conditioned by the expected effects and neurological properties of substances available:

[Blondie, A, male, 22, about alcohol and cannabis] Why do I combine them? To be honest I have no idea; it usually just happens that way. [...] The only thing I can really think of to explain it is that I don't really like that aggressiveness that comes with alcohol sometimes; you can get aggressive and irritable, whereas marijuana you don't. So if I'm combining the two, I'll still get very drunk and euphoric and go wild and have a good night out, but I won't be stressed or worried about where I'm going or anything; you're just cruising along and I think that's the marijuana side of things. [...] So I try to keep my uppers with my uppers and my downers with my downers, like a synergistic effect that I

would be getting. That's why I like alcohol and marijuana, I think it's a good combo because you're into this super-relaxed state and then you cancel it with all the other bad parts about this.

, or, concerning stimulants:

[Toulouse, A, male, 27, about mixing and MDMA/speed] It's not like I first think I will drink seven cups of wine and then smoke a joint and then drink one more cup of wine and then do a line of speed because I want to feel this way. It just happens. You don't set out to go, okay, tonight I'm going to have MDMA. I'm going to have speed, I'm going to have alcohol and I'm going to have a little bit of ketamine because I like the way it all mixes together. It just happens. It just gets offered to you or you bump into someone who's selling it and yeah, I don't think - besides mixing speed with MDMA because you want to get high off MDMA but you also want to keep going. You might use speed. Speed can prolong stuff; but only if it's an amphetamine or a nasally induced drug. Everything else pretty much doesn't mix good.

"Non-planners" also frequently indicate that some substances are not "good" being mixed together and limit their combinations to a range of "well-known" recipes that can produce the effects desired. These two last points tend to demonstrate that these users, if they openly explain that their use reflects their own will at a specific moment, still go out in specific setting and consume drugs accordingly to the setting and the related particular activities. All of them choose their drugs accordingly to the function best suited to these activities: for example, going in a discotheque, the polyusers might not want to consume benzodiazepine or opiates at the beginning of the evening, or in a club; conversely, they might not take ecstasy or methamphetamine before going to bed.

The second pattern consists in planning the different drugs that are going to be taken. This planning is established in order to assure the good continuity of the session and consists in an ordered sequence of instrumental functions. Therefore, respondents preparing their SPU generally plan to consume the different substances related to this ordered sequence of functions:

[Youssef, A, male, 29, about polydrug use] I want to have different effects. So at the beginning of the night I don't want to be dancing on the table. Took it the wrong order guys, sorry. [...] I'd be taking certain drugs because of what impact they're having on me and why I would mix it is because at the beginning of the night I just want to be social and get the night started so having weed at the beginning of the night is not going to suit that because then I'm going to be tired potentially in a couple of hours and then I'm going to have to try and lift up. So I try - if it's going to be a graph it'd be starting off fairly low on the chart and then I want to pick that up over the night and don't want that to drop down too quickly, want that to just taper off nice and smoothly and so that's why the marijuana would be a nice way to end it because it would just smooth out the end. Then if you needed some other drugs you'd probably put them on somewhere in between that as well. So if there was coke in the mix as well, you would probably put some coke in earlier on and then potentially - I wouldn't waste the coke after the pill, I'd be just building up to the pill with the coke and then let the pill fizzle the night off and then have the weed at the end. That's a nice night.

These users have generally bought the different substances they intend to take beforehand. But, again and as already pointed in Section 2.2.3, these "planned" uses are still subject to externalities, which can modify the routinized and preplanned consumption.

To obtain a better understanding of the ordered sequence of functions, the next subsection describes the different forms of polysubstances and their particularities. It also intends to describe the neurophysiological mechanisms at play for every SPU.

5.4.2. Forms of simultaneous polysubstance use during the instrumenting phase

The forms of polydrug use could be differentiated based on two main criteria (1) *temporality*, i.e. at what moment of the session the substance(s) is (are) consumed, and (2) the *in-order-to motives* behind these consumption, i.e. the effects that users target through these

polyuse practices. Before describing the different forms of SPU, it needs to be specified that recreational polydrug users do not limit their polyuse to only one of these forms, but can shift from one to another depending on the state they are in and the state they want to be, as indicated by Bobby:

[Bobby, A, male, 25, about polyuse]: [*What makes you mix drugs for you, in your opinion?*] Typically when one stops working. So I'll have more and more of one drug and then it stops working, I'm not getting much out of it anymore, so I'll have something else. Or I'm sick of the effect and I need something to counter it.

As previously underlined, *externalities* (peers pressure or unplanned settings/activity changes) can potentially occur during the session and influence the form of polyuse that individuals may decide to engage in. These externalities induce changes in the substances consumed allowing users to adapt to the situation. Through the interview analysis, SPU appears to follow four main patterns: *controlling long-lasting effects*, *changing*, *enhancing*, and *pilling up*. These four patterns of SPU are consistent with precedent research concerning SPU [246] and could be presented as follows:

A) Controlling long-lasting effects

The first type of SPU has already been briefly discussed in the precedent sub-section. The ingestion of depressants after stimulant drugs constitutes the most frequent form of polysubstance use cited in the interviews. This SPU mainly concerns the end of a drug use session and is, in the interviews, never used at other moments. In the related extracts, depressant drugs appear as giving a "parachute" to the users, reducing this way the pain and discomfort occasioned by the stimulant comedown:

[Yousseuf, A, male, 29, about ecstasy] There has especially after a big night and you start coming down and you just feel like absolute crap. I've definitely felt a few times like I really want this to stop. I really want to sort this out. So usually what I'll do is I'll smoke a lot of weed so then I start feeling stoned instead of feeling like I'm coming down, so

provide a bit of a parachute. So that's why when we order all the drugs, we'd always make sure if you're ordering pills, order weed as well. Then the next day you can just smoke instead of feeling like shit. You can at least feel stoned which is better. There have just been days where you felt like you wanted to die.

, or:

[Pablo, A, male, 25, about stimulant and Valium] When I was first going to clubs at 19, if we were going out to a club I would - as I said, I don't mix my chemicals with my alcohol too well, especially not at that age. So I would go out and we'd take pills and that's all we'd take and drink a lot of water and maybe some Red Bull. Then when I would get home, on the way home or sometimes halfway through the night, we'd smoke marijuana. Certainly when we got home we would [...] just smoke a ridiculous amount at my house 'til all hours in the morning, until we got tired or felt that we could go to sleep. Then we'd sleep. That was at about 19. At about 23, I was sick of only being able to sleep for four hours and then get up. I finally learnt the value of Valium and Xanax and I would come home and as soon as I'd get home I'd have a Valium, smoke a little bit and then I'd be able to fall asleep.

The generalization of the side effects inherent in long half-life stimulant drugs (such as, amphetamine-type or MDMA-type) leads most of the respondents to "learn about the value" of depressant substances. From a neurological point-of-view, stimulant drugs, due to their agonist effects on glutamate and norepinephrine neurotransmitters, counterbalance the normal sedative effects of GABA_A inducing sleeplessness and the impossibility to rest. By absorbing depressant drugs such as alcohol, cannabis or anxiolytics, which are GABA_A agonists, polyusers balance out the high level of glutamate and norepinephrine in the brain in order to be able to fall asleep:

[Nick, A, male, 18, about cannabis/MDMA] I like marijuana, in conjunction with MDMA. I often take it at the end of the night with MDMA to calm me down, help me sleep and the next day is a lot better after MDMA, I find, if I smoke marijuana afterwards. So it tends to be more helping the MDMA process, putting a cap on the end of the MDMA process. [...] So I'll come home from a rave and then have marijuana to sort of calm myself down and help me sort of sleep and put an end to the MDMA experience.

Using depressant drug to "put an end" to these effects, not only aids the polyusers to ease the effect of stimulant substances, but also helps polyusers to easily reintegrate their "normal" and routinized social life cycle without experiencing severe outcomes induced by the lack of sleep:

[Pablo, A, male, 25, about uppers/downers] Valium, alcohol or marijuana, but not when I'm high but later when I'm coming down. I need it as a - to help me go to sleep. I find with most stimulants, if I have coke or I have speed or ecstasy, I have very, very, very much trouble sleeping. So I'll need something like that just to make sure I get a good night's rest and that makes the day after a whole lot easier, if you've had a good seven, eight hours sleep. So it could be the end.

In other words, this polyuse practice is employed to close a session by reducing the excitatory effects of the stimulants drugs and limit the side effects caused by the comedown of these stimulants. This SPU could be considered, in terms of instrumental usage, as the "Energy" function followed by the "Relax" one. There is no occurrence of stimulants used to palliate the side effects of downers (translated into instrumental functions: a "Relax" or "Intoxicated" use followed by "Energy" function) at the end of drug intake sessions in the empirical material. This case, moreover, does not appear in the literature concerning polydrug use.

Furthermore, the regular and repetitive use of stimulants can modify the polyuse practices and related decision concerning drug choice. Indeed, when the side effects due to acute tolerance on stimulants become too severe, some respondents indicate that the possession of depressant drugs becomes a *sine qua none* condition for using stimulant:

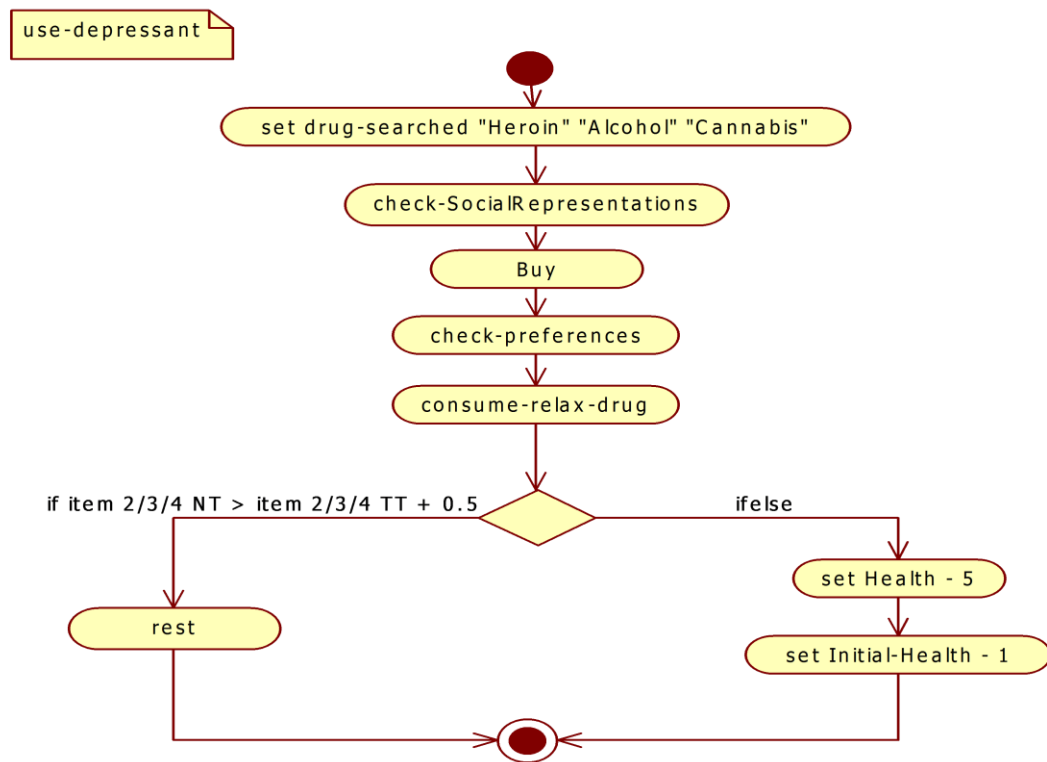
[PBoy, A, male, 39, about Ice and Valium] Like if I run out – for example, doing a cost benefit analysis. If I don't have any Valium left, I won't go out and use crystal because the come down is too severe without having just four Valium or something.

This *rule* regarding the stimulants consumption will be extensively discussed in Section 6.2.2.

It is important to highlight that a few respondents use opiates (morphine, heroin, raschacha or codeine) to obtain the same relaxant and sedative effects as benzodiazepine, alcohol or cannabis. The action of opiates on the brain differs from the depressant drugs previously cited. Opiates have antagonist effects on GABA_A receptors and an agonist action on the μ opioid receptors. The reduction of the release of GABA_A increases conversely the level of dopamine in the brain [161]. This augmentation of the dopamine level counterbalances the depressive mood following stimulant drugs and the agonist action of opiates such as morphine, heroin or codeine on the μ opioid receptors causes analgesia and sedation (in a lesser extent than CNS depressants such as, barbiturates or benzodiazepines) which is the result searched through this SPU [160].

This particular form of SPU is modeled in SimUse by means of the **use-depressant** method. This one was designed to mimic the *controlling long-lasting effects* practice: the agents that have used long-term duration stimulants and still exhibit "Energetic" as a value of their Behaviors are asked to run this operation (some "rules" of consumption prevent the agent to use depressant drugs, but this point is developed in the subsequent chapter):

Individual Operation 30: use-depressant



The **use-depressant** operation is called when the *users* want to **rest** and if the level of Glutamate or Norepinephrine in their NeuralBox (Section 2.2.3) is higher than the Tolerance-Threshold and exhibit the 'Energetic' value for the Behavior attribute. After having consumed the different depressant drugs, if the levels of EndoCannabinoid, Endorphin or GABA become higher than their related Tolerance-Threshold, the *user* can run again the **rest** operation, otherwise, it loses some Health and Initial-Health to mimic the lack of sleep.

B) Changing

The second form of use, *changing*, refers to using a substance with neuropharmacological properties that can counteract or palliate the effects of substance(s) previously taken. Respondents frequently employ this SPU with the purpose of continuing the drug use session by shifting to a different instrumental use:

[Toulouse, A, male, 27, about his use of speed] Maybe to be able to talk to lots of people because for instance maybe I'm stoned on weed and I'm out and find there's speed, then I'll do some speed so I can be awake.

, or conversely:

[Jacko, F87, male, 31, about cocaine/alcohol] I've never taken coke thinking that I would be less drunk [...] but

conversely there is always alcohol with it. You must make the association. I think it takes the excess of control you get from coke: the combination of the two is made for that.

The most common form of changing consists of the consumption of a stimulant drug after alcohol. This combination allows the individual to counteract the drunkenness caused by an important consumption of alcohol and prolong her night-out:

[Marie, F88, female, 21, about speed and alcohol] I drank a lot before and when I took my speed I was directly in the state I wanted to be. I don't know how to say that, I wasn't that drunk, I was just at the point where ... [*The state where you began to be drunk?*] Yeah. But I'd still remember everything. I took my speed and suddenly, I was fine. It was the recipe for a good night out and for forgetting nothing. I took alcohol to be good, in the early evening, during the road we drank, we arrived at the parking lot, we took speed and I was just drunk enough to get in the club and then I took my speed and it was good for the whole night. Until 5am, I was okay.

, or:

[Pablo, A, male, 25, about cocaine] Generally that would be mixed with a couple of beers, alcohol, or marijuana or pills, is generally always mixed in game with something else. [...] Cocaine would be the addition, generally. So if I'm having alcohol then it'd be like, I'd use cocaine to make me want to stay out longer, to make it possible to keep going, otherwise I would have had to go home.

The precedent extracts illustrate the two main patterns of changing. This SPU either refers to a consumption of stimulant drugs followed by depressant drug(s), or conversely, a "downer" followed by an "upper" substance. The former counterbalances the excess of energy and alertness; while, the latter allows the polyusers to reengage into social activities involving interactions with other individuals (who may not be under the influence of relaxant or intoxicating substances).

Translated into instrumental functions, the former corresponds to the combination of "Energy-Relax" functions and the latter to an association "Relax-Energy" or "Intoxicated-Energy". It consists in the same

neurophysiologic model that for counteracting long lasting side-effects, playing on the glutamate and norepinephrine on the stimulant side and GABA_A and μ opioid receptors on the depressant side. Changing remains distinct from controlling long-lasting effects because it is intended during the session and is not used to palliate the effects of stimulants at the end of the session. In SimUse, this SPU is not the subject of a particular operation, but is instead directly inserted in the **consume-function** methods (Section 7.1.2).

C) *Enhancing*

The third common form of SPU, *enhancing*, increases the effects of one drug and/or its duration by using one or several other substances. These substances generally share common neuropharmacological properties or, more rarely, can facilitate the continuation of an effect by resorbing the side effects of prior drugs:

[Neron, F89, male, 28, about alcohol plus cannabis and intoxicated uses] It also allows you to get smashed faster. The mixture of the two accelerated it. It also multiplies the effects, if you smoke a joint after three or four beers, you'll be three times more hammered than if you had just three or four beers. The guy who drinks three beers and the guy who drinks three beers and smoked a joint after, that one is often a little more destroyed in the end.

, or:

[Picasso, F90, male, 34, about cocaine/GHB/ketamine] In the end, my little weakness was what I call the three A, that is to say, the three anesthetics, cocaine, GHB and ketamine.... Cocktail that smashes you hard [laughs]. If you prefer when you're in a mode where you get too high with cocaine, there is necessarily a moment when you'll feel it here [pointing at his heart], you'll take good doses, but GHB and ketamine allow you to take more cocaine, to go further into it.

, or concerning stimulant drugs:

[Jurion, F91, male, 27, about MDMA/speed/cocaine] [...] if I'm already on ecstasy, I may take some speed, if I feel the come down starting. But these are drugs that go well together, that's clear, and if I really want to have a big night, I will take the three indistinctly in any order, but [...] if you took one ecstasy, when it goes down, you want to

delay the come down, by taking a line of speed or a line of cocaine to bring you up a little bit...

As illustrated by the previous examples, this SPU takes place during the session and is related to a notion of temporality. This form of SPU rapidly brings the user to the state he wanted to be (in the case of Neron) or could extend the duration of the targeted effect (in the case of Picasso and Jurion). The recreational polyusers employing the enhancing generally search to intensify or to extend the duration of a specific effect. This SPU is represented by the **more?** operation presented in Section 5.2.3.

D) Pilling up

The last form of SPU, *pilling up*, combines of several distinct instrumental functions or as a combination of as least two forms of SPU — changing, counteracting long-lasting effects or enhancing — in the objective to experience a large variety of effects during the same session. The most common pattern of pilling up found in the interviews refers to a succession of "Social-Energy-Relax" instrumental functions (which can also be understood as enhancing followed by a counteracting form of SPU). In that case, substances are conjointly used in the polyuse session to enjoy the social aspect of a night-out for a longer period (due to the use of stimulant drugs) and followed by a relaxant intake to ease the comedowns when the session ends. The other frequent case of pilling up is more oriented toward "Intoxicated" instrumental function and generally involves hallucinogenic substances for their specific neurological actions. In this case, the hallucinogens are consumed in combination with either stimulant or relaxant substances, depending on the intensity and desired duration of the session. Overall, the pilling up mode of polyconsumption is practiced by the recreational polyusers who want to play with the palette of effects that they can obtain through the consumption of various psychoactive substances:

[Gourou, F92, male, 19, about polydrug use] [...] I always see it as jumping off a stratum of consciousness to another.

At the beginning, we are in a collective stratum of consciousness, we will have delusions and we laugh together. And get to speed plunge us into another system, we will always be connected, but we will react differently, think differently and so on. And with hallucinogenic mushrooms, that's the same, it will still be very different and very interesting. We are well prepared and in good shape, and we go for an interesting and spiritual journey. [*So you don't take the ingredients randomly?*] No, not at all. I really carefully think of what I want, of the state I currently am, and what I'm looking in this party, with the people I am with. [...] It is always calculated the drugs we take, they are always... The way we consume them now, because we know these substances more or less, we know the effect that they will have on us, we know when we are going to take them, we know what to do. It's not a reckless excess.

The previous extract illustrates the different "strata" that a recreational polyuser can achieve through the combination of different psychoactive substances. But it also indicates that this form of polyuse is generally planned due to the large number of different drugs involved in this practice. Furthermore, this type of SPU requires a higher level of mastery and knowledge regarding the substances, their combinations, and the consumer physiological reactions to avoid any adverse consequences related to the large amount of substances consumed. Therefore, pilling up remains infrequent and is a practice only found in the interviews of experimented polyusers.

The panel of effects that respondents search to achieve intentionally through their polyconsumption and the variety of these combinations demonstrate that SPU is not a single practice common to all of the polydrug users. Contrarily to what is indicated by most of the institutional organization (Section 1.3.3), it can be conjectured that polysubstance use consists in a variety of practices responding to pragmatic reasons. These practices are intentional, differ by their orders and are subject to a form of learning that can only be acquired through repeated experiences. Nevertheless, if the description of this plurality of practices informs the in-order-to motives at play with the different SPU,

it does not indicate the underlying contextual and social reasons influencing these practices.

5.4.3. Polysubstance use: a side effect of the late modernity?

The first section of this chapter has developed the idea that at this stage of their drug career, the recreational polyusers consider psychoactive substances as neuropharmacological means to achieve specific instrumental functions. These functions are perceived by the respondents as facilitating the adaptation to contemporary social norms — *autonomy*, *self-reflexivity*, and *performance* — inherent to the late modernity described by both Ehrenberg and Giddens (Section 5.1.2). Considering the motivations shaping this drug usage, it could be asserted that the different modes of polyuse, as recreational practices, consist in an intentional series of instrumental consumption that have for goal to optimize the experiences of the users.

This optimization passes by two main components: time and intensity. Concerning the former, the respondents describe their SPU using terms such as, "earlier", "after", "at the beginning", "spend the night", "stall", "at the end", "until", "next days", "longer" or "rapidly". The precedent list is not exhaustive, but gives a precise idea about the role that polyuse plays to manage the duration of substances effects, and, correlatively, the impact of these sessions on their everyday social life. For example, individuals employ polyuse such as controlling and changing to shape and delimit the extents of relaxant or stimulant substances on their interactions with others and on their overall social life; while enhancing and pilling up allow the users to continue their intake sessions by prolonging the effects associated with particular instrumenting uses or by experiencing different feelings during the same session. Nevertheless,

these two last forms of SPU are more related to the second component of this optimization: intensity.

As emphasized earlier, respondents commonly employed verbs, such as, "counter", "intensify", "calm", "equilibrate", "balance" or "annihilate" to characterize and describe the motivations and the effects expected from their polyconsumption. This suggests again the ability developed by the recreational polyusers for choosing and using drugs in order to modify at will their psychological and/or physiological state(s). These changes seem consistent with those targeted through the use of one single substance. But, contrary to their "mono-substance" consumption, the polyusers frequently employed hyperbole or superlative expressions such as, "super-relaxed", "make the night bigger", "completely smashed/excited", "sublimate the effects", or "ultimate combination" to describe the effects of their polyuse.

This search for "sublimation" incites to conceive SPU as intentional practices, but also as usage oriented toward the maximization of user's pleasure and performance. Coupled with the management of effects duration, these different forms of polyuse should be reconsidered through the theoretical perspective developed in Section 5.1.3. Henceforth, the polyuse practices, such as, *changing*, *enhancing* and *pilling up*, could be seen as maximized responses to the social norms of performance and self-reflexivity; while *controlling long-lasting effects* would be related to the management of this maximization, guaranteeing, at least partially, the control of the impact of these practices on the daily life of users, and, correlatively, on their autonomy. The previous developments seem to indicate that Simultaneous Polysubstances Uses constitute the climactic and paradoxical responses of individuals to the norms of autonomy and performance inherent in the late modernity.

The polysubstance use is paradoxical because these climactic responses to the late modernity norms appears to be in direct contradiction with the self-reflexivity required from individuals — the construction and management of individual's own 'life project' — inherent in the risk society. If polyusers increase their individuality and autonomy through the polyuse by multiplying at will their psychical/physical states, they also put a higher pressure on their mental and physical health. Indeed, research concerning the health risks of SPU has pointed out that these polyuse practices are accompanied by an augmentation or a potentiation of the neurologic or physical harms²⁰⁵ [305-307].

Therefore, on one hand, the injunctions of performance and autonomy constrain the recreational polyusers evolving into the current western societies to maximize their autonomy through the consumption of several psychoactive substances; while on the other hand, the risks associated with these practices — addiction, long-term harms or fatal accidents — are potentially reducing the performance and autonomy of the users, and put in danger the good realization of their 'life project'. The recreational user is consequently confronted to a paradoxical double injunction: "being yourself in your best day" and realize your life project; while remaining in good health shape and staying out of addiction, harms and social issues. By extension, the risks inherent in the different forms of SPU could be understood as products, outcomes of the late modernity.

Therefore and, in order to maintain a balance between drug use and integrated social life, it is argued here that the recreational users tend to develop several rules and sanctions that generally modify their

²⁰⁵ A good illustration is the example of cocaethylene forms by the combination of alcohol and cocaine. Once in the organism, this substance increases the risks of neurological accidents (intracranial hemorrhage and cerebral infarction) and hepatic complications due to the extensive consumption of alcohol and seems to augment the chance of myocardial infarction and cardiac arrhythmias [Landry, 1992; Farroq, Bhatt & Patel, 2009].

routinized practices [152]. The different sanctions and rules that can be qualified as being *techniques of control*, already exist during the instrumenting and switching phases and are employed for specific situations (essentially, for hallucinogens uses). However, in the "Slowing and Selecting" phase of the recreational polyuser's career, these control techniques become integrated, routinized, and employed before and during the course of the drug use sessions. The omnipresence of these control techniques has for main consequence to frame and delineate — in terms of duration, intensity and outcomes — the recreational drug use practices. This evolution of the recreational practices toward a higher level of risks control marks the turning point between the "instrumenting and switching" phase and the "slowing and selecting" one (some respondents refers to this change as "stop being out of control"). It is important to specify, here, that the entry into this slowing and selecting phase does not mean that the individuals cannot reenter in a phase of instrumenting with a higher frequency and dosage of use.

The exact nature of the rationales of slowing and selecting will be detailed in Chapter 6, as well as the different techniques of control.

Chapter 6. Slowing and Selecting: Autonomy, control, and second-order deviance

[LittleDevil, F93, male, 29, general]
I do what for me is manageable.
I try to control my addiction.

As discussed in the conclusion of Chapter 5, the instrumenting step of the recreational polyusers drug career is followed by a phase in which the control over usage becomes predominant. In the interviews, this augmentation of control has two main consequences: a global reduction of drug use ("Slowing") and a cessation of some specific forms of instrumental use and polyuse ("Selecting"). These two particular moments are attained through several "control techniques" developed throughout the individual experiences. However, the analysis of empirical data suggests that a labeling process inside the social group of users as a whole is at the origin of the development of control techniques. The following sections aim to describe the two moments of the last step of the recreational polyuser drug career, as well as the elements that need to be controlled and the different control techniques themselves.

The Section 6.1 examines the different reasons of slowing and the importance of social commitments on the way recreational users select their drugs. Following the idea that these users increase their control on drug-related practices, the Section 6.2 details the different "control techniques" employed by the respondents to stay integrated and

functional. Because these two particular notions appear as central for understanding how the status of the recreational users is built, the last Section 6.3 investigates the role of "staying in control and integrated" in the construction of the "controlled" and "recreational" status.

6.1. Slowing and selecting: process of maturation, social control and drug of choices

First, and in order to avoid misconceptions, it needs to be specified that in this research, "Slowing" differs from "Switching". "Switching" concerns substances, while "Slowing" concerns drug use in its entirety. Contrary to Measham, Parker, and Aldridge [72], the analysis of interviews reveals that respondents do not completely stop their consumption, but continue to use some selected psychoactive substances in preplanned moments by following particular practices. The developments of this section are more limited since only less than half of the interviews respondents (16 out of 38) have attained this stage of their drug career. As could be expected, this group is mostly composed of users belonging to the older group (above 24 years old, with three exceptions). All of these respondents, except one (Picasso), have professional activities — full or part-time job — or were studying full time. Nine of them were engaged in a relationship at the moment of the interview.

As it appears for criminal behaviors, the desistance from drug use ultimately depends on the *biographical situation* (set of consolidated experience plus the actual social position) of the respondents [242]. In their work on the addiction to heroin, Stimson and colleagues [235] identified four main factors influencing the temporary or definitive cessation of heroin consumption for dependent users: aging; realizing

that heroin use becomes more detrimental than beneficial; events modifying their situation (e.g., unemployment, getting into a relationship with a non-user, etc.); and, finally, realizing that heroin use includes several risks (e.g., health, social, law). Although the present research was neither oriented toward addictive use, nor on heroin as a single substance of use, the analysis of the empirical data collected shows some similarity with the work of Stimson and Oppenheimer. In the case of recreational users, the process of slowing down the overall drug consumption appears as a conjunction of several factors:

[Neron, F94, male, 30, about his actual consumption and his consumption of stimulant drugs] Before, it was "no limit"; nowadays it is not really any limit anymore. [...] I no longer have the desire to get it [*NfA, speaking about stimulant drugs*] that way, if one day I may buy it, if the opportunity occurs, maybe I'll take it, and it depends which one. But it will be taken intelligently, in a very specific place, at a very specific time. There is no way that I take in the middle of the week. I would not take ecstasy in midweek. There are plenty of things that I will not do, that I won't do any longer. With cannabis, it's the same: I always try to delay the first joint of the day.

According to the respondents, the reasons for slowing appear to have two main origins: (1) a form of individual "maturation", and (2) an increasing number of social commitments and form of controls that recreational users need to abide by. In order to describe the last steps of the recreational polyuser drug career, the two first two Sections, 6.1.1 and 6.1.2, detail the different factors inducing the slowing phase by distinguishing these individual and social dimensions. The last Section 6.1.3 describes the process of drug selection and analyses the rationales of such choices.

6.1.1. Individual reasons of slowing: maturing out drugs and aging

The concept of "maturing out" was initially employed by Eleanor and Sheldon Glueck [308] to address how criminal offenders "naturally"

removed themselves from criminality and deviant behaviors, due to a gradual reevaluation of the pros and cons of their activities. The process of psychosocial maturation suggests that individuals attempt to self-regulate their behaviors and thus correct behaviors that are perceived as not normative or socially acceptable. As asserted by the 'Role Incompatibly Theory' [309], the behaviors that are not congruent with a social role are more likely to be discontinued. This concept of maturing out has been applied to drug use in the previously cited work of Stimson and colleagues [235], but also in the research of Charles Winnick [310] on heroin users, and by Erich Labouvie [311] in the general drug users population.

These different studies seem to indicate that "matured" users tend to self-limit their consumption as a result of four main factors: (a) a pileup of problematic situations directly experienced or witnessed by the recreational user; (b) the global weariness concerning drug use; (c) the fact of aging; and, (d) the accumulation of social roles and commitments. This last point appears as the most important and will be, therefore, detailed in a separate subsection (6.1.2).

The *accumulation of problematic situations* is gradually built throughout the continuation of drug consumption, which makes the risks inherent in these practices increasingly visible. Moreover, the accumulation of "switches" decisions leaves fewer substances with a positive representational scheme and a positive ratio between beneficial and detrimental effects (Section 5.2.2). The hyper-availability of substances characterizing the actual drug context (Section 1.3.1) seems to have no real influences on the process of *slowing*. This could be partially explained by the fact that users compare different drugs based on their functionality: for example, if an individual has a negative representation about ecstasy, he will not be inclined to consume molecules approaching the chemical structure of MDMA, such as MDA (methylenedioxy-amphetamine), MDE (methylenedioxyethyl-

amphetamine) or DMA (di-methoxy-methyl-amphetamine) known as 'designer psychedelics" and sharing common neuropharmacology with the molecule of MDMA.

Also, the pileup of lived or witnessed problems — i.e., health issues, pedestrian/car accident(s), brawl, or witnessing problems with police — contributes to make the risks more visible and entail a modification in the practices around one or several substances:

[Mike, F95, male, 30, about cannabis] There are some who have had problems with the cops but no more problems than that, I think. [*What was your reaction when you knew that they had problems with cops?*] Others, well, with cops, maybe it made me change. As we age, seeing others getting caught, you become maybe a little bit afraid to go out with something on you. So you avoid walking with it on you. If you can avoid it, you leave everything at home. [*But did it reduce your consumption?*] Probably yeah. Smoke in the street, things like that, I won't do it again, for example. Roll a buzz on the street, I did it back in the days, now I won't do it again. So, you also smoke less during the day. It may have an influence too. During a period, I always had some with me, no longer now.

In the previous example, the representational scheme does not change, but the drug routinized practices was modified to ensure a more adapted use considering the perceived and estimated risks.

The second point, *weariness*, is attained when the recreational users consider that the overall enjoyment obtained through drugs diminishes or when they have reached all the different experiences they wanted to live:

[Jurion, F96, male, 27, about barriers] The buzz for drugs fades away, back in the days and like I said, I wanted to test all drugs at least once, now it is not necessarily something I want to do, so... [...] Barriers have changed, because now I put more limits, because now I have tested almost all drugs ... It makes me less excited than before, because in fact I want to live my life fully, and not need to take things to achieve it ... And still, I have alcohol so it's all good... [Laughs]

, or:

[Youssef, A, male, 29, about his drug career] It would definitely be, I think for me as a teenager, I was really curious about so many things, not only drugs, a whole range of different things. I think the fact that I'm getting older and my curiosity has probably been cured. I feel like my intellect will switch in and go, hang on you don't need to have any more drugs in the sense that I've had enough.

Respondents refer to this state of "lassitude" by using expressions, such as "had enough", "interest fades", "know all sides", "curing the curiosity" or "less interest". This weariness is also linked to the self-perception or self-revaluation of their biographical situation. If respondents "have enough" of these practices, it could also be due to a conscious desire to modify or cease this particular habit in order to start activities or a personal life that some respondents defines as more "constructive":

[Sony, F97, male, 28, general] In fact my 25 years, it was a transition stage because I realized that I had a lot of fun but a part of that, I had not built much in my life, well I experienced a lot of things, it seems to me, but not according to the current norms [standards] [...] Also, I was separated from the girl with whom I spent a lot of time, the Parisian girl with whom I remained until the age of 24. I took a serious (moral) hit. I really took a serious hit because she dumped me because I was stagnating in my life and I was smoking too much weed and I was too zoned. And I was just like "fucking shit, in five years, I have thirty years old but what do I have? What kind of future am I preparing? Yeah, I had good fun but I have to move on otherwise I really wouldn't prepare a good life and it would be difficult for me. Especially, well, there are people I know even at my age or even older for whom there is only getting high that counts and that's all.

, or:

[Nancy, A, female, 25, about cocaine] I'm 25 now, at 23, when I started when it was just always available. Anything that you wanted was available. I was using it maybe four or five times a week. Then I suppose at the end of that when it wasn't always available I would find means to buy it because I wanted it then. It's weened down because I think my head's a little bit matured of, I don't want to be a trash bag five nights a week. I've got better things to do with my time. The sexuality that comes with cocaine got pretty messy. Also, just the wellbeing of health and what is reality

in your brain. Being off your head even one night a week can change that. You need to find some stability. I needed to find some stability in my soul to ground me. Because you can become an egomaniac and think you're the fucking Prince of Persia.

By comparing their current situation with the "actual" and accepted social norms of life, several respondents explained their desire to change their biographical situation. In the last two examples, the maturing process is motivated by the will to slow down drug use in order to "do better things with my life", to "live my life plenty". This change is related to and oriented toward an improvement in the "health" and "well-being" of the users, implying a form of "stability".

These improvements seem to be also linked to the inability of achieving "normal" social activities if they maintain the same degree of consumption:

[Sony, F98, male, 28, general evolution] There was a time, well for a long time until I was 24-25, my limit was the physical limit. Basically, I took all that was within my reach until I felt that I was burnt out and I had enough. Now, it shouldn't stop me from having a normal activity when I have to have it. This means that for example, if I have to manage stuff on Monday, I won't get dead high because I have to be in good shape to do it. [*So you have more time to make something else?*] Yeah, I have more free time to do other things and that's it, I like to go out and get smashed a little bit from time to time but this is what makes me hard-on in the morning when I wake up, telling me: "This weekend, it's gonna be the orgy..."

These precedent developments illustrate the importance for the respondents to guarantee their 'life project' and, therefore, abide by the injunction of self-reflexivity.

As partly indicated in the previous extract, the third factor that can influence the process of slowing down is *aging*. The impact of getting older as a cause of slowing down appears in almost all the interviews of respondents aged of 28 years old or older (there are two exceptions, but

their situations will be discussed later in Section 6.3). Older respondents explain that they had to reduce their frequency of use and quantity of substances consumed during a session, because the time needed to recover from their intake sessions become too important and made impossible to fulfill other activities:

[Sammy, F99, male, 36, about drinking in excess] I don't want to rip my head off, I want to be up and efficient the next day, I am much more responsible in the way I drink. The problem is that when I do it, my body doesn't follow anymore. [...] I realize that my body doesn't follow anymore. This is the principle, once bitten, twice shy, so you think: "Wow, I'm going to take another pasting and I'll need two days to get over it." This is the kind of thing that I prefer do it on a Friday evening rather than a Saturday night, because I know that I have both Saturday and Sunday to get over it. I know I have my Sunday. To stay at home as a larva because I drank too much the day before.

If the example of alcohol is recurrent in the interviews, the respondents indicate that they have to slow down the frequency of "big night outs" to handle the commitments they abide by in their everyday life. This last point appears as being the most important and requires being extensively detailed (cf. 6.1.2).

6.1.2. Social reasons of slowing: getting a "normal" life and the role of social commitments

As previously discussed, the long-term drug use is generally accompanied by a state of weariness in conjunction with a decrease in respondents' ability to recover from big drug sessions. However, the most salient reasons for slowing down their global drug consumption are related to both *social obligations* and *social control*. References to these obligations and form of control, which are called *social commitments* in this research, play the role of limiting factors and could be found in all the interviews. These social commitments appear and

evolve throughout the life span of the users and affect their drug career by regulating or allowing some specific practices.

The preceding subsection developed the idea that users may reduce their consumption to remain in a physical and/or psychological state permitting them to adjust with their everyday social life and non-drug-related activities. Indeed, all the respondents declare being reluctant to use psychoactive substances if they have to execute important tasks or interact with significant persons. In the interviews, *work*, *finances* and *partner/family* appears as the three main social commitments that recreational users respect the most. The following paragraphs examine the reasons and consequences that these social commitments have on the drug career of the respondents.

Amongst these main social commitments, work remains the most cited and appears as the most important of them. The necessity to be capable of working and/or performing in the different responsibilities inherent in their employment, forces the individuals to exclude the "Intoxicated" instrumental use and to limit their practices to substances and/or moments:

[Youssof, A, male, 29, about cannabis] I just really felt that it was overtaking me and on top of that 'cause I've got a lot of responsibility at work, as the responsibility climbed up I realized that, okay I can't keep this up with the same amount of weed otherwise I'm just not going to get my job done and it was really starting pay its toll. I had to scale down on the amount of weed I was smoking, just to get shit done otherwise - you're always a bit dopey the next day and trying to work is always hard.

, or:

[Neron, F100, male, 30, about alcohol/cannabis and social commitments] Job is a factor. Now I have a job with responsibilities, I get up very early in the morning so alcohol is something I banished. I can't get there in the morning and still feel groggy and not remembering what I did yesterday or even at work. [...] There's the fact that I work more than 10 hours per day with the travel time. So during these 10 to 11 hours, I don't smoke. Then, I have to sleep

about 6 hours per day and then I also need to eat [laughs]. It's been 17 hours plus one hour to wash up in the morning and in the evening so it is the 18 hours, you see? [...]

Conversely, the respondents with a non-permanent job or a relatively free schedule are more inclined to continue long or heavy sessions of intake and/or to maintain regular consumption.

The importance of work as a social commitment comes from its interactions with several other aspects of the everyday life of the users, especially with money. The overall cost of substances becomes a limiting factor when the respondents get in a social position where they have to manage their own budget. When the cumulated prices of the different substances do not fit in the budget of the recreational users, these latter reduce or select the different substances they routinely took:

[Soph, A, female, 23, about ecstasy and her consumption in general] [*What made you calm down?*] A part time job, I think, mainly and I just stopped going out as much, I think, was a big one. Yeah, I don't go clubbing at all anymore. I couldn't afford it. My ex-boyfriend was a DJ so I'd go watch him play and then we'd do some ketamine or take some pills or whatever. He'd pay most of the time or I'd pay. I don't know, just the money was there. Now I'm living out of home and I'm not really working that much and I want to go away at the end of the year. All these aspects of wanting to do something with your life stops you from being able to afford to do drugs as often. You have to commit more to things. I know that if I do ecstasy, I'm not going to be able to do anything the next day or I don't want to, and I'm not going to do that to myself.

, or:

[Nancy, A, female, 25, about budget and normal life] If you can't afford to go out then you can't afford to - if I've got a certain birthday party or something on then I will budget for that. I've got a cat and she needs to be fed. If she doesn't get fed I can't - I've got rent to pay. I'm adult enough to know what my boundaries are to make sure bills are paid and keep everything in balance because you can't enjoy it.

The fact of wanting to "commit more to things" and "paying the bills" oblige the users to behave financially in adequacy with societal expectations. The respondents, who generally consider being responsible as a necessity to progress in life, see this adequacy as a sign of maturity. Indeed, several respondents explain that some practices and substances are perceived as immature and reserved to younger individuals.

Neron, who was working 50 kms away from the place he lived at the moment of the interview, explains that needing his driving license has strongly influenced his practices regarding alcohol and other psychoactive substances:

[Neron, F101, male, 30, about alcohol] It's also the driving license, it's also having another responsibility with laws where you're not allowed to drink or just a few to take the wheel, so already there are those elements that henceforth, just with the [legal] frame that is around me, I'm limited. For example, when I drink, once in a week basically, I go by foot and I found a bar near my home, I drink one to two glasses of 50cl, no more. One liter of strong beer, once a week.

"Having responsibilities in front of the law" is a direct consequence of the will to obtain a "normal" and well-integrated social life. Work is the warrant of such integration. The different elements gravitating around this social integration (i.e., driving license, respect of the law, finances to pay for bills and/or projects) become social commitments, and, by extension, a form of social control, that interfere with some or all of previous drug-related practices.

The last of these social commitments is a *partner* (and by extension, children). Respondents from both genders tend to indicate that being involved in a relationship requires to an adaptation to the partner habits regarding drug use. This adaptation generally entails a

diminution²⁰⁶ of their consumption and/or a modification of their practices:

[Marie, F102, female, 21, about the impact of her partner] I have a boyfriend for almost a year now, and it makes me become calmer and changed me. And my best friend is a little bit calmer, but I also know that she still takes things from time to time. [*Does your boyfriend slow your consumption?*] Yeah, completely. But, he smokes joints that's maybe why I smoke a little bit more now. But, for everything else, he calmed me. This is about that time that I stopped everything.

, or:

[Jacko, F103, male, 31, about his ex-partner] [*Do you consider that during the time you were with your ex-partner that you had significantly calmed down your use regarding of your current expatriate life?*] Compared to my consumption, yeah. It is obvious that I wasn't any more in that at all. I wasn't going out that much. I wasn't seeing my buddies that's it. Sure. I don't know if it's direct consequence, but with this couple life, I had gotten away from it really. [...] This is something [drug consumption and stimulant session] that I'd maybe go to do again if I become single again or if I'm with someone who understands it, that's the thing... If I'm with someone who understands it. So if I'm with someone who does not understand that I take drugs, okay well, that's it! It also depends on the job, your social life in general, it's a whole. In fact, it is social. If socially you can afford it or not, I think. For me, because I am not working at the moment, I'm not so much socially inserted here, I have friends, but I have no job and I am not in a relationship... Well I do have a little bit of a couple life but hey, this is my future ex ... (laughs), it's not very ... [*This is already your future ex?*] Yeah, but you know, that's interesting because she is taking drugs and in fact I don't like it. I can't be close to someone if she takes. That's it. It's pretty funny. I think my promise will be someone, who has tried it but which no longer takes it.

Moreover, all the female respondents assure that becoming pregnant or having the project of being pregnant would lead to the cessation of all psychoactive substances:

[Nancy, A, female, 25, general] I think I have always been consciously aware of my health. I'm very aware of what

²⁰⁶ There were two cases in the interviews where a relationship has led to an increase or a modification of the practices of use.

goes into my body, being fit and healthy and eating organic food. It's always been a big part of me. I've been a bit of a hippy. I look forward to starting a family in a few years and being healthy and passing that on to my children. I don't want them having all sorts of fetal syndromes from drugs that I have done in the past and continue to do.

As just discussed, the process of slowing is related to individual and contextual elements that appear throughout the life span. These elements affect the different members of the group of recreational users, who progressively lost their illicit drug-related contacts. This fact creates by extension a situation where the individuals who are still in a phase of drugs "instrumenting" get a limited access to the different substances they might use:

[Neron, F104, male, 29, about access to drugs] I got older; it became less easy to get drugs for me. I'm no longer in the right environment or with the right entourage for being able to source it. I would have to initiate some bigger steps to try to get some.

, or:

[HandyCool, A, male, 25, about stimulants] I guess my social life changed. I wasn't going to dance parties and wasn't hanging out with people who used it so much. So it wasn't in my periphery and so that led me to stop taking it. [...] I think it was very particular to the social environment in which I took it and when I wasn't in that then I didn't take it.

The analysis of the global life spans of older respondents reveals that almost all of them become progressively involved in several social commitments in order to integrate a "normative" social life and, by extension, achieve their 'life project'. Life span events, such as, getting into a relationship, becoming a parent, finding a stable employment, and/or having to pay rent and bills participate to this integration. Drug usage is, for older respondents, perceived as a risk factor, due to their potential adverse effects and/or affects their daily obligations, to the right achievement of their 'life project'. The incompatibility of some drug practices with the continuation of everyday life orients the choices and

decisions of recreational users toward specific substances and/or practices detailed in the next section (Section 6.1.3).

6.1.3. Selecting: manageable practices, controllable drugs, and "special occasions"

Despite the various individual and social reasons for ceasing drug usage, the respondents getting to that stage do not completely stop their consumption of psychoactive substances. It appears that they tend to select some substances for regular uses and/or "save" specific drugs for particular occasions:

[Youssef, A, male, 29, about his drug career retrospectively] I feel like I think now with about to turn onto 30 I'm conscious of how many big nights I've got left, as far as what my body can take. I think my body can take a lot more but as much as how much I want it to take, I'm starting to get more and more conscious of my liver. I think I'm just starting to be overall more conscious. So as far as my career's gone, I really feel that I started off with a big bang and really went, okay I'm going to try as much as I can and then found through chance and environment alcohol was enough to support me for a while. Then just sort of stayed on that phase for a while with alcohol. Then realized I needed to change jobs and really needed to try everything again and then I went for a second attempt at it. A bigger one with more money and a bit more brain on how alcohol can be mixed in and weed can be mixed in but then realized as well that I couldn't keep on doing that forever and so I've slowly slowed down. So now the career more like I'm starting to take on - I guess I'm going to slowly retire out of - part time retirement out of drugs, especially the stronger drugs and just enjoy when I have drugs now, it'll just be on the odd occasion and something very specific that I want to feel and in a group situation and so in that way you can get the optimum benefit from it rather than just being, I'm just going to take this for the sake of taking it.

, or:

[Nancy, A, female, 25, stopping and selecting] [*How do you make your decision to use drugs or not?*] It can be a big decision sometimes to whether or not. Something like that has been in my head a lot more this year than any other year. I have been conscious of actually stopping taking

drugs altogether and consciously trying to stay away from them. Because I know how big it was to get over the last couple of years and how long it's taken me to get to where I am now in some sort of sense. But I also know that I'm 25 and I live in Pots Point and I like to go out.

This "part-time retirement out of drugs", where drugs are kept for "very specific occasions", characterizes the second feature of the "slowing and selecting" phase. This one is, nevertheless, related to a particular decision process. The decisions concerning whether or not to take drugs and the choice of the substances to consume remain similar to the description given in Section 5.2, but users seem to integrate a stronger form of risk reduction or risk management in their choices. Indeed, the respondents explain founding their selections and decisions on three main criteria: the *"usefulness"*, *duration*, and *controllability* of these drugs.

Concerning *usefulness*, several respondents indicate that they select drugs that potentially increase their wellbeing in consideration of their everyday life and biographical situation:

[Mike, F105, male, 30, general] [*Does your polydrug use have changed over time?*] Between my 20 and my 30, you see that there were peaks but... (silence) Everything I tried, I tried thoroughly! It lasted a year, let's say. When I said that there was nothing more to do with it: that is, I've seen from every angle. [*You still have not finished with cannabis?*] No. It's not that I haven't been around but I like it, it helps me to live well, it's like a good beer. And I don't see it as a drug as long as I'm not using it every day. I'm done with smoking to smash my face all day long, that's for sure. Smoking a little spliff in the evening is always good! [*And what do you think of cannabis now?*] I think you can still be in danger with it, in the sense that you can get quickly to the point where you smoke all day and there you ruined your whole life. Now, if you manage to make a rational use, which not stop you from living your everyday life, I don't think it is that dangerous.

This usefulness is still related to one of the different social norms enunciated in Section 5.1.3. However, if, in the last extract, the substance is preserved, the "Intoxicated" mode of consumption of

cannabis is abandoned, while the "Relax" one is kept. In a general manner, respondents exclude from their regular practices the "Intoxicated" function, consisting of "disconnecting" from reality/"losing control" (Section 5.1.2), mainly because this instrumental form of use is in direct contradiction with the logic of control gradually integrated by the recreational users. Nevertheless, the "Intoxicated" instrumental uses could be reactivated for "special occasions".

These "special" or "big" occasions — birthdays, New Year's Eve, celebrations or some music festivals — are planned, isolated in time, and generally considered by the respondents as "exceptional" social events, where they "grant an indulgence" concerning certain practices and substances:

[Youssef, A, male, 29, about ecstasy] So we only just had a small amount and just - but we had a lot. Since then, since that year I slowed down a bit because I realize I just hated to come down. I was just getting to the stage where I was just sick of the fear, sick of feeling that. So slowed it down quite a lot and saved it for when big groups of us wanted to have it together or a special occasion. So it became very much more, hey someone's having a birthday, we want to have the best night ever so we'll take pills.

Overall, respondents tend to change their instrumental uses toward the "Sociable" or "Relax" functions. These appear as more "adapted" to a biographical situation where social obligations and commitments become the warrant of their life project.

If the "Energy" function is maintained, the respondents tend to modify their decisions regarding stimulants substances, by basing their choices on the *duration* of drug's neurologic action (this duration needs to be understood as the cumulated time encompassing both intake and comedown). Indeed, respondents appear to compare the expected duration of the drug(s) effects, based on their previous experiences, with

their schedule. Therefore, recreational users seem to orient their choices toward drugs with short action duration:

[Jurion, F106, male, 27, about ecstasy] The problem with ecstasy is that it's a "heavier" drug: the next day you aren't fresh at all. Generally, I do not take it if the next day I got something to do, because I know that if I take ecstasy, I'll end up at 6am... it depends what time you take it, but generally you don't take it if it's too late, I am really careful of not taking it if it is too late. If it is 3am or 4am, forget about it. Because otherwise you're on it until 9am-10am, even if I only work during the evening after that...because you're spending some much energy beyond normal that your body is ravaged the day after. So it's really a drug that I can take if the next day I got nothing to do.

, or:

[Sony, F107, male, 28, about MDMA/LSD and social commitments] It is certain that for example, if you really have a really important thing on Monday, you'll maybe go over it easy, you maybe have ecstasy rather than LSD because you know that E will last 6 hours while LSD, even if you take it in the evening, the next day you're still in it, you will still be zoned. With E, even if the next day you're still in block, it will be easier to manage anyway.

By using short duration psychostimulants, the respondents try to limit the duration of the comedown to a period of time that is not affecting the right achievement of their daily obligations. In the neurological language, "short duration" for a stimulant means that the substance has a short half-life (Section 2.2.2). For example, respondents, while aging, seem to prefer cocaine rather than other types of stimulants. This choice is based on the expected duration of cocaine: the respondents generally consider that the effect of cocaine wears off after 30-45 minutes [161], which corresponds to the neurophysiologic half-life of this substance; while the effects of amphetamine-type substances last for 12 hours and 8 hours for MDMA-type drugs [160];

[Toulouse, A, male, 25, about speed and cocaine] It's a lot better than speed because it wears off quicker and you can do it and not have to worry about any consequences.

, or:

[Mike, F108, male, 30, about cocaine vs. other stimulants] You're not ravaged [with cocaine], you're not completely

zoned, you can have a discussion. You can be clean, well at least, you can look clean. You're not struggling let's say, you don't have a hard time. Anyway, it's pretty mild effects, I would say. It's not that strong. The feeling! You don't have a strong... Well you have a short high but compared to other [stimulants], it's not that strong. That's maybe why we go to that sort of things when getting older.

This criterion is also employed to choose amongst substances that target the same instrumental use. For the 'Relax' type of instrumental use, alcohol tends to replace other substances, due to its short duration and social acceptance:

[HandyCool, A, male, 25, about alcohol and other relaxants] I guess the big bonus of it is it's easy to acquire and it's got a short term. You know it doesn't last for 10 hours. You can have two drinks and you can be relatively normal four hours later, which is a benefit to it. I guess also the benefit is that it's widely accepted by so many people therefore it crosses cultural barriers and gender barriers.

Short durations allow the recreational users to become "relatively normal" after a short time and capable of fulfilling their everyday activities despite that consumption. The short duration of the effects also facilitates the integration of this type of consumption in busy schedule inherent in the augmentation of social commitments coming with age.

Finally, the last criterion cited by the respondents that influence their choices regarding substances is their ability of *control* over the substance. This notion, which will be extensively discussed in the Section 6.3, recurrently appears in drug's intake stories and is frequently associated with terms related to the notion of risk. Respondents try to be more in control of the potential detrimental externalities and eventualities that can happen during their sessions:

[Jacko, F109, male, 31, about cocaine/ecstasy] And that's what bothered me when we were talking about effects of pill, of E: there were some moments when I was overwhelmed and there were times where if something would have happened, I would have been unable react. Especially because you can't see at more than two meters

around you. So this is also annoying to have a very limited sight, not knowing how to react... Damn, it pisses my off in the sense, I like to let myself go, but not to that point... that's what coke allows you: you let it go, you can go far but you know how to control. That's why it's a little bit more a "grown-up" drug. Youngsters, maybe they like to let it go completely, they are in adolescence. Cocaine, it's an older drug.

If in the previous stages of their drug career, the decision of using psychoactive substances was oriented toward a form of social integration ("Starting and Learning") or based on the instrumenting of psychoactive substances to achieve specific goals ("Instrumenting and Switching"). In the "Slowing and Selecting" phase, this decision is characterized by a rationality oriented toward the control of drug' usage, this control aims to manage and reduce the risks inherent in these practices. Moreover, the analysis of the interviews reveals that the risks perceived are not only associated with physical/psychological harms as indicated in the two previous drug career stages. Indeed, the respondents also explain their reasons for staying in control of their consumption by referring to several risks that could be designated as "social". These factors are examined in the next section.

6.2. Risk and control in recreational polydrug use: perceptions, techniques, and motivation

The perception of risks inherent in recreational polyuse evolves throughout the drug career of users (Sections 4.2.4 and 5.3.3). These risks move from an apprehension of short-term and irremediable harms during the starting and learning phase, to a fear of long-term effects and dependence in the instrumenting and switching period. The section 6.1 has developed the idea that recreational polyusers, once reaching the stage of "Slowing and Selecting", search to manage their

consumption by banning practices and substances that can potentially lead to a loss of control. Because this loss of control becomes the main perceived risk by the respondents, the present section aims to investigate the different aspects related to this type of risks.

In order to do so, the first section (6.2.1) examines the various elements that respondents point out as requiring to be managed during their intake. These elements are handled through different control techniques, which will be described in section 6.2.2 and illustrated by extracts coming from both users in their “Instrumenting and Switching” or “Slowing and Selecting” phases; and, finally, the section 6.2.3 describes and discusses the main *because* motives attached to this necessity of control.

6.2.1. What need to be controlled: "face", consumption, and autonomy

As aforementioned, respondents perceive other risks than these related to physical or psychological harms. Indeed, the analysis of interviews reveals that recreational users aim to stay in control of their behavior and appearances in public, but also of the social consequences of their drug intake. For the respondents, the presentation of the self while under the influence of one or several substances must remain within some boundaries. These social requirements are consistent with the interactional theories of Erving Goffman. He highlighted the fact that individuals behave in concordance with what other interactants expected. According to Goffman, the individuals need to preserve their *face* during interactions if they want to appear as normal people [312]. Goffman defines the notion of face as: "the positive social value a person effectively claims for himself by the line others assume he has taken during a particular contact. Face is an image of self-delineated in terms

of approved social attributes"²⁰⁷. It is important to note that in the conception of Goffman, face should not be restrained to the body but "rather something that is diffusely located in the flow of events in the encounter and becomes manifest only when these events are read and interpreted for the appraisals expressed in them"²⁰⁸. In the case of recreational polydrug use, the empirical material indicates that *losing face* corresponds to situations where the users consider their own "image" as repellent or disgusting or if they consider some of their actions as being "out of control":

[Maggy, F110, female, 31, about heroin] I was unwell, I knew that I was sending a crappy image, of pure shit that can't even stand up and that can't even articulate properly. It was really that, a lass who was in pain, a shit, a human wreck. It wasn't at all what I was looking for.

, or:

[Billy, A, male, 22, about alcohol] I feel that it is somewhat wasteful. I still feel it's enjoyable, but I know that drinking for four or five years has taught me that you end up doing things that are very embarrassing if you don't actually control the amount you consume. You can actually feel quite bad about yourself. So now, my opinion is that it's a precarious drug, meaning it's kind of dangerous. You can go either way with it. You can have a good night or you can have a really embarrassing one... [...] What I dislike is that in that being so comfortable, things can come out of your mouth that you don't quite expect. Or you can do things that are just horribly stupid, you'd never consider if you were sober. [...] I don't like that nature of it, that you actually lose control of what's normal, what would be regular. If you lose that control, you can really go over the edge. I don't like that, that you can be there. It only takes a few people erring you on, or like a few extra drinks that can make you do something particularly stupid that you wouldn't - can't even fathom, in how you could have attempted something like that.

The previous extracts demonstrate how respondents tend to modify their practices to preserve the face. Another aspect of the face, *speech*, is also an element that requires to be controlled. Several respondents

²⁰⁷ Goffman, E. (1967) *Interactional Rituals: Essays on Face-to-Face Behaviors*, Transaction Publishers, New Brunswick, p.5.

²⁰⁸ Goffman, E. (1967), *op.cit*, p. 7.

indicate that they retrospectively regret some of their night-outs, due to excessive consumptions and the damages cause by the "embarrassing" things said. This type of damage arises from the judgment of peers or peoples considered as important for the right achievement of social obligations.

More frequently, respondents refer to distinctive physical traits that need to be controlled while in a public environment. The distortion of some facial traits, erratic behaviors or visible signs of intoxication (i.e., incoherent speeches, bloodshot eyes, dilated pupils) generates what can be called *temporary stigma*. The respondents generally perceive these temporary stigmas as easily noticeable and potentially leading to labeling as a drug abuser by both recreational users and non-users. In their interviews, respondents describe how they try to avoid being "obvious" or "out of their faces" by reevaluating their practices:

[Billy, A, male, 22, about ecstasy/cocaine] I'd be very reluctant to take ecstasy, although I've done it, because I don't like it. You're very obviously - I don't like to be very obviously on a drug. You can control the way you look more on cocaine than you can on ecstasy. Ecstasy is different. Yeah, you can't - you talk crap and your mouth doesn't move properly. Cocaine is more - so they say, but you can actually focus and have a conversation. When you do talk, you're extensively more confident than you usually are. You say things you wouldn't normally say and tell people very frankly and honestly about things.

Nevertheless, users' *behaviors* during intake(s) remain the main element cited by respondents as requiring to be managed. Respondents seem to emphasize the necessity to "keep the control", to "remain responsible" for their acts, but also to be able to react to problematic or dangerous situations that can arise during nights-out:

[Jacko, F111, male, 31, about control and responsibility] [You told me that you didn't like in the others behaviors was the loss of control?] Loss of control, and those you must manage. It was a time, it made me laugh. Now, it doesn't make me laugh at all. Having to deal with someone ... people who drift like that, I think it really sucks [...] you may laugh at me, but I like the responsible drug. I know

that when I drink, when I'm drunk, for example, it might happen something bad, I think I'd know how to react, I think I would still know how to react. Especially with alcohol, this is the kind of thing that makes you want to take something and especially when you're drunk, you can't realize what you take and then you can do crap.

, or:

[Neron, F112, male, 28, about alcohol] Alcohol can make you lose control, to get you fly off the handle. There are many people and I am the first, after a heavy alcohol intake, I woke up with black holes, I do not know for some time, a few hours... What I did, where I was, what I did say, and I think it's really panicking. It's a pain, because it's not having the control over something you've been, over what you did and you don't remember anymore. And it is a danger, because if you lose control at some point during your night-out, it can be dangerous for others, but finally it can be even more dangerous for yourself. Yeah, that's it, and the danger is that you see the risk less coming, because you're more relax, more zen, more cool, so you're less apprehensive about what can happen and you can fend up in difficult situations.

As just indicated, respondents consider that every drug user should be able to have control over their actions because they are representing a risk to affect their own life and the lives of others, but more likely because losing their faces is against the normative rules of social interactions.

Hallucinogenic substances constitute a good illustration, even if climactic, of the different previous points. Most of the respondents consider that hallucinogens should only be consumed in private settings within a group of people that are also consuming hallucinogenic substances. First, because the behaviors exhibited while under the influence of hallucinogens appear as outside the borders of "normality" and could be easily perceived and considered by others as "madness" or "erratic"; and, second, due to these behaviors, the communications and interactions with other persons that have not used hallucinogens appear as impossible, increasing the impression of abnormality:

[Neron, F113, male, 28, about magic mushrooms] Then it all depends on who you are with, the more people around will be communicative and the more you like them, the more it will be okay. Generally, if you are with people who are strangers, you're not reassured. And because you don't control that much the state you are in... because the guy who took mushrooms doesn't control what he does, it's pretty rare. You're a little bit like an alien, if you're not with people on mushrooms at the [same] place ... If you are with other people who are not on mushroom, it will not necessarily be great and even manageable, because you'll be more than noticed.

, or:

[Jurion, F114, male, 28, about magic mushrooms] With mushrooms, you gonna be serious for five minutes and you'll be laughing, you're gonna look at yourself trying to be serious and you'll blow your fuse alone. Or you're talking with someone and suddenly you're going to be like "WOOW" watching a fly flying. You're like a mental patient on mushrooms. People can lock you up.

Concerning the overall consumption, the last point requiring control concerns the maintenance of the entire social life of the user: their *autonomy*. As already pointed (cf. Section 6.1.1), the respondents consider that the different elements guaranteeing the fulfillment of a "normal life" (i.e., employment, finance, health) should not be affected by their recreational consumption. As a consequence, the recreational polyusers tend to plan more carefully their consumption, trying to manage and frame all the different aspects of their life that drugs could affect:

[Neron, F115, male, 28, about cannabis] With drugs, you must take them intelligently, knowing when, knowing yourself; you must know what the effects are of the substance have on you and if you don't want it to manage your life... You choose what you watch on TV, you choose what you're going to put on your plate, you know what time you eat, it's a bit the same with drugs. At 28 years, that's it, it is canalized, it is managed and budgeted... I can even tell you how much it cost me almost daily.

The ability to "canalize" and "budget" drug use rely on several rules created by the individual in order to remain able to live a "normal life".

Indeed, according to Zinberg [152], recreational users have to develop specific techniques of control if they want to manage these different aspects of their life and remain in control of their uses. These control techniques could take on several forms that are described subsequently (6.2.2).

6.2.2. Techniques of control: rules, management techniques and sanctions

In this section, the different *sanctions* and *rituals*, (Section 1.4.2) employed by the respondents are described to highlight and update the techniques of control employed by recreational polyusers. These techniques appear as being developed throughout the user career to answer to situations that have become problematic. These control techniques help to integrate drug use into the daily schedule of the individuals, this schedule being shaped by the different social obligations the recreational users need to abide by. These techniques act on the decision process by affecting (1) the choices of functions and way of consumption; (2) the way of acquiring some substances, and; (3) the moment and place of use or the overall quantity consumed.

1) Control over functions and route of administration

One of the most common forms of control found in the interviews consists in *avoiding particular substances or practices*. This form of sanctions could take the form of several rituals: (a) avoiding instrumental use that can induce a loss of control; (b) stopping specific route of administration, or (c) ceasing the use of one or several substances. The first form of this technique, avoid the "Intoxicated" instrumental use as already been described in the previous section (Section 6.1.3). Concerning the second technique, it has already been aforementioned (Section 2.2.1) that psychoactive substances could be administered through different ways depending on their immediate and readily chemical forms. For example, cannabis could be smoked by

using a water pipe, as a cone or joint, with the adjunction of tobacco or in a "pure" form; heroin could be snorted, injected or smoked in the same way as cocaine, which can also be transforms into crack or freebase. Amongst the different routes of administration possible for each substance, the respondents generally abandon practices entailing a rapid loss of control:

[Pablo, A, male, 25, about cannabis rules] I never smoke - I do have rules about this, I guess as well. I very, very rarely smoke during the day. I'm a bit useless once I'm stoned. I can't really do anything so I know it's best for me to smoke once I've done my duties for the day. So I smoke at night. I only smoke joints. I don't smoke bonges or pipes.

, or:

[Toulouse, A, male, 25, about alcohol] You could actually get alcohol poisoning and I don't think - if you can't tell that you should stop, then you shouldn't be drinking. But I mean that doesn't work all the time. 'Cause you could go to a bar and drink 10 shots and not feel anything for 10 minutes - then it's too late. That's why I don't drink shots. Try not to anyway. I prefer the actual drinking. Hanging around the pub with a beer and talking to people while I drink as opposed to just getting drunk.

The third form of this control technique consists of *avoiding particular substance(s)*. These one are generally stopped either due to the way they affect the work/study/finances of recreational users or because it is considered as potentially addictive:

[Picasso, F116, male, 34, about heroin] [*Do like the effect of that drug?*] Yes, the effect. That's why I always forbidden myself from taking it because I could fall into it. [...] [*What's your opinion on heroin now?*] I told you that I forbid myself from taking it, but if you put a bag of heroin on the table right now, telling me: "I've got some", yeah, I'll maybe take a line, it would make me laugh, but knowing it, I wouldn't do the move to search for it.

Conversely to a switch (Section 5.3.2), this substance is stopped despite a positive representational scheme.

2) Control over access to substances

The second form of sanction targets mainly the *means* for acquiring substances. As partially indicated in the Picasso's above example, some respondents explain that they try to make drug not readily available by avoiding being in the presence of the substance or *not actively searching* for drugs:

[Kira, A, female, 24, about cocaine] I don't want to slip back into a cycle of doing it all the time. So the feeling is still there of wanting to do it, it's just I know that I wouldn't be able to control myself. I feel like I'd slip back into having it all the time. [*What would happen if there were a line of cocaine in front of you during a party?*] I'd probably do it. If it's free then I probably would. But I don't think I'd go out and actively seek it and pay for it.

, or:

[Mike, F122, male, 30, about cocaine] [*What would make you stop or what made you quit cocaine?*] The fact of realizing how it started to take over pretty quickly. When you start to think about it and you think too much about it, it's not good signal. [*How do you manage it?*] I tell myself that I must resist ... By the way, I avoid going to parties where I know there will be too much of it.

Furthermore, respondents indicate the importance of controlling the social environment while consuming psychoactive substances. In most of the interviews, some of them insist on the importance of being with the "good" or "right" persons to consume drugs. Indeed, this preference to consume into the right environment comes mostly for two reasons: (a) enjoying the moment with people they know and who know how they can react; more importantly, (b) having someone they can rely on in case of problems or someone who know them enough to be indulgent with their potential reactions:

[Neron, F118, male, 28, about stimulants and surrounding people] All these synthetic drugs I always took them with people I knew, I never took by myself or when I took them it was because I knew it would be okay, I was managing. I never really had any problems because I really paid attention of being in good company before consuming, to be well surrounded, and then I never took really huge quantities.

Conversely, several respondents explain that they try to limit their interactions with some users, who are considered as consuming too frequently or in too important proportions, in order to reduce their access to drugs:

[Jurion, F119, male, 27, about ecstasy] As this is a drug that I always wanted casual, like most other drugs, so I won't get around people who will regularly take it because I know if I do so, I'll fall in it [becomes regular consumer], so it's something I took quite regularly with different people.

, or:

[Nancy, A, female, 25, about hyper-availability and control] Because I'm in control of what I buy, drugs don't sort of just pop up here and there. I consciously will go and buy them these days more so. That's why it's even more for a special occasion because I don't hang out with some of the people I used to hang out with that used drugs all the time. Drugs are always available. I made a conscious decision to not be around that because I don't want to be around that. But if I know that I'm going to have a big night then I can decide what I'm taking and then if I'm a bit wasted I might polydrug use.

This technique — *disconnecting* — could produce drastic changes in the social environment of the users (in terms of peer's networks). Some respondents explain how they had to "break off all contacts" with some of their peers to remain in control of their consumption. This is particularly the case of respondents who had an "addictive episode" and try to cease their addictive practices (this point will be extensively discussed in Section 6.3.2). In the interviews, these two techniques — disconnecting and avoiding particular substances — have been cited regarding drugs with a high potency of addiction. Generally, these rituals concern cocaine, heroin and methamphetamine.

3) Control over time and place

A third frequent form of control technique consists of modifying their drug-related *routine*. The most current form of this change concerns

respondents who are full-employed. These one indicated that they rather confine their recreational practices to specific moments of the day or days of the week:

[Youssef, A, male, 29, about day and drugs] [...] I don't take ecstasy during the week and preferably if I'm going to take it, take it on a Friday night. So then that way I've got the weekend [to recover], yeah. It's very much around recovery. Alcohol as well. I'm not going to have too much drinks during the week 'cause you've got to recover but on a Friday night, different story. Friday or Saturday night, different story. Weed, try and limit it to Friday night so that way - Friday or Saturday night, maybe a Sunday afternoon but definitely not during the week anymore. So really everything has been focused on having it only on like a Friday night or a Saturday night mainly.

, or:

[Pablo, A, male, 25, about cannabis] I very, very rarely smoke during the day. I'm a bit useless once I'm stoned. I can't really do anything so I know it's best for me to smoke once I've done my duties for the day. So I smoke at night.

Most of the older respondents confirm that they avoid taking drugs during weekdays and try to *limit to weekend* their usage (Sunday to Monday night excluded), which does not affect their activity during the weekdays and leave some time to recover from the side effects of their consumption. Some, as Pablo, indicate that they limit their consumptions to the end of the day once achieve all obligations.

In the same vein, the recreational polyusers could *reduce the frequency* of particular substance consumption to keep the balance between recreational drug use and their everyday life:

[Jurion, F120, male, 27, about ecstasy and his consumption in general] Before it was once every six months, now it became once every three months, this is something that is very casual, it's something I wanted to keep like that, because let's say that from my 20 years, I start looking for information on drugs, so I knew what it was, I knew what the effects were and I did not want to do that on a regular basis. Basically, all the drugs I took whatever drugs or ... well, except alcohol and cannabis, it's really things that I didn't mean to... I didn't want to do that

regularly, I've always been very careful not to make it become current, something that would be like having a coffee. I always pay attention to space [*between intakes*].

, or:

[Neron, F121, male, 28, about cannabis rhythm of use] I try not to smoke in the morning except during the weekend, and I avoid smoking too much unless if I'm at a party, I avoid smoking more than two joints except if I am at a party. That's my limit in the amount and then I try not to smoke before the aperitif [*around 6:30pm*].

As indicated in the last narrative, some respondents explain that they *reduce the dosage* of their intake by fixing a limit for each type of use.

This technique is reinforced by the fact that respondents also tend to modify the type of settings they are consuming in, preferring staying into private type of locations ("my house" or "friend's place") minimizing the visibility of their consumption. For the substances consumed in public settings, recreational polyusers explain that they try to control the quality of the substances by either testing the product or by only buying the substances to known dealers or users:

[Paco, A, male, 27, about ecstasy] With ecstasy I'm a bit more guarded because you don't know the quality of it and you don't know the effects and I've had so many bad pills where I've just felt hazy and faded and vulnerable, like psychically and energetically vulnerable that it's not something I enjoy but it's a bit of a shame because I know that if I got the right pill - like I've had just some incredibly enjoyable, awesome, great highs but because I can't be guaranteed of the quality, I'm pretty careful when it comes to ecstasy but I'll still always try it. I'll still try it but I just won't go out of my way to look for it. If somebody just gave me a pill I'd have like a quarter first and then suss it out.

, or:

[ElPoyo, F122, male, 31, about liquid MDMA] For example, the liquid MDMA than the guy who showed up at the last festival, he put us half a bottle into our glasses and we didn't ask what it was. But then you see the guy who poured himself some, who took some, you analyzed him, he is not completely zoned, he starts laughing that all. You watch out. Even that shot I was careful, I haven't emptied

my glass, I took a few sips, I tasted, and I waited and saw. I haven't taken it on one gulp.

If respondents do not directly reduce the frequency of their use or change their "drug schedule", they generally "detoxify" after large periods or excessive use of substances. This *detoxification* consists of not taking a particular substance or all for a given period of time, which, in the interviews, can get from a few days to one month (respondents generally spoke of two weeks). These detoxification periods generally follow large consumption of alcohol or are found subsequently of extensive and/or intensive usage:

[Gourou, F123, male, 19, about cannabis] [*Did you ever have problems with cannabis?*] Yes, sometimes I had consumed too much for days and days, so maybe being stone and no being able to understand in course, be grounded, being unable to integrate things, not knowing how to synthesize my essays, the mental disorder. [*When that happens, what do you do?*] When it happens, I smoke less. I have a break. [*How is your break generally?*] It can go two weeks to three weeks. A fortnight.

, or:

[LittleDevil, F124, male, 28, about alcohol] The aftermath of binge I say I booze too much and overall I think it's okay ... because I'm regularly going for a fortnight, a month without alcohol to prove myself that I can work in a bar and resist to alcohol and I can.

Respondents also used these periods of abstinence as a neutralization technique (Section 5.3.3). These detoxification periods allow the users to consider that they are not addicted and still in control of the substances they used (this particular point will be extensively detailed in the Section 6.3).

Overall, these different techniques are consistent with the rituals described by Zinberg about usage of cannabis, psychedelics and opiates [152]. However, several respondents indicate that they tend to polyuse to limit their overall consumption. This technique of control is described as taking drugs that either enhance the initial effect or, conversely,

counteract the action of previous intake. Controlling drug use with more drugs is surprising and appears in only three interviews. This practice should be understood as a consumption that forces the users to reduce or slow down their other uses preventing the users from excessive intakes and from a potential loss of control (Section 5.4.2):

[ElPoyo, F125, male, 31, about alcohol and cannabis] In parties where there were no substances [*meaning psychostimulants*], then, that's true that I really consumed more alcohol, and I had some nights where I had "black holes" [*loss of memories*] and where I was doing my "one man show". But that's true that a few joints allow you to drink less. You smoke your little joint and it makes you stone, and it allows you to reduce your alcohol consumption.

Using this form of SPU (Simultaneous Polysubstance Use) to control the level of intoxication requires from the user an advanced knowledge of the different effects induced by the substances added and illustrates, again, that simultaneous polyuse needs to be differentiated in terms of both intake's order and aimed results. Concerning the former, during the slowing and selecting phase, the polyuse practice 'counteracting' allows the user to reduce the duration of action of psycho-stimulant drugs, which were, in the instrumenting and switching phase, employed to either prolong or ease the end of night-outs. More importantly, the *counteracting* polyuse practice, by inducing sleep, facilitates the return to the "normal" cycle, the everyday social-based rhythm.

This subsection illustrated the different techniques of control deploy by the respondents. Overall, the analysis of the interviews underlines ten main sanctions or techniques of control employed by the recreational polyusers:

- (1) Avoid intoxicated practices;
- (2) Avoid specific substances;
- (3) Detoxify;
- (4) Disconnect from abusers;
- (5) Limit to weekends;

- (6) Limit frequency;
- (7) Limit dosage;
- (8) No long-term stimulant drugs;
- (9) Do not actively search for specific substances;
- (10) and, Polyuse.

The *in-order-to* motivations that based the utilization of such techniques are oriented toward the different aspects (face, consumption, health risks, and autonomy) that recreational polyusers attempt to control. According to Hughes [313], a social status comes with "expected technical competence". This thesis claims that the "technical competence" characterizing recreational users is the control over their consumption. Accomplishing such control requires the recreational users to abide by specific rules called here, "control techniques". These rules are informal and are either learnt from experience or acquired through interactions with other users. These techniques are developed and employed to maintain a balance between (poly)drug use and integrated social activity.

In SimUse, these control techniques are acquired or built all along the different experiences or interactions of the agent. It is worth specifying that these rules are, in most cases, conditions added to existing operations and not methods by themselves. Indeed, most of these behavioral rules are directly integrated in the "routine" of the *individual* (Section 7.1.2), in the different "**deliberation**" algorithms (Section 5.2) or within the "**consume**" algorithms (Section 7.1.2). Each substance has a possible set of five rules listed through the different drug-rules attributes (see below). The rules are generated by the *users*, if these one experience adverse effects listed and counted in the mem-behaviors attribute (cf. p.96). The analysis of the interviews does neither allow extracting precise patterns regarding the order these rules are acquired nor on the exact nature on the maximal dosages or frequencies of use, mainly because these values depends on the type of substances and on

the history of the individual with these substances. To palliate these lacks of information, the *users* create rules progressively and by accumulation: if the first rule is already present in the list and the *user* experiences one more time negative experiences with the substances, it generates the second rules and so on. The rules are created in the following order: 1) reduction of frequency; 2) reduction of dosage; 3) substance used only during weekend (named, "OnlyWeekend"); 4) not looking for the substance (named, "NoSearch"); and, 5) definitively cease to use the substance (named, "Baned") and set the value of the associated SocialRepresentation to (-4). The precise functioning of this accumulation is described in the following box:

Individual Attribute 21: drug-rules

Type of values: list of 5 elements

Value: integer, character

Employed in: check-Activity

update-Known-Dealers

check-SocialRepresentations

all consume operations

1) The two first elements serve as counter: if the actual ticks counter indicates a value inferior to the subtraction of the second element (last use) by the first element (frequency), the targeted substance will be removed from the drug-searched list; otherwise, the substance could be consumed in a quantity remaining in the range of the third item of the drug-rules. The calibration of the first item cannot be specified, because these values differ largely from one individual to another and from a substance to another. The frequencies found in the interviews go from one month to twice a year. To palliate this lack of information, the value of this first item has been randomized with a range of 4 to 12 weeks (336 to 1008 ticks);

2) The third element of the list corresponds to the maximum dosage a *user* can consume during a session. This value is compared to the related memUse-day attribute to limit *user* consumption. If the *user* has already consumed a number of doses equal to the third element of this list, this rule will prevent further consumptions;

3) The next rule generated is "OnlyWeekend". If in the list, this rule will prevent any use of the related substance if the virtual "Day" is neither "Friday" nor "Saturday";

4) The rule "NoSearch" acts directly on the **update-Known-Dealers** operation by asking the *user* to replace the known-dealer value corresponding to the substance targeted by "0", that for each iteration of the **update-Known-Dealers** method. It has to be noted that by doing so, *users* can still purchase these substances directly in settings where they are potentially sold (cf. "sell" algorithm p.223) or to one or several of their peers (members of their networks);

5) Finally, "Banned" simply removes the substance from the drug-searched list during the deliberation process.

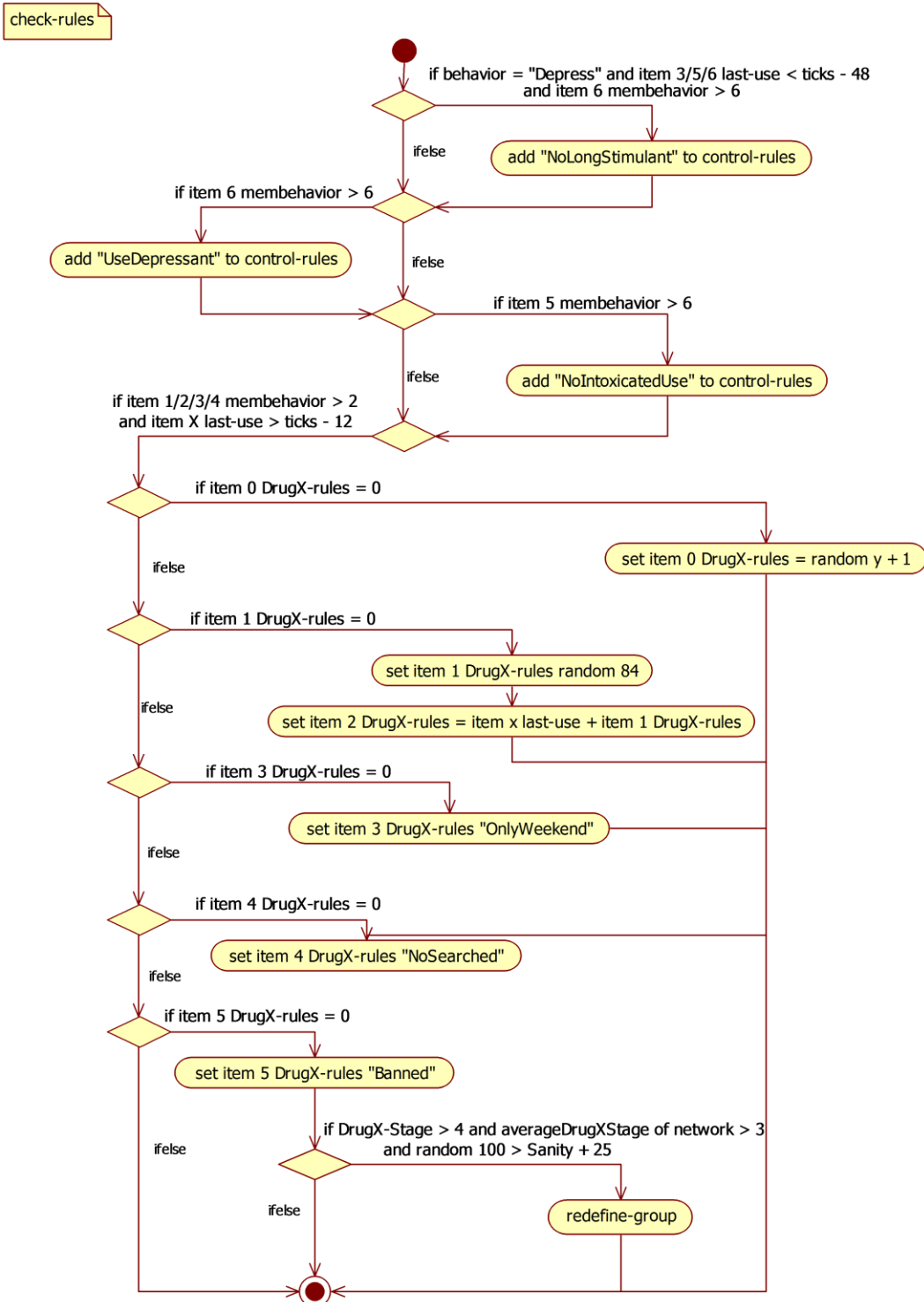
The rituals related to the limitations of frequency or dosage are directly integrated into the consume operations. However, they remain subject to externalities, such as those induce by **more?** or **more-Drink?** methods (cf. p. 309 and p. 310).

The control techniques that are not directly targeting substances are listed and embedded in the control-rules attribute:

Individual Attribute 22: control-rules Type of values: list (character) Value: "NoIntoxicatedUse"; "UseDepressant" "NoLongStimulant". Employed in: update-rules deliberate all consume operations
--

Both drug-rules and control-rules are created when the *user* runs the **check-rules** operation, described as follows:

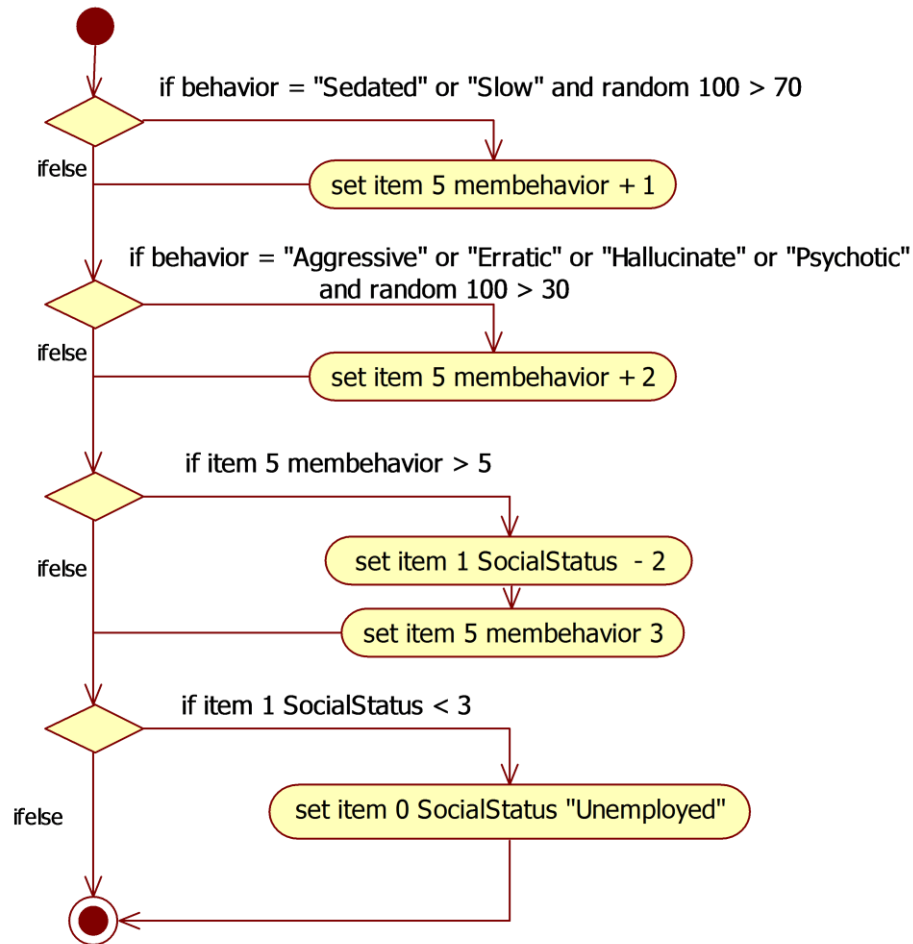
Individual Operation 31: Check-Rules



If one of the item 1/2/3/4 membehavior gets above 2, it is reset to 0 after the execution of this operation. The “Employed” *users* also run the **check-SocialControl** operation to assess the impact of their consumption on their work performance through the **check-SocialControl** operation described

Individual Operation 32: check-SocialControl

check-socialcontrol



This operation represents the possibility for a *user* to lose its employment if its behaviors appear as inappropriate for working. The sanction is symbolized by a loss of the SocialStatus (*user* will have less Cash to purchase substance). Moreover, if its SocialStatus goes below 3, it will become “Unemployed”.

The rule "NoLongStimulant" is directly integrated inside the **deliberate-drug-searched** operation and consists of replacing the values "Ecstasy", "Meth" and "Speed" by "0", if they appear in the drug-searched attribute (cf. p.287). The choice of removing these three substances is based on the empirical material (cf. above) and, on the fact that their half-lives are equal or superior to 8 hours (Section 2.2.2). This rule could arise if the *user* remains depressed in the following two virtual days, in other

words, if the Behaviors attribute of the *user* displays the "Depress" value 24 ticks (2 virtual days) after the last use of long-term stimulants.

Concerning the *disconnecting*, the **redefine-groups** operation is used to represent the modifications affecting the *user's* networks. This one redefines its primary *network*, either if its primary group asks the *user* to change its drug habits and it refuses, or because this *user* does not want to consume a specific substance that members of its *networks* still frequently used (Section 6.3.3). This rule is generated by a *user* either when the substance Stage of this *one* differs too greatly (difference of 3) from the Average-substance-Stage of its *network*, or if the *user* "realizes" that its primary group has a negative influence that can drive to addiction (this last point is detailed in Section 6.3.2).

The **detoxify** method represents the *detoxification* sanction. The functioning of this operation is based on another attribute, named detoxify?. This one acts as a time counter specifying the time period during which the *user* cannot consume any drugs:

Individual Attribute 23: detoxify?

Type of values: list of 2 items

Value: (Boolean, integer)

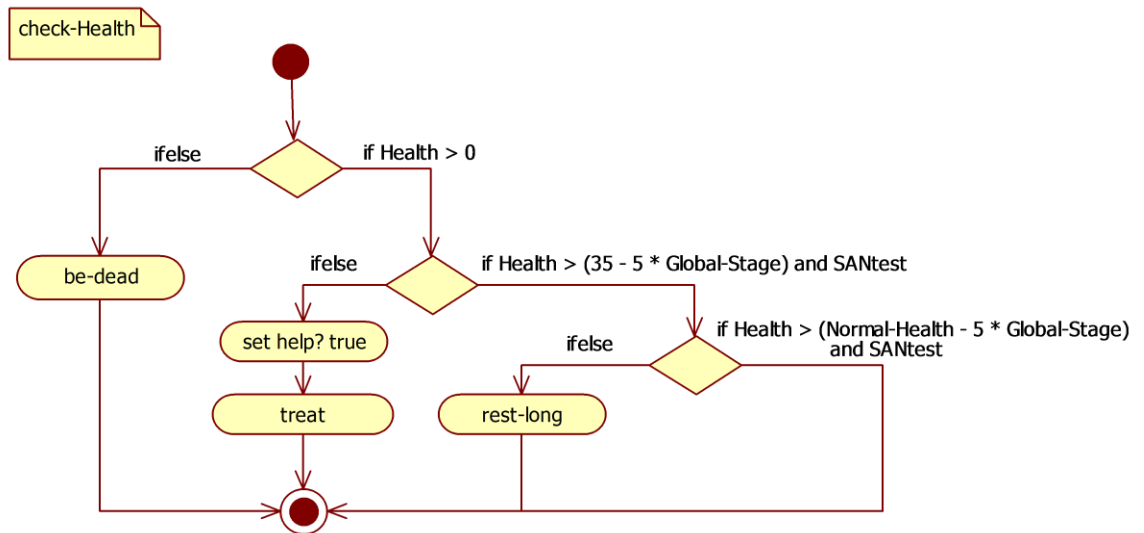
Employed in: schedule

1) The first item of the list specifies if the *user* is in a period of detoxify. If the value is true, **detoxify** prevents the *user* from running the **deliberate** operation. If the value is false, the *user* will execute the deliberate process normally.

2) The second item serves as counter giving the exact tick on which the *user* can restart their recreational consumption. The value of this item is fixed depending on the Global-Stage of the *user*. This duration is equal to: $192 - (12 * \text{Global-Stage})$, which gives a range of 9 to 15 virtual days. There is no exact data to support these values, but respondents indicated generally stop their substance consumptions for one to two weeks.

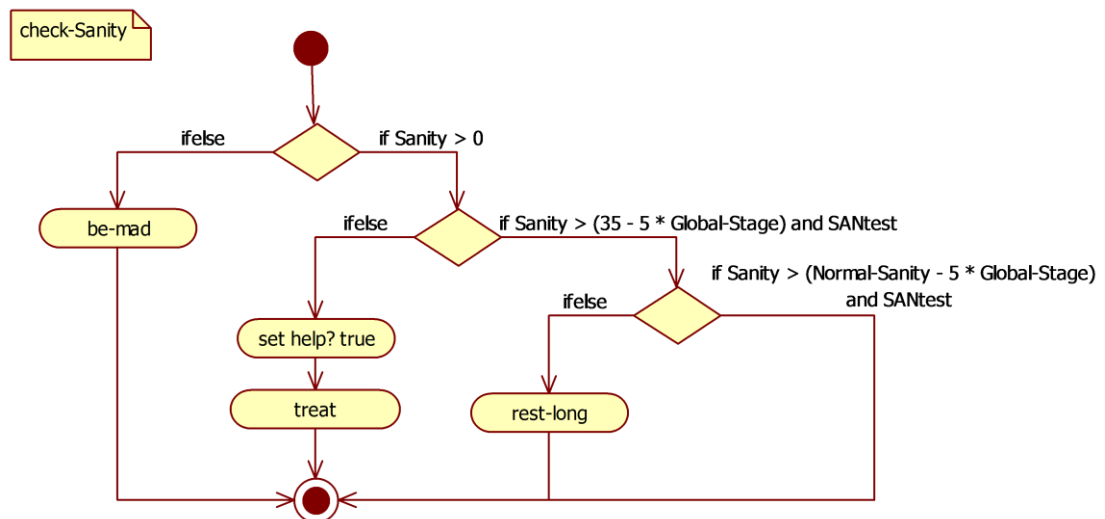
Users could enter such a detoxification period, if their Health and/or Sanity attributes are getting low. *Users* check these attributes through the **check-Health** and **check-Sanity** methods:

Individual Operation 33: check-health



The functioning of this algorithm is described together with the check-Sanity just below.

Individual Operation 34: check-Sanity



As indicated by the UML diagram, *users* will not consume psychoactive substances for the rest of the virtual day, if one of these two values is too low compared to their Global-Stage and Initial-Sanity/Health. If the Health/Sanity of the *user* becomes inferior to the level indicated in the diagram, *users* can choose (with a successful Sanity-test) to run the **detoxify** method (see above) or search for 'Treatment' through the **ask-help** method (Section 7.1.2).

Users with a Health value below or equal to zero run the **decease** method and change their typ? to "Deceased". In the same way, if the Sanity of the *user* reaches zero, the *user* runs the **commit** method and its typ? becomes 'Insane'. Insane or Deceased *users* remain in the simulation to represent the impact of such dramatic events on the representations and routine of *users* belonging to the same networks.

Finally, the rules concerning the polyuse are directly integrated into the different **consume** operations (Section 7.1.3) or integrated at the end of a session. *Users* create such rules (a) when their use impends their daily-life (i.e., their use of stimulants prevent them to **rest**); (b) they consider that their state of the moment is not adapted to their social environment (i.e., becoming "Sedated" because of Alcohol while targeting the "Social" current-InstrumentalUse); or, (c) when they could potentially lose their face (embedded in the simulation through the Behavior attribute).

In SimUse, the SPU used as control techniques could take three different forms: (1) *users* tend to generate the **use-depressant** rules, if repeated consumptions of long lasting stimulants prevent them from resting after a night-out: after having experienced six²⁰⁹ of these situations, the *users* can add this rule to their control-rules attributes and they will run the **use-depressant** operation; (2) the *counteracting* form of SPU could also intervene during consumption to rebalance the levels of GABA if too important: the *users* that frequently consume stimulants substances (in SimUse, with minimum of Stage 3 for "Cocaine", "Ecstasy", "Meth" and/or "Speed") can consume their favorite stimulant (Section 5.3.2) in order to palliate drunkenness/drowsiness; and, (3) *enhancing* SPU is implemented in the various **consume** methods. This particular rule of control asks the *users* to combine drugs until they reach expected behaviors in a shorter period of time (cf. Section 7.1.2).

The Section 6.2.2 has presented the different rules that respondents could create throughout their drug career to control their recreational intakes, as well as the different operations related to those rules. Nevertheless, to fully understand the reasons of such a necessity to control their recreational drug use, the different *because* motives

²⁰⁹ This number has been chosen to represent a limit because it is high enough to leave no doubt concerning the causes of the sleeplessness and not too low. However, this number varies importantly and needs further calibration.

attached to these techniques need to be described and captured. The subsequent Section 6.2.3 describes and examines these motives.

6.2.3. Stay functional: the social causes of slowing and selecting

When asked about the evolution of their rules and boundaries regarding their drug uses, the older respondents outline the importance of clearly differentiating the consumption's moments from the "normal" life, considering that their drug usage should not interfere with their "weekly rhythm":

[Mike, F126, male, 30, about stopping drugs] I knew what I was doing, even if it was more or less stupid I was well aware of that, but I never had too irrational use. I always check the context in which I was taking. I've never taken in random places and carelessly. It has never stopped me from working I would say. That was the most important thing, trying to keep a rhythm during the week. Most of the time, I may have stopped when it started to turn upside down my weekly rhythm. If on Monday I was unwell, you think: "come on, I won't do that all my life."

To maintain this rhythm, recreational users may cease specific substances (as shown above) or modify their practices to facilitate the re-entrance into the "real life". In other terms, techniques of control could be employed to ease the movement from the private sphere to the public one, while the recreational movement consisted of moving from the public to the private sphere:

[Kira, A, female, 24, about stimulants] The hardest thing is with all of these drugs I couldn't go to sleep until I'd eaten. I don't know what it was, like after I ate my brain could shut down. With cocaine I can't sleep but once I've eaten it's like I can sleep. But you just don't have the urge to eat obviously, you don't really want to eat anything but you try and do things to make yourself eat or sleep. Because you know those have two things that you have to do, get them done soon. To get out of it, you know what I mean? You've taken your drugs and you've had your night out or whatever, and now, go back to real life.

As aforementioned in the previous subsection (Section 6.2.2), the respondents also abandon practices incapacitating their ability to act and "perform" (in both the theatrical sense and in the sense of achievement) in conjunction with social norms. This necessity to perform adequately becomes even more essential in a phase of their life span in which the autonomy is acquired through daily commitments and remains dependent of their social obligations:

[Sony, F127, male, 28, about cannabis vs. stimulants]
[*Finally, what do you dislike with grass?*] It's because you're not doing a fucking thing and that's why I say that weed is perhaps one of the most pernicious thing because quite frankly, it happened that I did some administrative procedures or come to class or go to an hour's of driving lesson while I had snorted a line of speed or a line of coke before and no one seen it... no one got it. It didn't stop me at all to do my stuff. Well, it was really casual ... it was really more for fun to say: "Let's do it, after a little [line], I'm going". Well, okay, no harm trying, you're not becoming a beast. No, it's quite manageable. [...] Frankly, it's worse for me to smoke a joint than snort a line of coke, because you can snort your line of coke, like I said you'll be able to go... you can buy your bread, go do your shopping... You can go to class, you can chat with your floor neighbor, who is (whistle) straight, she knows nothing, she doesn't smoke. Finally, you can have a normal activity ... it will not be noticed ... you'll be pumped, you'll feel like you got your puck, which is anesthetized, but nobody can notice that. You can manage a normal activity. But, weed is harmful in the sense that when you smoke, you don't want to go to class, you don't want to do things, you don't want to do your administrative proceedings, you don't want to look for a job. This is really a drug that makes you stay stuck on the couch and wants to do nothing. It stops you from moving forward in your life and this is why, for me, it is one of the worst gear.

Here, drug usage is abandoned because of the detrimental effects inherent in the individualized practices, which affects negatively the daily social obligations of the interviewee. In the last extract, Sony stopped his usage of cannabis, because his use affected his social obligations, these one guaranteeing its autonomy and allowing him "moving forward in [his] life".

The respect of these social obligations appears even more clearly when respondents refer to their *employment*:

[Neron, F128, male, 28, about commitments and risks] [...] I prefer being addicted to cannabis and even if it already puts me in trouble, it puts me less in trouble in the social and professional point of views as if I was addicted to cocaine or to ecstasy. When I smoke two joints in the evening, I have a little bit of trouble waking up in the morning ... but when I arrive at work, my brain is operational and relatively aerated, and I can think. In any case, I feel I have my full mental capacity when I'm working. While I'm sure that if I had taken LSD or E the night before, I wouldn't even go to work. [...] With the job position I have today, I can't do that. I know that if you give me coke or LSD or whatever, it will be for holidays or for a weekend. But I will never take it in the middle of the week and even on weekends this is impossible, I know the impact of those things, and I won't go in the kind of trip that I had before. I won't jeopardize everything just for a night and have fun. With those drugs, it is also an effect they have: you put all your life and balance at stake with every intake.

At that stage, the different types of capital — financial, but also, symbolic and social — needed to achieve their life project, are dependent and inherent in the right fulfillment of a series of social obligations (e.g., employment, respect of the law, and balance in their budget). Thus, the main risk perceived by the socially well-integrated users is the possibility to "jeopardize everything" and "put all [their] life and balance at stake" because their drug consumption might interfere with the different social obligations the individual needs to respect. Therefore, at this stage of the user's career, these different capitals acquired throughout their life span weigh massively on the scale of their substances-related decisions. Illicit substances that can potentially impede with the right achievement of their daily obligations are stopped and, concerning remaining substances, users deploy progressively more techniques of control to secure the balance between integrated social life and selected substance use.

Overall, respondents modify their routinized drug-related practices in order to remain *functional*. As illustrated through the previous extracts, expressions and terms referring to functionality (e.g., "responsibility", "administrative procedures", "weekly rhythm", "obligations", "operational", "normal activity") appear recurrently in the interviews as a causal factor influencing the cessation of a particular substance or as the cause of modification of some practices by the utilization of one or several control techniques. This injunction of functionality, which could be conceived as the sum of actions that individuals must achieve to stay socially integrated, is a product of the late modernity. As indicated in Section 5.1.3, the late modernity induces a form of individualism that constrains individuals to autonomy. If the instrumenting of psychoactive substances could participate to the autonomy of the recreational users, drug use could also entail social disqualification, and potentially, from social exclusion.

Considering the preceding developments, one of the hypotheses proposed in this research is that recreational polyusers deploy such techniques in order to remain within the "normality", being delimited by the social norms and relayed by other individuals' acceptations. The respect of the different sanctions guarantees user autonomy and, conversely, the obtaining of a normal and accepted social life. These affiliations to normality and acceptance by other social beings are achieved through the maintenance of functionality, but as developed in the last and next section of this chapter (Section 6.3), the techniques of control are also employed by the polyusers in order to remain in the "recreational side" of drug use.

Conclusion:

In the previous sections, it was stated that the rationality of recreational polyusers at this stage of their drug career is oriented toward *the limitation of risks*. It could also be added that this rationality is oriented

toward a limitation of drug-related risks to maintain a certain form of functionality needed for the achievement of users' life project. It could be opposed that the risks inherent in drug consumption also encompass health risks, which is perfectly accurate. Several respondents describe their concerns about their health (e.g., "gaining weight", "concern about my liver" or "bad for my lungs") and global mental health (especially concerning "memory" and depression). Nonetheless, the respondents reaching the stage of slowing and selecting have already reduced their list of consumable substances due to repeated "switches", and have, in all the cases, deployed control techniques that reduce their drug usage and the potential long-term harms related to these consumption. Furthermore, it could be assumed that the realization of the 'life project' also encompasses the injunction to stay in good health: the actor is responsible for her own life and it is awaited from individuals to act in a healthy way to insure the achievement of the life-project.

As just discussed, the empirical data reveal that recreational polyusers tend to create or "generate" techniques of control to limit the impact of their consumption on their daily life. Considering that simulation is a generative process (Section 2.7.3), one of the objectives of this research is, therefore, to be able to reproduce the construction of such rules of control and to observe virtual agents generating these one during their drug career. This point will be further developed in the Chapter 7.

As just indicated, the recreational polyusers develop techniques of control to remain in the range of socially accepted behaviors in order to fulfill and guarantee their life project. However, the question remains how recreational users delimit and define these "accepted" and "normal" behaviors? The analysis of the interviews reveals that this delimitation is based on an interactional process by which the recreational users labeled the behaviors and practices of compulsive users to define

recreational conducts. This interactional process of identity construction is developed and investigated in the next section.

6.3. The construction of the recreational status: control techniques and labeling the deviants inside deviance

This section attempts to demonstrate that the recreational and controller status is based on a comparison/distinction between users and abusers. The recreational users utilize the characteristics and behaviors of the dependent users to delimit and define the "acceptable" behaviors and target which elements require control techniques.

To support this hypothesis, the Section 6.3.1 describes the main theoretical notions regarding normality and deviance and shows that the recreational status is built on an interactional process of labeling. The next Section 6.3.2 presents the main characteristics that respondents attribute to controlled and recreational practices. The last Section 6.3.3 depicts the main characteristics and comportments of users labeled as "compulsive" and "dependent" by the respondents, and points to the importance of the "dissocialisation" as a causal factor in the continuation of addictive conducts.

6.3.1. Construction of the recreational status: second-order deviance and labeling the "addicts"

The study of acceptable and normal behaviors is related to the concept of normality and norms analyzed and theorized by Georges Canguilhem. In his book *The normal and the pathological* [314], he asserted that an entity is normal when adapted to the milieu in which it evolves, while

the abnormal, the pathologic, as the "logical negation"²¹⁰ of the normal, appears as unfitted to the same milieu. It could be said that social groups and institutions generate those norms. These groups of institutions prescribe specific values and practices judged as acceptable. The formation of the deviant identity generally appears in the sociological literature as "the interplay between self-perception and the perceptions of others"²¹¹: the individuals perceived as transgressing one or several of these norms are designated or "labeled" as deviants by "others".

As indicated in Section 1.1.2.1, the use of illicit substances, as deviant behaviors, has been widely analyzed through the prism of the labeling theory. This theory understands the deviance as an interactional process: moral entrepreneurs label specific practices as abnormal and individuals using such practices are designated as being deviants. Nonetheless and as indicated by Zinberg [152], the process of labeling is not limited to the designation effectuated by non-users on users (as it appears in *Outsiders* of Becker, (cf. section 2.5.2), but could also be operated by one type of users on another one. Indeed, Zinberg also indicated that: "one way in which controller users [of heroin] can assert their normalcy is to spurn and condemn junkies [...]"²¹².

According to Peretti-Watel [281], if the norms transgressed by cannabis users in the study of Becker were moral norms (inherent in the American puritan culture), the actual drug practices should be considered as both "deviant and risky"²¹³. Indeed, this author considers that: "nowadays, risky behaviors tend to be labeled as deviant behaviors"²¹⁴. This analysis is based on the work of Giddens about the

²¹⁰ Canguilhem G. (2007) *Le normal et le pathologique*, PUF, Paris, p.180.[Free translation]

²¹¹ Bradley-Engen M.S. (2011) Stigma and the Deviant Identity, in Bryant C.D.D. (2011) *The Handbook of Deviant Behavior*, Routledge International Handbooks, p. 307.

²¹² Zinberg N.E. (1984) *op.cit.*, p.153.

²¹³ Peretti-Watel P. (2003) Neutralization theory and the denial of risks: some evidence from cannabis use among French adolescents, *British Journal of Sociology*, 54 (1) p. 22.

²¹⁴ *Ibid*, p. 23.

impact of the late modernity on the self of individuals. According to Giddens, the loss of influence of the traditions and institutions on individual's fate, force these one to build their own 'reflexive project' (cf. 5.1.3). This reflexivity of the self generates an acute awareness of the potential risks populating the everyday life-world. This 'climate of risks' forces the individuals evolving in the modern society to 'colonize the future' to secure their reflexive project [215].

This particular context brings Peretti-Watel to consider that: "People (and especially young people) who indulge in risky behaviors shorten their life expectancy, they blindly endanger their future rather than colonizing it, and they show an inability or refusal to manage their "reflexive project"; thus, they break the new behavioral norms induced by the risk culture."²¹⁵ This labeling of risky behaviors as being deviant could explain why recreational and controller users perceive uncontrolled practices and compulsive users as deviant. *Therefore, one reasonable hypothesis consists of considering that the recreational users labeled compulsive users as deviant within the field of drug use, and that this labeling participates in the formation of the recreational status.* The following theoretical reflection aims to support this hypothesis by reviewing the little research that has studied the representation that controller users project on compulsive users.

Sharon Rødner has studied the controller users' representation about their self, (Us) and the compulsive users (the Others) inside a Swedish population of controller users. The analysis of the different labels employed by Rødner's respondents allows her to classify the main characteristics attributed by the controller users to the abusers: *lack of self-control*, *passivity* (in opposition to free-will), and *problematic use* (both social and health-related) are common to the different designations enunciated. More importantly, Rødner specifies that drug users legitimize and justify their practices by using the attributes of the

²¹⁵ Peretti-Watel P. (2003), *op.cit*, p. 24.

abusers as a "system of distinctions": "[controller users] rely heavily on a common system of distinctions through which they differentiate themselves from drug abusers. This serves as a strategy of positive self-presentations within the lines of drug taking."²¹⁶

However, the author also points out that the strength of the labeling depends on the substances used by the Others. Most of the research concerning controller and compulsive users is substance-oriented, but all point out the prevalence of the labeling process described by Rødner in the formation of the recreational and controlled user's status. For example, Gaussoit [315], in his research conducted with Ancel, concerning the practices and representation of the different forms of alcohol consumption, demonstrates that the representation concerning alcohol's controlled behaviors and reasonable drinkers are constructed by dichotomization and differentiation from the compulsive conducts and practices inferred to the "drunk". Gaussoit analyzes the representation of two practices, the "savoir-boire" (good drinking or drinking with manners), and the "mal-boire" (bad drinking) concluding that the edges of the savoir-boire are shaped and delimited by differentiation with what subjectively appears to the individuals, as its "logical negation":

"The savoir-boire is not a data or a norm definitively installed in the core of actor's subjectivity, [...] the representation and images, which symbolize the bad drinking, intervene strongly in the good-drinking cognitive and normative elaborations, and these negative and stigmatized images contribute to the construction of the good-drinking and to maintain [the actor] inside the "reasonable" consumption mode."²¹⁷

Gaussoit insists on the fact that an excessive consumption of alcohol is generally tolerated if this does not affect the life of others. The excess is considered as deviant if its consequences go beyond the harms of the

²¹⁶ Rødner S. (2005) "I am not a drug abuser, I am a drug user": A discourse analysis of 44 drug users' construction of identity, *Addiction Research and Theory*, 13(4), p. 334.

²¹⁷ Ancel P. & Gaussoit L. (1998) *Alcool et Alcoolisme: Pratiques et représentations*, L'Harmattan, Logiques Sociales, Paris, p. 76. [Free translation]

one who provokes it. The labeling becomes active if the practices negatively have an impact on the public sphere if it becomes visible in the social environment in which the "abusers" evolve.

Decorte conducted similar research on cocaine users in Belgium [153, 316]. He aimed to qualitatively capture the representation of drug users concerning both "controlled" and "uncontrolled" forms of use. Decorte identified twenty different behaviors, rules or patterns of use that users considered as a proof of control and mastery over cocaine [316]. The uncontrolled mode of consumption appears as an inversion of these signs of control. The non-respect of these controls techniques and/or behaving in direct opposition to the comportments perceived as proofs of control are designates of being part of the uncontrolled mode of consumption. This dichotomization of practices seems to allow the controlled users to "draw a line between use and misuse":

"[...] Problematic or extreme cocaine use patterns of friends, acquaintances, partners, relatives and others can serve as counter examples. These examples of how not to use cocaine help the user to draw a line between use and misuse. As with the process of modeling and imitation of significant others, users tend to observe other cocaine use patterns and lifestyles, and decide not to follow counter examples. Boundaries of appropriate cocaine use are set and informal rules which help the user not to cross these limits are deduced from these observations."

These "counter examples" that Decorte described, constitute the objective and "observed" part upon which the representation of the abusers are built. However, the archetype of the abusers is also constructed on the subjective and unverified representations embodied in the figure of the "addict" (or "toxico" in French). According to Beck and colleagues [317], "A stereotype is a social representation of a particular type that is attached to a class of individuals, to draw a unique portrait, a condensed cliché, without nuances and very schematic. Generally, a stereotype has also a clear moral connotation,

either positive or negative"²¹⁸. These authors take their definition of stereotype from Lippman [318], who introduces the concept of stereotype in social sciences. Lippman insisted on the fact that stereotypes are cognitive shortcuts, which permit reducing the complexity of the social world by giving immediate simple types that ease actions and interactions in the everyday social life²¹⁹. Lippman insists on the fact that this stereotype could also be attached to individuals whom users do not currently or ever mix with. These persons remain estranged, facilitating the reduction of their variety to a set of simplified traits. Originally, the stereotype of the addict is based on the traits and behaviors of heroin injectors. This stereotype was built in the 70's and reinforced in the 90's, [72]. Nevertheless, if this one exists in the speech of the recreational polyusers, it seems to encompass several other practices and substances.

The preceding theoretical review indicates that the perceived images imputed by the controlled users to the compulsive users influence their practices. This dichotomy between controlled and uncontrolled practices and characteristics enable the recreational users to create their "identity", as recreational users, and to delineate their status as a drug user marking their difference with the "addicts". Hence, remaining in the boundaries of the controlled use constitutes one of the most important stakes in the drug career of the recreational users. Similarly as Gausson and Decorte, the aim of the following subsections is twofold: the Section 6.3.2 details the interviewee's representation on both 'controlled' and 'uncontrolled' practices and users; and the subsection 6.3.3 answers the question to know if whether or not polysubstance usage influences these representations, by paying a particular attention to the utilization of terms correlated to polyuse in the respondent stories.

²¹⁸ Beck F., Legleye S. & Peretti-Watel P. (2002) Penser les drogues: perceptions des produits et des politiques publiques. *Enquête sur les représentations, opinions et perceptions sur les psychotropes* (EROPP), OFDT, p.131. [Free translation]

²¹⁹ Stereotype could be considered as a form of typifications conceptualized by Schutz as described in Section 2.2.1.3.

6.3.2. The characteristics of the recreational status: social aspect, self-regulation, and control.

The present section examines the different attributes and comportments that respondents impute to both recreational/controlled and abuse/compulsive forms of drug usage. These data are extracted from the answers of respondents when they were asked to give their opinions concerning the dangerousness of their own practices or about what they like and dislike about their own reactions and behaviors of others when under the influence of specific substances. Respondents explain and argument their usage to legitimize their mode of consumption and designate behaviors that they try to avoid.

According to the respondents, one of the most important features of the addict is the *lack of control* on their consumption. The different elements that need to remain in control were described in section 6.2.1, the present development highlights the precise aspects of what is designated as characteristic of a loss of control. The abusers are categorized by the respondents as users that *lose their face* (Section 6.2.1) while consuming. The *temporary stigmas* are the most obvious and immediate elements of the *face* that recreational users denigrate and label as abnormal:

[Sammy, F129, male, 36, about ecstasy] What I do not like are the lousy guys who take like piglets, who sweat like pigs, who grind their teeth, who are completely blasted, who can't align three words straight without stuttering or without drooling. They pulled half of their teeth. That I dislike, but that's the same for everything, that's people who make excess.

, or:

[ElPoyo, F130, male, 31, about speed] Anyway, you can see that all the guys who are really into speed are guys who are super knackered, super excited with hollowed eyes and cheeks, you can be sure that those guys run on speed. It's easily noticeable, someone who runs on speed.

Second, the *incapacity of mastering* one's global state could be forgiven if the lack of control comes from young individuals, still considered as inexperienced. However, the absence of mastery and control over their intake is perceived as deviant and could entail sanctions by other users if the same behaviors are exhibited by older users:

[Jacko, F131, male, 31, about MDMA liquid] I felt no high, no sweat, no nothing ... while a youngster who came earlier in the party, and he was completely tripped! Really! And he took almost less than us. So I think that by aging and with the habit of taking, you develop a kind of ability, that's for sure. [Later in the interview] There were situations where it was stupid to take something because we took something not long before and it was still on the rise. Last time it was a guy, a thirty year old guy with whom I went out for New Year Eve, he was so pitiful because that guy, he couldn't even remember what it took 5-10 minutes before, and he was so drunk! It's funny because I did the test: I asked him when was the last time he had taken. We just got out from the car... so we were in the parking lot, we took it out of the car, I asked him, he didn't know anymore. So, him, I sermonized it during the week and he couldn't remember anything anymore. Stuff like that, that's for sure, it's scary. I no longer see that guy.

More specifically, the respondents tend to explain that some behaviors need to be managed and restrained especially inside public spaces. Asked about what they dislike concerning substances when used by others, the respondents answered by designating behaviors judged as dangerous or unacceptable. Erratic actions, aggressive reactions, vomiting, and other *disruptive comportments* are perceived and judged by controller users as abnormal and signs of abuse:

[Jacko, F132, male, 31, general] [What you do dislike in the behavior of others in general?] People who take no distance from it [drugs]. There is this and there are those I meet in clubs who control nothing and are happy to master nothing. I think it bothers people. Basically, as long as you're presentable and as long as you've totally integrated it, you know how to manage it, I have much more tolerance for it. But those who are really ... those on whom it is too noticeable, who control nothing and are glad to control nothing but detrimentally for others that are around, that, that pisses me off.

In this extract, the respondents express the idea that “tolerable” users are those who “control”, “have integrated it” and are “presentable”; conversely, users who are “too noticeable”, who “control nothing” and are behaving in a disruptive way for others, are labeled and designated as abusers.

Respondents categorize these disruptive behaviors depending on the substances used and on the form of instrumental use targeted:

- In the case of excess of cannabis, opiates or benzodiazepine (which corresponds to the “Relax” function), “inactivity”, “lazy”, “lethargic”, “passiveness” or “amorphous” are the terms and expressions used to describe behaviors perceived as a lack of control;
- The excesses of alcohol or cocaine (“Social” instrumental use) are constantly linked to “brawl”, “aggressiveness”, “angry”, “arrogant” and “sickness” (this last one for alcohol only);
- The behaviors judged as unacceptable due to an excess of stimulants (“Energy” function) are “aggressiveness” and “erratic, unwanted, or compulsive” movements, and;
- The “Intoxicated” instrumental uses are generally done in private settings with a small group of known people, but the respondents still indicate that “aggressiveness” and “sickness” are the main compartments they disapprove and find annoying.

Again, the case of hallucinogens is special: the complete “loss of control” or “loss of reality” could entail dangerous or hazardous behaviors, putting, physically or psychically, in danger both the user and the surrounding individuals. However, because hallucinogen use remains casual and is subject to several sanctions and rituals, most of the respondents do not label hallucinogen-related behaviors as abuse or compulsive.

In most of the interviews, the temporary stigma and disruptive behaviors are imputed to *excessive consumption*. Respondents tend to consider these excesses as a distinctive trait of lack of control and/or dependence on the substances:

[LittleDevil, F133, male, 29, about cocaine and overconsumption] [*What do you dislike about this drug?*] For me, nothing, because I moderate, I control. With others, the extreme consumption [...] there are diehards, as I told you earlier with some people it burns their hands, if they have some, they took it. Here, I've done parties, the guy had 2 grams, and these 2 grams disappeared during the night. Okay, you're four or five guys, it offered a line to everyone, but you could still see him regularly.... [*He mimes the gesture of someone sniffing cocaine*].

, or:

[LadyFly, F134, female, 24, about cocaine] It can go far, I think, it can go until ... I know people who consume three or four grams per day or sometimes even during the week all the time, every day, consuming 10 to 15 grams per week. [*What do you think?*] I think this is the point where the drug that takes over, you're a little hooked on it and you can't stop, you can't do [function] without it properly.

Conversely, respondents frequently use terms, such as "moderation", "regulate" or "calculate" to qualify their own substance uses, stipulating this way that they are able to manage their consumption in terms of quantity:

[Pablo, A, male, 25, about cannabis] At the moment, I say moderation is the key for me, anyway. As long as I'm not using it too much, I'm using it socially and I'm using it infrequently, I don't see any reason or need to stop.

, or:

[PBoy, A, male, 39, about alcohol] Yeah everything in moderation but I think once people go across that line then it starts getting messy. Like any drug if people use too much marijuana, or too much ice, yep.

Furthermore, controller respondents explain that they remain able to *keep a portion of drugs* for other occasions, contrary to the dependent users, who are considered as unable to save some of their stash for subsequent intakes, due to their compulsion to use:

[LittleDevil, F135, male, 28, about his ecstasy consumption]
[Ecstasy you said between 2 to 4 per party?] No more, I don't like to take one at 7am, you leave, you're back home at 7:30am, you're still under the substance it's not ... I'm not an addict, I don't have to finish everything up once I'm partying. No, I do my party and I told you, when I buy some, usually I still have some left. That's why when I buy a gram, I prefer separate it, and keep some here for our recreational use...

One last characteristics of the addict representation is the *modality of consumption*. Several respondents specifically label several way of administration as belonging to the abusers and dependent users. Indeed, injections, smoking on foil ("baking"), using water-pipe ("bong") are depicted as "more addictive" than the other ways of consumption and are generally associated with hard drugs:

[Jurion, F136, male, 27, about methamphetamine smoke on a sheet of foil] just the modality, it really makes you look like an addict, it really makes me think of the junky, it really makes me think crack, it really looks like hard drugs.

When talking about their consumption of cocaine, heroin or methamphetamine, several respondents immediately specified that they never inject these substances:

[Sony, F137, male, 28, about heroin injection] [...] so heroin, I didn't take that much. I took twice in my life and not by injection because here, shooting up it's something... No way because it marks socially, I mean having traces of injection on your arm, well, socially, you're dead. That's sure, you'll be filed.

As illustrated by the previous extracts, injection remains the administration mode directly associated with the stereotype of the "junky" or addicts, mainly due to the physical stigma inducing a "social marking". Moreover, the fact that those practices remain rare amongst the users reinforces the abnormal characteristic of such modes of administration.

Furthermore, respondents tend to characterize practices judged as inappropriate by using qualifications such as, "messy", "dirty",

"disgusting" in conjunction with excessive consumptions, craving and disruptive behaviors. By using such terms, the respondents also refer to the way of life of individuals that they perceive as being abusers:

[Toulouse, A, male, 25, about speed and cannabis] I don't like the fact that it turns some people into speed freaks - like they always have to do speed because they just get into that rhythm. I guess weed is not the same as speed because weed you can just get high and then it goes away and then you don't have to do it for a week or two and then, you're like: "Oh, I feel like getting high". But speed, if you do it you're like, "I want to get higher. I want to get higher." Then the next day, if you've got some speed, it's just sitting there, you think, might as well do it. Then all of sudden you're just doing speed every day. You're just a loser. You don't have a job and you live in a rat-infested place and you just do speed and that's your life.

, or:

[Jacko, F138, male, 31, about cocaine] For example, this happened recently, someone I saw before, long ago, who was desperate to buy something for my friend A. ... And my mate has not sold it to him because it was so pitiful, you know ... In fact, those who sweat too much the substance, they really disgust me.

Besides quantity, the frequency of use is also a criterion of designation. In the conception of most of the respondents, the daily consumers are necessarily dependent, while recreational use should remain occasional and associated with pleasure, "special occasion":

[PBoy, A, male, 39, about cocaine] What I don't like about it is it's quite addictive as in I want to have more, more and more on that night. [*So it's really addictive, why don't you want to stop cocaine?*] Because I only use it on special occasions, so it's a real treat. Because I don't really have - I'm not addicted to it and I don't think I'll ever be addicted to it because I don't use it enough.

Moreover, the ability to stop for a while, to have a "detoxification" period (Section 6.2.2) is recurrently employed by the respondents as an argument to underline their control over their drug usage in contrast to abusers, who are perceived as unable to cease their daily consumption:

[D., A, male, 19, about addiction] I don't feel that I'm really a drug addict. I just enjoy the feeling of when I use them - I

have been able to quit for a fairly long period of time - like last year I was able to quit for six weeks - everything [...]. So I don't feel like I'm addicted. I feel like I'm always in control and I'm never really worried that it's taking over my life. I wouldn't see myself as a junkie.

Still concerning the forms of consumption, the "recreational" qualification is, by essence, an irregular and occasional activity (Section 1.4.2). Controller users construct their image of the addict/abusers as an individual who "can't function without" drugs. The figure of the addict as a slave, *ad-dicere* to the substance (Section 1.4.2), is frequently employed to explain and portray the addict:

[Maggy, F139, female, 31, about heroin addicts] I didn't like them at all, in general, there's nothing I like about them, because heroin users are whores, a heroin user is a whore and I don't like them [*Whores?*] I say that they are whores, because there is nothing that counts more than that and these are people who would sell mother and father, who would kill their mother for their consumption. There are no more human values. No. There is only one thing that counts in their minds... and based on my experience, this is the only drug addiction that makes people behave like that.

This harsh representation of the heroin addict refers to the *unreliability* that recreational users impute to the abusers. Some respondents express their "fear" about the unreliability of addicts. Several respondents consider that dependent individuals are "liars", "thieves" or "cheaters", mostly because their actions are only oriented by their need of the substance:

[Billy, A, male, 22, about addicts and heroin] [*Does this archetype of drug addicts - what is your opinion about that?*] Fear, really. I really don't like to see strong drug addicts, because I know they're temperamental. I know they're willing - it doesn't become about life as much as it becomes about the drug anymore. They sometimes see the drug - with those harder drugs, they see the drug as more important than really anything else they're doing. I don't like that thought, that they - I would never really like to interact with them, because I feel like they're liable to go off at any time and snap. I don't know whether that's actually true, but I am quite fearful of those types of people. Maybe it's the unknown as well.

, or:

[Gourou, F140, male, 19, about heroin addicts] What I don't like with heroin addicts is that they are always in the need and they are dependent on others, they are struggling to manage themselves, they are too wasted [lost/being outside/elsewhere]. Frequently, they demand, they solicit [*NfA*, *racoler*, *action of accosting a customer for a prostitute*] sometimes they can be aggressive to get their drugs when they are craving for drugs. It's a bit their need for drugs that drives them that bother me.

Another common characteristic of abusers is their *weak adaptation to the norms of responsibility and functionality*. Being responsible for their acts, active and functional is also a mark of control and users that abide by these norms are accepted; while terms such as "slacko", "good-for-nothing" or "lay about" are employed to characterize the passivity of some non-controller users:

[Soph, A, female, 23, about stimulant] I saw that woman. It ruined her children's life. Actually, they weren't poor or anything like that but I did go to the house once, and I was doing speed and cocaine in the laundry. It was her kid's birthday and everyone had gone, but her kids will still playing in the garden. I was kind of like, this is really fucked. She's okay with doing speed around her children - looking after them while intoxicated. I guess it's the same for alcohol. I think that's also wrong. [...] I can appreciate a mother who has to work a 12-hour shift and then look after her children would need ice to be able to live that lifestyle and to be able to support their children. I can empathize with that situation, but with this woman in particular, she was a stay at home who wasn't working.

, or:

[Diane, F141, female, 31, about cannabis] It depends, some handle it well, but there are those who are completely amorphous and who don't make anything with their day. That's what I noticed: big pot smokers, they do nothing. [...] From my experience and those I know, people who smoke a big joint right in the morning, they do nothing with their day. (this could illustrate the "Slow" behavior that *users* can exhibit in the simulation)

Likewise, the stereotype of the addict appears to be associated with social failure (i.e., unemployment, homelessness) or depression. These

two states are conceived by the recreational polyusers as the main cause of use amongst the addicts:

[Sammy, F142, male, 36, about his reasons to continue cannabis] Nothing special, the taste, how it feels, it is not because I'm unhappy, depressed, in failure or having a family problem. It really is purely voluntary. This is because I liked it period.

In the last extract, Sammy explained that, as a recreational and controller user, he always consumes cannabis intentionally, due to his own reasons (here, the effect and the taste). This intentionality distances him from other users, who are perceived as consuming cannabis because they are in "failure" or "depressed", or because they need it due to their compulsion toward the substance.

The difference of in-order-to motives between recreational/controller and addict/compulsive individuals regarding their drug uses, appears as crucial in the process of the recreational status construction. Respondents give their own definition of the term "recreational". In all the extracts, this status necessarily implies a social dimension: terms or expressions, such as "with other people", "socially" or "never alone" are frequently employed. The "social" feature of the controlled way of using is another manner to indicate that their usage always corresponds to a social activity (i.e., night-out, celebration, party) which guarantees, from the point-of-view of the respondents, the festive and the leisure dimension of their consumption:

[Soph, A, female, 23, about recreational] I definitely think it's recreational, mainly because I only ever take it with other people. It's not like I sit at home and take ecstasy by myself. I think recreational is defined as something that you do for fun. Even if it's every weekend, that's still recreational because it's not in an addictive nature, I guess. It's just more when you're out with other people normally.

, or:

[Ursula, F143, female, 24, general] [*Do you have rules concerning your consumption?*] I don't consume alone, even joint, even alcohol. Alcohol, it happened one day that I took out a beer from the fridge and I said to myself "What am I doing with my glass?" And with joint the same, not alone,

nothing alone. Because it would freak me out, because for me, a drug must be shared and because for me, people must be there if ever... you know. So this is really a big limit that everyone hasn't got with coke, if someone gives me coke and I 'm by myself, I won't take it, I'll call someone to take it with me. Even during a party, I'm not going alone to the bathroom to take a line of coke if I had some.

This definition of recreational practice is still effectuated by the comparison with addictive practices, which are conceived as being effected in private and isolated from other consumers:

[Pablo, A, male, 25, about cannabis] I generally do all drugs socially and with other people and that, to me, convince me that it's not really a problem. I generally see, once you start using alcohol or drugs on your own at home, that's when you've got to start asking questions about why you're doing them.

, or:

[Bobby, A, male, 25, about morphine] I like drugs for the social aspect, I like talking to people, and I like being out and about. I like that sort of thing. I don't really like the idea of just taking a drug to sit there by yourself and feel good, because I can see how that could be addictive. Getting into that place where you're happy to that, and then you do it again and do it again and before you know it, that's all you do and you want to do that rather than see your friends, rather than be social.

Furthermore, the in-order-to motives of these two forms of consumption differ through the eyes of the recreational users. Recreational practices are described as "festive" and "for fun" and they are opposed to the dependent forms of usage, which are conceived as taken "by yourself" to "feel good":

[ElPoyo, F144, male, 31, about his consumption in general] But there is also the fact that we are a group, it's in a group of good guys [...] because we're not conventional regarding drugs. For example, if it happens in a party that a guy drops the bag cocaine in the toilet that will make us laugh, you know it's going to make us laugh and it won't create any problem; while in other situations that can create a terrible mess... but for us. We don't care. This is where I think we don't care about drugs; I think we don't give a fuck about it but completely. We will snort, we'll take stuff and all of that, but basically we don't care. It's not that

important. [...] But, anyway in the group, there's never been one guy who got too much into it [fell into it]. We always considered drug for partying, to party and not for our well-being. This is something to celebrate, it wouldn't come to buy one gram of cocaine for myself, just for: "I have nothing to do today, I would like buy 1 gram of coke and I'll snort it."

, or:

[Jacko, F145, male, 31, about controlled/compulsive use]
As I often say, you must be careful not to cause the party to take drugs. This is the opposite and so I don't mix with people like that anymore. You know at my age, you see people who really crave it and create parties just to be able to [take]. But there is no theme to their feasts: the recurring theme is to take drugs and these are people who are a bit weary and [seeing] that calmed me down a little bit. The circle of friends in which I am, it's really for partying. And most importantly, we never talk about that. This is something that is integrated but we never talk about it, really. In fact, we try to source it but it lasts for a sentence or one call, with them it lasts for... But last time, I was with a friend we were looking for it for 15 minutes, we gave some phone calls and we quickly got bored, it was "pfff, we stop because I don't want to be bother with that." The thing is that we won't persist like crazy. If we can get it, that's fine, if not, that's it.

In these extracts, the two respondents compare their own types of uses and group of peers, who are using for partying, with other users designated as using for their "well-being". These respondents insist on the "festive" nature of their consumption, which remains "occasional" and "not fundamental". They also compare their conception of drug use with the conception of a group composed of users who "create party to take drugs". *This comparison allows recreational users to label the compulsive users as «deviants» inside the group of drug users.* This labeling process permits confirming their status as controller users and delimiting the field of recreational consumption.

According to the previous examples and the global analysis of the empirical material, it could be conjectured that through the eyes of a "recreational" user, uncontrolled/compulsive individuals are those:

- (1) consuming in private setting hidden from other controller users;
- (2) their consumption are not for fun, nor leisure, but oriented toward "well-being";
- (3) abusers are depressed, have social problems, and/or are in social failure situation;
- (4) do not control their behaviors and/or the dosage/frequency of their consumption;
- (5) conversely to (4), their consumption are "messy", unplanned and oriented toward the cessation of the craving; and, finally,
- (6) addicts and abusers do not preserve face: they have physical stigma and are socially noticeable.

The characteristics of the recreational are, therefore, built in contraposition from the different attributes just enunciated. These characteristics are presented in Table 6.1.

Table 6.1. Comparative characteristics between controller and compulsive users as perceived by recreational users.

Categori es	"Addict"	Recreational
Context	Private settings	Public and Private settings
Intention	Escapism, for "well-being"	Leisure, for "fun"
Social Status	In Social Failure, Depress	Inserted, Functional
Practices	Compulsive, "Messy"	Managed, Planned
Uses	Intoxicated, Excessive	Social, Moderate
Face	Marked, "Visible"	Unnoticed, "Invisible"

These findings are consistent with the theoretical review effectuated in Section 6.3.1, it could be asserted that the construction of the recreational status passes by the justification of their consumption through comparisons with the characteristics of non-controllers users. This leads to the development of social representation (a) concerning

compulsive use that is labeled non-recreational and (b) concerning compulsive users by labeling them as "addict".

Concerning polyuse, there is no direct association in the empirical material of this thesis between any of the different forms of polysubstance usage and stigmatized practices. However, polysubstances uses are considered as a reinforcing factor in the sense that some practices could facilitate the continuation of addictive practices. These types of polyuse (especially, pilling up and counteracting, Section 5.4.2) are perceived as aggravating more than the main source of loss of control and/or addiction. It is worth underlining that polyusers are not the target of any form of stigmatization: the process of labeling targets either the level of control exhibit by users or specific substances as the unique responsible for addiction and misbehaviors. Indeed, the respondents do not perceive the polyuse as a social risk leading to exclusion or social disqualification.

Finally, it is worth to specify that the recreational polyusers must find a form of *balance between abstinence and abuse*. Indeed, the answers of the respondents concerning their own practices generally leave some "space" for their own practices. For respondents, every user is responsible of their own usage and related problems:

[Sammy, F146, male, 36, general] Everyone does what they want, I have no a-priori about that. I have no prejudices about people who drink, I have no prejudice against people who smoke, I do not have prejudiced against people who use drugs. What are the reasons and motivations of other peoples, I don't know, but I do what I want for me [*Speaking of ecstasy*] Everyone does as he pleases, usually I try to prevent those who never took it and that want to take some. People who take it, I try to temporize them, after they do as they want, I am not their father, but that's true that I've always had a pretty patriarch approach. But now I'm at a point, I don't give a fuck about that, I don't want anyone to piss me off, that kind of guys who take too much and piss me off, it's fuck off, out, bon voyage.

Respondents assume that every user should be able to manage both consumption and their 'projects of life'. Therefore, they also considered that users should be able to "take care of themselves" and do not want to be annoy by individuals putting at risk their own life projects.

The last extract also illustrates the interactional mechanism of exclusion that recreational and controller users seem unconsciously to effectuate upon compulsive users. This process of distancing, which is a consequence of the labeling, is discussed in detail in the next subsection.

6.3.3. Perverse effect of the 'addict' labeling: social control, addictive episode, and distancing

This thesis considers that the status of controller and recreational user is founded by comparison with its "logical negation". Indeed, the characteristics attributed by recreational users to "addicts", to abusers or compulsive users serve to delimitate the key lines of this status. The extracts presented in the previous subsection (Section 6.3.2) provide a precise idea of the characteristics that recreational users attribute to compulsive users. However, it does not indicate the consequences of that labeling on "second-order" deviants.

Some respondents have described situations where one of their peers recurrently misbehaves accordingly to the controlled norms. These situations generally result in a form of warning by the group members. These exert a pressure on the users considered as deviant, asking them to cease or reduce the frequency of their consumptions and uncontrolled practices. Depending on the reaction of the labeled users, these situations end up with two opposed possibilities. In a first case, the user who misbehaves corrects his conduct(s) and modifies the incriminated practice(s), such as the situation described by Nick:

[Nick, A, male, 18, about alcohol] [...] One of my friends gets quite aggressive regularly when he drinks. Some of my friends have actually talked to him about it and he's a lot better now. He drinks a lot less. So he's made the conscious decision to remove himself from it because he doesn't act well on it at all.

Doing so, the designated individual reintegrates the norms imposed by his group of peers and restores his status of recreational and controlled user. This does not mean that this individual will never behave in an uncontrolled manner again, or that he will always rectify his comportments accordingly to the norms of the group, which brings to the second possibility.

In the second case, the deviant users do not modify their attitudes toward the substance(s) and adopts the practices labeled as uncontrolled, which result in their slow exclusion or distancing from the group of peers:

[Diane, F147, female, 31, about ecstasy and abuser friends] Overconsumption, they are not the same anymore. I feel that their brain has burned out; they are not the people I used to know. [laughs] [*What was your reaction about those people who have disconnected?*] Well, you're trying to help them but you know... You can't do much because they are convinced they're fine. Well, I have friends who are completely disconnected and I know it's because of that [Ecstasy]. And you can no longer have a normal conversation with them. When they drink a glass of alcohol or they take something, it's over. You can't do anything, they have passed the point of no return, it's over. [*Do you still go out with them?*] No, because they are completely stupid. They are paranoid, they fantasized about everything [*Literal translation of: making movies about everything/se faire des films sur n'importe quoi*] they say inconsiderate things that you can't even justify. You're not on the same wavelength anymore.

, or:

[Jurion, F148, male, 27, about excessive consumptions on others] [*Did you ever lose sight of the people after they exhibit this type of behavior?*] Yeah, it happened. Then after that it's not necessarily between four eyes, something like: "you drink too much, I don't want to see you anymore". It's usually things that are insidious, over time, when you start

to see people less and less and because you see them less and less, you have less and less to say, you have less and less contact with them and finally they disappear gradually from your life. Sure I lost a lot of people on my way because they took too much and going out with them became a problem rather than a good time. And it happened with alcohol, with cannabis, and all the people who abuse of a substance, after a while if you are not abusing, if you don't abuses of this substance, you'll begin to realize that first, these are not people who will pull you up, these are people who will rather push you to consume more, and second, these are people who have a problem with their consumption, and conversely have problems in their lives in many aspects.

This distancing appears as a process coming from both parts. Respondents describe this distancing as a slow and "insidious" process provoked by the impossibility to communicate with peers that have become abusers: they considered these compulsive users as "no more reading the same sheet of music". The incompatibility of both practices and usage also plays a major role in this distancing: some respondents explain that because they do not want to consume as much as their deviant peers, they prefer not having night-outs or drug-related activities with them. More rarely, the respondents explain that they avoid being in contact with these "problematic" users, because they fear being caught into risky situations, due to their excessive consumption and being, in turn, labeled as losing control. These two reasons for avoiding contacts with abusers could also arise from the will of recreational users for not being labeled as abusers because they are spending time and "hanging out" with abusers.

If the deviant users exit their original group of peers, they can reintegrate another network of users. The choice of this new group generally follows the principle of *value homophily*. Users select peers that shared common values and representation and who have similar practices (as indicated in Section 4.3.3). In other words, the individuals designated as "having problems with their consumption" integrate a group in which those practices appear as not problematic. Considering

the fact that the meanings attached to acts and objects are socially and interactionally constructed (Section 2.4.1), it can be hypothesized that this distancing modifies the representational schemes attached to these practices and reinforces the acceptability of these latter. By entering a group where excessive consumptions and/or inappropriate behaviors are accepted, the practices previously labeled as uncontrolled and deviant, become "normal", unproblematic, and could become, therefore, routinized. This distancing is an infrequent event in the interviews and represents a particular step in the drug career of the respondents.

Only three of the respondents have described an "addictive episode", during which they were labeled as deviant by their initial group of peers and have lived a situation of distancing.

The two last subsections (Sections 6.3.1 and 6.3.2) have presented the idea that recreational users designate as deviant, practices labeled as risky and uncontrolled. The distancing could be reinforced by the nature of the addictive practices. This distancing could also be voluntary maintained by the abusers to hide any aspects that can betray their status and its related loss of control. First, knowing that they will experience temporary stigma due to their practices, the respondents tend to hide their self and *face*. By doing so, they avoid the judgments of others that could reinforce the labeling as a compulsive user/"addict":

[PBoy, A, male, 39, about injecting Ice] I have my come down but I don't know – I don't get upset when I'm coming down at all because when you do ice there's obviously effects. Like I don't go out of the house for a couple of days or whatever because I'm paranoid or I look like shit. You know, it has some physical effects. [...] I know that sounds silly but if you're having sex for 12 hours, 24 hours, your physical being – yeah, and you just don't feel like being around people. Because you're obviously out of it and I get a bit paranoid, yep. So I plan in advance to do it, yep and then I don't make any plans for the couple of days after then I'm back to the real world.

Second, these respondents indicated that their usage was strongly associated with stigmatized routes of administration (e.g., smoking on a sheet of foil, through a water pipe, or injecting). The stigmatization of these practices entails the intentional and conscious decision of hiding this type of consumption from other users consuming in an "accepted" way:

[Picasso, F149, male, 34, about crack cocaine and consuming alone] But I think you have this kind of collective unconscious in people: someone who takes drugs but who is in this kind of drug sharing, and who takes drugs when he is with other person that's okay. In contrast, someone who consumes alone, he'll always be frowned upon by the group, I think in a global way, some people won't admit it, but it's true. [...] Finally, it depends on the types of drugs, such as when I smoke C [Crack]: in group, it is inconceivable. This is really something I'm really going to do alone, or with not many people because I know its filth. Generally, I'll do it with people who have done it already or are still doing it. [...] The purpose of this will be [getting smashed] at the end, even if you have to avoid some people... For example, yesterday, I didn't tell you yet, but in the evening yesterday, the girlfriend who I paid a visit, I told her "I have to go, I need to eat, I'm really hungry," but what I wanted was to lock myself up here to do that [smoke crack]. And she tried to hold me and tell me "come on stay there". That's my "bear side" and I'll still go. It's not even necessarily cool in your relationship with your friends: suddenly... This is something very personal, very selfish. Crack is the quintessence of all this bullshit.

, or:

[PBoy, A, male, 39, about methamphetamine injection] Problems, yes, socially. You lose contact with your friends. I want my privacy and I have had people freak out when they found out that I inject. Because when I first started do it, it was almost like a badge of honor, like I'm an injecting drug user. [...] It was like it was all exciting to me. Then I realized it's a bit of a social taboo to be injecting. Yeah, so now I went from not telling people. It's not anyone's business anyway what I do anyway, so it's not an issue. Like what I do in the privacy of my own home.

As illustrated by the previous extracts, these practices (which consist in the "Intoxicated" form of instrumental use) induce consumption apart from the habitual group of users. The 'selfishness' depicted by Picasso

seems inherent in crack use. Indeed, he explained later in his interview that this particular substance "gets the best" on recreational and controller users, entailing from these one, compulsive and abusive behaviors:

[Picasso, F150, male, 35, about crack cocaine] I have a very good example, once, I had friends who prefer drugs such as LSD or ecstasy. They are clubbers who are really in the drug sharing. That's to say that if they have some drug, they will offer to everyone, it's really not your little something just for yourself, just to go to the toilet by yourself and take it. So, really and naturally in almost all situations, they are sharing. So once, we came here and inevitably I started doing freebase and there were two or three people who have already tried and they liked it because it's something that works really well at the beginning and the effects are really amazing. And it didn't miss, after maybe an hour or two, I saw all these people who are in the profile that I just mentioned, that began to look who put what on his little pipe, where the spoon is, if this one hasn't put too much in it. It changes people's behavior. [...] To tell you simply that this substance has taken over everyone. [*What kind of behaviors do you refer to?*] See if this one didn't put too much. You see, we bought it together for that afternoon, so here you try to see what's left, and if there is not one that jumps turn, if someone hasn't taken too much, stuff like that ... while with other stuff [drugs] they wouldn't give a shit about that.

This addictive nature of some specific drug-related practices could also leads to conflicts inside a group of users, as illustrated by the previous example, and could increase the possibility of distancing between peers.

It could be hypothesized that if the users become dependent and start to exhibit visible signs of addiction (e.g., compulsive consumption, withdrawal, craving), the repetition of these distancing processes could lead to a social exclusion. This process consists in a drastic reduction of interactions with most of, if not all, the significant nondependent peers of the individual, and by a slow exclusion from all activities involving other nondependent users. This social exclusion is reinforced by the reactions of other users who tend to limit their interactions with peers that have been labeled as addict. However, given the fact that the

process recruitment of this research was targeting recreational users and excluded individuals that have already enter a treatment, the conclusions proposed in this last subsection remain theoretical and require deeper investigations.

Finally, amongst the three respondents who had an addictive episode, Maggy was the only one who gave a precise description of the way she have managed to exit her cocaine addiction. Her story gives a precise idea concerning the importance of being re-socialized in a group of nondependent peers in the process of resorbing addiction:

[Maggy, F151, female, 31, about cocaine and addiction] To put you back in the context, there has been a history with this guy that I broke up with and after I cut ties with everyone him and I knew. I ended up alone, alone with my cocaine. And there's a day you look at yourself and you tell yourself: "there's only that in your life". And at that moment, I met and started to know other peoples who are my friends now, Danny and his friends, the guys from New Caledonia. In fact, it's a little bit thanks to them that I got me out of it [*Could you tell me a little bit more about it?*] I rested on them, I decided to stop my bullshits all alone let's say, because my life didn't please me anymore. At one point, I told myself. "You're all alone with your cocaine, you're worth nothing in fact, I'm unworthy, you're not worth a nail, you have no friends, your family, you've ignored for too long, you don't have any buddies, you got nothing, you just lost your job, your job has just finished [end of a temporary contract], what are you doing now?" So I reacquainted with my family, and I tried to make myself a new group of friends, because my old childhood friends who scraped me up off the road on Sunday, after a while, I lost them more or less... I still had contact with them, but I ignored them, you know because we were not in the same trip and I was always in the extreme, while they were not in the extreme, so we went apart... In fact, my life became empty and I just filled it with cocaine. But, one day I realized, I don't know why, I just realized I started to make new friends, Danny and others, I was still into it and then I decided one day to focus on that. On my new friends on refunding the broken ties with my family, mend broken ties with my old friends. And to get there, I forbid myself to have access to the market and one more time there were people I've given up for not having to be confronted with it and not be tempted to buy. And that's how I stopped, and that was ultra-mega

difficult. My new friendships I had then, they didn't know about it and they helped me. They helped me pass the time, to rediscover myself. To pass the time and not thinking too much about it, trying to not think about it. To keep me busy some other way.

As Maggy explained, her change of networks had played a significant role in her way back to recreational use. This change in the social environment, induces by a will of self-regulation, has allowed Maggy to avoid any contact with cocaine and, through the interactions with nondependent users, to dispose of other representational schemes regarding the substances, modifying, this way, her decision process.

In the simulation, both cases are represented by the **redefine-network** already described (cf. p. 247). However, the conditions of activation differ accordingly to the situation of the *user*: in the first case — *users* ostracize by recreational users from network composed of nondependent individuals — is activated by the **check-Group-Influence** operation (cf. p. 204); while the second case — agents leaving a group of compulsive users — is embedded in the **update-Rules** operation. In this last case, the **redefine-networks** is linked to a decision of the *user* triggered if the following conditions are gathered: (a) if the value of the substance Stage attribute is superior to 5; (b) if the average-Stage of the *user network* is superior to 4; and, (c) the *user* has the "Banned" control rules as an element of its drugRules attribute. These three points are required for the *user* to leave its primary *network*. This aims to mimic the fact that the *user* needs to be dependent (high stage); its peers frequently consumed the substance incriminated; and, the *user* would be confronted to the "banned" substance, if it remains in contact with this particular *network*.

Conclusion:

This chapter has described what is considered in this research as the most frequent final step in the drug career of the recreational polyusers. The “Slowing and Selecting” phase could be defined as a drug career moment (a) where the respondents mature out their drug usage and (b) where social obligations inherent in a daily routinized life force the recreational users to limit and control their usage. Contrary to the research of Measham, Parker and Aldridge [133], it is conjectured in this research that polyusers do not completely stop their consumption. Instead, the polyusers orient their drug choices toward substances with short-term duration and with comedowns that allow the achievement of their daily obligations and to remain unnoticed as drug users in the everyday social life. To maintain recreational and unproblematic consumption, users develop several techniques of control to manage different aspects of their consumption. More importantly, the interview's analysis demonstrates that reaching this stage, the recreational users employed these techniques of control to stay functional, because they want to fulfill their 'life project'.

Investigating the origins of these techniques of control, the analysis of the empirical material reveals that these techniques are based on the stereotype of the "addicts". This stereotype is founded on the recreational user's perceptions concerning the characteristics and comportments of the compulsive users. The controlled and recreational individuals shape their status by opposition to this subjectively built archetype. Doing so, these users label the abusers as deviant to the norms of functionality and self-reflexivity: uncontrolled users are understood as putting at risk the realization of their own life project. This labeling could result in the distancing of the users designated as deviant and to their social exclusion from groups of controlled users. Conversely, the "resocialization" with controlled users tends to modify the meaning attached to the compulsive practices favoring their cessation.

Part III. SimUse:
an Ontology-
driven Model of
Recreational
Polydrug Use

Chapter 7. SimUse: a Recreational Polydrug Use Social Simulation

The first chapter of this thesis underlined the fact that drug use results from the intricate interactions of several risk/protective factors that coevolve dynamically. The previous chapters justified the different drug career stages and displayed the methods and attributes relative to the neurology, actions, decisions, interactions, and re-evaluations executed by the agents. These methods have been built by using qualitative material collected during semi-directed interviews with recreational polydrug users. The findings from the empirical arm have reinforced the idea that recreational polydrug use is a complex phenomenon.

The complex and dynamic aspects inherent to drug use raised the question of the aggregation and modeling of such a level of complexity. To capture these two characteristics, this thesis proposes to consider recreational polydrug use as a Complex Adaptive System (CAS) and aims to represent this system through the construction of an agent-based model called SimUse. This social simulation has been conceived as an ontology encompassing five levels of reality — *drug*, *individual*, *network*, *context*, and *society* — that interact and influence each other. Most of the characteristics of these levels, their potential actions and interactions have been detailed and formalizations have been proposed by the mean of UML diagrams. However, the inner functioning of this ontology has not yet been detailed. This present chapter details the global architecture and functioning of SimUse.

The first section of this chapter (Section 7.1) describes the conceptual structure of SimUse by recapitulating the methods and attributes presented above. It also details the functioning of the simulation by connecting the classes' attributes and methods and presents the remaining types of agents and their methods (Sections 7.1.1 and 7.1.2). Section 7.1.3 gives the ordered sequence in which these operations are run. This section finally explains the way this conceptual model has been implemented in the NetLogo[®] platform and how to set up SimUse for launching simulations (Section 7.1.4).

A second objective of this chapter is to verify the simulation. The Section 7.2 of this chapter introduces the notion of verification. It also presents the tests employed during the verification of the implement code by assessing the correctness of essential and complex operations. It will also provide results from tests evaluating the exchange of money and substances during agent interactions.

Finally, the Section 7.3 examines the degree of agreement between the implemented model outputs and qualitative findings, by testing the reactions of SimUse to "external shocks"; by assessing the impact of the algorithms related to the re-evaluation processes and creation of rules, and; by evaluating the agreement between the global evolution of the SocialRepresentations and consumption rates. The neurological engine is verified by judging its capacity to reproduce neurophysiological data and mimic some of the respondent polyuse sessions.

7.1 SimUse: An ontology-driven and agent-based model

One of the main hypotheses of this research is that this recreational drug use could be compared to a Complex Adaptive Systems, which is constituted of a set of interconnected subsystems (Section 2.6.1). To integrate these subsystems in an agent-based model, they have been formalized and embedded inside different *classes* (Section 2.1.3) [319]. Each *class* exhibits a set of attributes representing its characteristics and a set of **operations** defining behaviors and actions of each class instances (Section 2.1.2). Most of the attributes and operations previously described belong to the *drug*, *individual*, or *network* classes and several remain to be described. Furthermore, in order to insure the good functioning and representativity of the model, other classes were needed. To clarify the global architecture and operating of SimUse, this section recapitulates the components of SimUse and presents the actions and interactions of its constitutive classes.

Section 7.1.1 presents the global architecture of SimUse by introducing the final class diagram. The classes are extensively described with their attributes summarized and detailed. Section 7.1.2 recapitulates the operations of the different classes. It also presents the relations existing between them and describes the different interactions existing between each class. Section 7.1.3 details the ordered sequence in which the different agents of the model execute their operations. Section 7.1.4 presents the interface of SimUse and briefly explains the way parameters can be set and SimUse launched.

7.1.1 Conceptual model: a multilayered influential structure

Chapter 2 presented an original theoretical attempt to capture the different factors influencing drug use. However, the abductive process at play during the construction of the conceptual model has forced reconsidering its primary conception. Initially, the model encompassed three main levels of analysis: *psychoactive substances*, *individual*, and *network*. Nevertheless, implementing elements of these three strata of reality did not permit reproducing the kind of social environment in which real recreational users live. Indeed, the analysis of the empirical material indicated that the recreational polyusers consume drugs in specific settings at specific moments of the week (Section 5.2.1). These analyzes also confirmed that the transformations of the representations attached to drugs and to their practices are built through interactions between users (Section 2.4.1). Therefore, the *users* needed to be able to gather on the same location at the same time to reproduce both the consumptive contexts and the interactional processes. Consequently, SimUse had to integrate both spatial and temporal dimensions. These two dimensions are integrated in the *context*, which represents the different locations accessible to the *users* and *dealers*, as well as a "calendar" reproducing a normal week and shaping their activities.

Furthermore, SimUse also needs to represent some of the social and economic elements influencing recreational drug use, such as public policies relative to drug use or some particular events that can modify the decision of recreational polyusers. All these elements potentially influencing individual routines have been included in the *societal* level. SimUse has been reshaped to integrate these contextual and societal dimensions. The overall structure of SimUse and the main characteristics influencing the simulation could be represented in Figure 7.1.

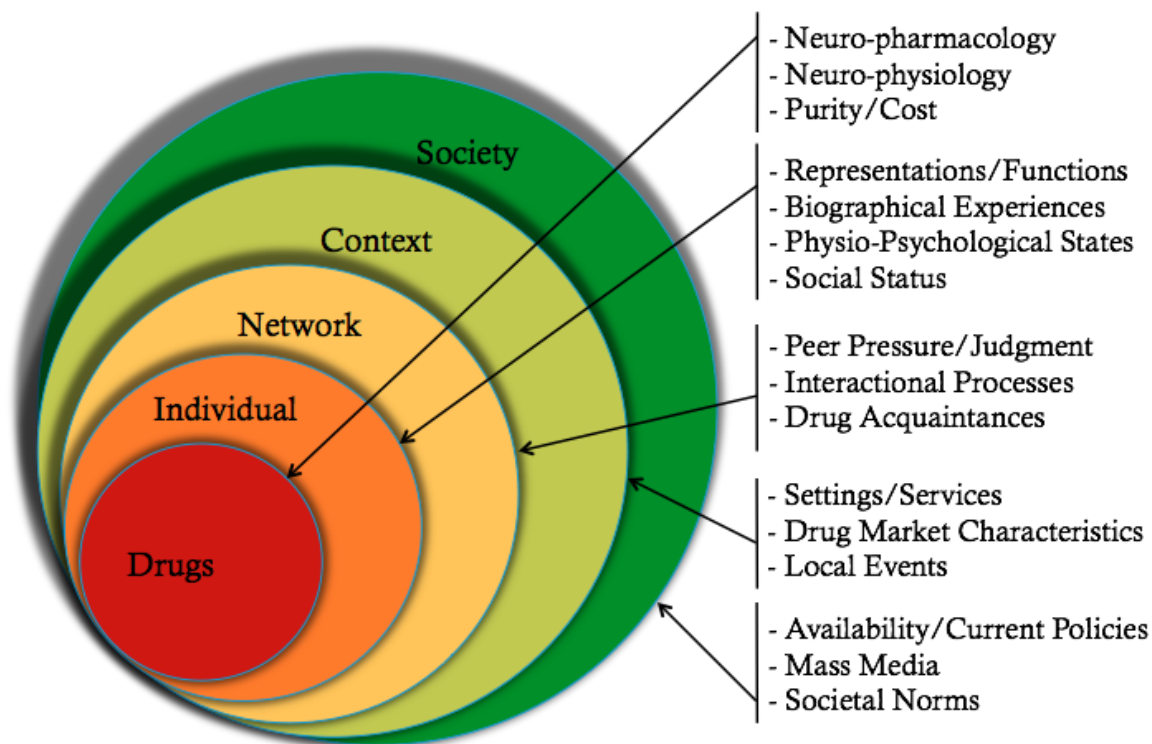


Figure 7.1. Architecture of SimUse as a multilayer model.

The proto-model designed at the end of Chapter 2 was based on the scientific literature and on the theoretical approach developed in the same chapter. The final class diagram incorporates this multilayered perspective as well as the information that has arisen from the empirical material (Figure 7.1).

As it can be noticed, this diagram embeds three new classes of agents: *policeman*, *doctor*, and *wholesaler*. Their attributes and operations are described below. Moreover, some attributes of the *individual* and *network* classes have not been described in Part II mainly because these are related to the internal functioning of the model. The next paragraphs aim to fill these gaps by describing the different classes and by recapitulating and detailing all their attributes.

N.B: As pointed in Section 2.1.4, the *class* of agents is put in italic, the **operation** are put in bold, and the attributes are underlined. *Users* and *dealers* are differentiated, but if the attributes or operations concern both, the term *individual* will be used.

A) Societal level

This meta-level is not a "true" class of agents, but a set of different parameters shaping the simulation and affecting an *individual's* operations. This level encompasses (a) an indicator of "Wealth" influencing the wage of each *user* (cf. **be-paid** operation p.69); (b) the number of *policemen* and *doctors* to be created, and; (c) different public policies affecting the operations of *policeman* and *doctor*.

Society also displays a range of "Events" that can be triggered to modify *user's* normal routine and mimic particular daily events affecting drug use. These "Events" are optional and were designed to test the reactions of the model to macro-externalities. The latest version of SimUse proposed four types of events:

- "BigDays": days, such as New Year's Eve or Christmas are represented by asking all *users* to engage in consumption with the "Sociable" current-InstrumentalUse;
- "Music Festival": a temporary setting is created inside a random block and *users* with "Energy" as one of their InstrumentalUse and *dealers* of stimulant drugs could gather on that temporary location;
- "Depletion": one of the illicit substances sees its Stock value sets to zero, which leads to a definitive disruption of its distribution;
- "Wholesaler Busted": one *wholesaler* is removed from the simulation, which can create a constant or partial disruption in the drug market.

These elements are formalized in an oversimplified version by the means of adjustable parameters that directly influence attributes and/or operations of the remaining classes. It has to be underlined that these different elements are just logical assumptions that require deeper investigations, but could be used to test the reactions of the model. These parameters are set by SimUse users and can be modified throughout the simulation to test different scenarios (Section 7.1.4).

B) Context Class

This class embeds both temporal and spatial features of SimUse. Each time step in the model represents a two hours time frame. The temporal dimension is modeled by a "clock" marking time by couple of hours in the following way: "08:00-10:00" or "20:00-22:00". Days are organized as a standard week and the exact day of the week appears on the "Day" monitor. Passing from "Sunday; 22:00-24:00" to "Monday; 00:00-02:00" adds one to the numeric "Week" counter. As indicated in Section 5.2.1, *users* and *dealers* follow a particular schedule and routine accordingly to their typ? and SocialStatus. Therefore, depending on the values of "Day" and "Hours", each of these agents moves to a specific location accordingly to its schedule and acts accordingly. The spatial dimension is represented by an urban grid where "streets" delineate "blocks" of locations. As explained below, *users* and *dealers* orient themselves on this grid through their Territory attribute. Each location displays the following attributes in Table 7.1.

Table 7.1. Presentation of the Context class attributes.

Attribute	Type	Description
coordinates	list (2)	Precise location on the grid (x;y).
type	character	Type of setting (see below).
occupied?	boolean	Is there agent(s) living on that location?
inhabitant	list (n)	ID of agent(s) that lives on that location.
downtown?	boolean	Is the location is situated in the "center" of the grid?
n-brawl	integer	Number of brawl started in the location.
n-crime	integer	Number of crime committed on the location.
street?	boolean	Is the location a street?

Attribute	Type	Description
alcohol-price	integer	Purchased price of Alcohol in this location.

The attribute street? was initially required for the construction of the urban grid, but it is also involved in the **bounced** method detailed in Section 5.2.3. The type defines the specificity of the location and the different operations *users* or *dealers* can execute while in it:

- "Home" corresponds to a place where one or several *users* are "living". This is the location where they start their day, have private parties with other members of their network (through the **check-peers-activity**), and where they execute the **rest** method. Most of the locations constituting SimUse are of that type;
- "Bottle-shop" are outlets where *users* can buy alcohol at the value indicated by the "Price-Alcohol" parameter;
- "Bar" correspond to settings where *users* can gather, interact, and **consume-alcohol**. Alcohol-price is equal to the value of the "Price-Alcohol" parameter plus three. *Users* that are involved in a fight run the **bounce** method and move to the nearest street location. It has to be noted that **brawl** could still erupt on this particular "street" location;
- "Dealer-Place" are locations where *dealers* are situated when they are not executing the **sell** operation. *Users* can move to this location to directly buy their drug(s) of choice when the *dealer* living on that location belongs to their known-dealers repertory;
- "Disco" are similar to "Bar" except that the alcohol-price is equal to three time the normal price of alcohol. Stimulant *dealers* **sell** their products on patches with that type;

- "Hospital" is a unique location. *Users* move to the "Hospital" if they have called the **treat** operation or if their Health or Sanity values have largely decreased after a **brawl** or consequently to a **hazardous-acts** (see p.312). *Doctors* start the simulation on that patch;
- "PoliceStation" is a unique location. *Users* or *dealers* arrested are sent to the police-station and run the **go-to-jail** operation. *Policemen* start the simulation at this point;
- "University" is a unique location, where *users* with the "Student" value for their SocialStatus spend most of their time during weekdays.

Most of the attributes characterizing the *context* do not change during the simulation, except the n-crime and n-brawl attributes. These are affected by methods of *users*: n-crime if a *user* executes the **break-in** operation (described in Section 7.1.2), n-brawl if two or more *users* are involved in a fight in that location (cf. **brawl** p.313).

C) Individual Class

Individual is the main class of the agent-based simulation. It has seventy-nine attributes and seventy-seven operations. The next table gives an overview of the attributes display by every *individual* (Table 7.2).

Table 7.2. Presentation of the Individual class attributes.

Attribute	Type	Description
ID	integer	Unique number identifying the agent created at the beginning of the simulation
typ?	char	Defines the kind of routine followed by the <i>individual</i> .cf. p. 221.
birth	int	Week of birth. Randomly picks up between 1 and 52 at the beginning on the simulation.
age	int	Actual age of the <i>individual</i> .
Archetype	list	Determines initial experiences, memories of use, and willingness to use (cf. below)
territory	list (12)	List of couple of coordinates describing the patches where the <i>individual</i> generally goes. cf. p.282.
group	list (2)	Contains the id of two <i>networks</i> the <i>individual</i> belongs to. Randomly pick up amongst the different <i>network's</i> <u>GroupID</u> at the beginning of the simulation.
SocialStatus	list	Describes status and income. cf. p. 300.
Budget	integer	Cash agent could spend on a night-out. cf. p.300.
Initial-Health	integer	Value describing the initial health capital of <i>individual</i> . cf. p.93.
Normal-Health	integer	Value describing the health capital the <i>individual</i> starts the day with. cf. p.93.
Health	integer	Current value of the health capital. cf. p.93.
Initial-Sanity	integer	Value describing the initial psychological capital the <i>individual</i> . cf. p.94.

Attribute	Type	Description
Normal-Sanity	integer	Value describing the psychological capital the <i>individual</i> starts the day with. cf. p.94.
Sanity	integer	Current value of the psychological capital. cf. p.94.
Initial-NeuralBox	list (8)	Set of the initial neurotransmitter levels the <i>user</i> starts its life with. cf. p.88.
Normal-NeuralBox	list (8)	Set of the neurotransmitter levels the <i>user</i> starts the time step with. cf. p.88.
NeuralBox	list (8)	Set of the current neurotransmitter levels exhibited by the <i>user</i> . cf. p.88.
NeuralBox-ComeDown	list (8)	Set of neurotransmitter level's values the <i>user</i> will need to recover. cf. p.88.
Tolerance-Threshold	list (8)	List of values the <i>user</i> needs to attain to obtain the substance effects. cf. p.88.
memUse	list (9)	List of counters summarizing the number of substance doses already consumed by the <i>user</i> in its whole career. cf. p.222.
memUse-tick	list (9)	List of counters detailing how many doses of each substance was consumed during the time step.
memUse-intake	list (9)	List of counters indicating how many units of substances remain in the brain. cf. p. 93.
memUse-dayX ¹	list (9)	List of the number of doses consumed by the <i>user</i> during the day X. The value of X goes from 1 to 7 representing the totality of substances consumed by day in the last 7 days.

Attribute	Type	Description
memUse-week	list (9)	List of counters detailing the number of substance doses the <i>user</i> has consumed during the last current week.
Stage	list (9)	List of values representing the level of tolerance for each substance. cf. p.91.
Global-stage	integer	Value based on the Dopamine level that influences the frequency of use. cf. p.85.
Behaviors	list (5)	List of behaviors exhibited by the <i>user</i> . This list is updated through the check-brain-Intake and check-brain-ComeDown operations. cf. p.86.
InstrumentalUse	list (2)	The two type of functions the <i>user</i> is generally targeting. cf. p.258.
Current-InstrumentalUse	list	The two types of functions the <i>user</i> is actually targeting.
Drug-searched	list (9)	List of the different drug the <i>user</i> is looking after. This list is created during the execution of the deliberate-drug-searched operation. cf. p.288.
Drug-used	list (9)	Repertory of the different substances already consumed by the <i>user</i> .
last-use	list (9)	Repertory of the last time steps, the <i>user</i> consumed the substance. Remain to zero, if the substance was never used.
Social-Representations	integer	Value representing the opinion of the <i>user</i> on the substance (from -5 to 5). cf. p.201.
Control-rules	list (3)	List of the general control rules developed by the <i>user</i> . cf. p.387.

Attribute	Type	Description
Drug-rules ²	list (6)	List of the substance-related control rules created by the <i>user</i> . cf. p.386.
known-dealers	list (7)	List of <u>ID</u> of <i>dealers</i> either belonging to one of two <i>user networks</i> or encounter on a specific location (street, bar or disco). cf. p.222.
cash	integer	Virtual money owns by the <i>individual</i> .
possession	list (9)	List of the substance doses owned by the <i>individual</i> .
network-activity	list (3)	Informs the type of instrumental use proposed by the primary network of the <i>user</i> . The two last items define the coordinates of the activity.
detoxify?	list (2)	Defines if the <i>user</i> is in a phase of detoxification (first element) and for how long (second element).
memtreat	integer	Number of time the <i>user</i> has entered treatment or has been healed by <i>doctors</i> .
memod	integer	Number of time the <i>user</i> runs the declare-OD method.
membehaviors	list (6)	List of six values counting the bad experiences and problematic situations experienced by the <i>user</i> in its career.
memArrest	integer	Number of time the <i>individual</i> has been arrested by <i>policeman</i> .
numSell	integer	Number of occasions the <i>individual</i> has sold or given drugs to other <i>users</i> .
drugTyp	char	Last substance sold by the <i>individual</i> .

Attribute	Type	Description
last-sell	list (7)	List of the last ticks during which the <i>individual</i> sold drugs to other <i>users</i> .
drugtype	char	Substance(s) sell by the <i>dealer</i> .
wholesaler?	list (6)	Coordinates of one or several <i>wholesalers</i> from whom the <i>dealer</i> can obtain supply. There are three couples of coordinates (x,y), for three different possible <i>wholesalers</i> .
OD?	boolean	Tag signaling if a <i>user</i> is overdosing.
infected?	boolean	Tag signaling if a <i>user</i> suffers from an infection.
value-drug ²	integer	Value calculated through the through the check-preferences operation. Represent the willingness to consume the substance.
value-list	list (9)	List of the different <u>value-drug</u> attributes.
preferred-drug	list (9)	Ordered list of the <u>value-list</u> , presenting the substances in the decreasing order of willingness to consume.
expenses	Integer	Total price of the <u>value-list</u> substances multiply by their related <u>Stage</u> .
pay-day	integer	Value from 1 to 14 specifying which virtual day the <i>user</i> runs the be-paid operation.
hazardous-act?	boolean	Tag signaling if the <i>user</i> is running the hazardous-act operation.
consuming?	boolean	Tag signaling if the <i>user</i> is consuming drugs.

Attribute	Type	Description
come-down?	boolean	Tag signaling if the <i>user</i> needs to run the comedown operation.
brawl?	boolean	Tag signaling if a <i>user</i> is involved in a fight.
break-in?	boolean	Tag signaling if a <i>user</i> is actually stealing another <i>individual</i> .

¹ There are seven memUse-day to represent the last seven days of a virtual week.

² There is one attribute of this type for each of the nine substances existing in the simulation.

During the setup phase of the simulation, SimUse differentiates *users* according to their archetype attribute which can take three different values: "Rejector", "Neutral", or "Curious". Generating different types of *users* permits integrating the role of "experienced peers" (Section 4.2.3), essential in the initiation of future users: these being represented by the "Curious" archetype. These archetypes mainly differ from the SocialRepresentations values they start the simulation with. The different representational values of these agents are described in Table 7.3.

Table 7.3. Initial values of the different SocialRepresentations attributes accordingly to the Archetype of the *user*.

Substance	"Rejector"	"Neutral"	"Curious"
Alcohol	1	1.5	2
Cannabis	0	0.5	2
Cocaine	-3	-1	2
Ecstasy	-1	0	2
Heroin	-5	-2.5	2
Meth	-4	-1.5	2
Speed	-2	0	2

Substance	"Rejector"	"Neutral"	"Curious"
LSD	-2	-1	2
MagMush	-2	0	2

During the setup phase, these values are set using a Normal law: the above values serve as the mean and the magnitude is fixed to 0.25. The values presented in Table 7.3 have been attributed arbitrarily with the objective to create a range of different representations amongst *users* belonging to the same *network*. This allows bringing some *users* with negative representations to consume that they would not have consumed in another environment and, conversely, to restrain the consumptions of *users* with positive initial representations. Setting the values as just indicated also helps to create a larger diversity amongst the population of *users*. By doing so, the model does not display massive and simultaneous changes, due to cohorts of *users* displaying common attribute values.

Furthermore, *users* with the "Curious" archetype start the simulation with some consumption experiences: the values of their memuse characteristics are attributed randomly (from 0 to 10) to mimic history of consumption. Therefore, the initial values of the Normal-NeuralBox have been set slightly higher (+1) than the Normal-NeuralBox of "Rejector" or "Neutral" *users*. These are initialized with a blank memuse list and a Normal-NeuralBox equal to the value of their Initial-NeuralBox.

The initial proportions of these different archetypes are as follows: 30% of the total numbers of users are "Rejector", 50% "Neutral", and 20% "Curious". Their choice was qualitatively based on data coming from the Blue Moon Research concerning drug users [320] which states that almost 84% of the Australian population were "Cocooned Rejectors" or

"Considered Rejectors", while 16% are "Careful Curious", "Risk Controller", "Thrill Seeker", or "Reality Swapper". SimUse embeds these last four categories in the "Curious" archetype. This latter was designed to create a proportion of *users* representing individuals who are willing to consume and share a common attraction toward drugs: they represent the "experienced" peers essential for initiation (cf. Section 4.2.3). The pool of 'Neutral' *users* should be inferior to 50%. Result finding by Clark and colleagues [320] indicate that they should represent only 32%) while the proportion of 'Rejector' should be set to 52%. Given the fact that the goal of this research was to reproduce and observe the career of recreational polyusers, the proportions of potential *users* have been increased to favor the development of drug use patterns, the 'Rejector' being created to counterbalance the influence of 'Curious' *users*. Nevertheless, the proportion of each archetype and their initial SocialRepresentations needs to be calibrated more accurately. This called for deeper investigations that should take the form of quantitative surveys²²⁰ assessing types of archetypes, their proportions, and their opinions regarding each substance.

D) Network Class

Networks are created in proportion of the number of *individuals* in the simulation. The average density of the network is chosen by SimUse user before its initialization through the "average-network-density" slider on SimUse interface (Section 7.1.4). This value determines the average number of *individuals* that will be incorporated in each *network*. *Networks* are characterized by twenty-seven attributes and five operations. These attributes mainly serve to create a range of values for *users* to refer to during the execution of the **check-group-influence** operations (cf. p. 204). The different attributes of the *network* class are presented in Table 7.4.

²²⁰ The "Blue Moon Research" has undergone such research but this research does not give indications regarding the individual opinions regarding each substance.

Table 7.4. Presentation of the Network class attributes.

Attribute	Type	Description
GroupID	integer	Unique value identifying the <i>network</i> .
Member	integer	Number of <i>individuals</i> belonging to the <i>network</i> .
Member-list	list (n)	List of <i>individual IDs</i> belonging to the <i>network</i> .
Average-Health	integer	Mean of the <u>Health</u> of <i>network</i> members.
Average-Sanity	integer	Mean of the <u>Sanity</u> of <i>network</i> members.
Average-DrugStage ¹	list (9)	List of the drug <u>Stage</u> means of all <i>network</i> members.
Average-SocialRepresentations ¹	integer	Mean of the substance-related <u>SocialRepresentations</u> of all <i>network</i> members.
Average-Status	integer	Average <u>income</u> of <i>network</i> members.
Average-Archetype	integer	Average <u>archetype</u> of <i>network</i> members.
Network-activity?	list (3)	The first item corresponds to the function proposed as a network activity. The two other values correspond to the location of that activity. cf. p.281.
Preferred-Territory	list (6)	Coordinates a "Bar" and "Disco" patch where <i>network</i> members gather

¹ There is one attribute of this type for each of the nine substances existing in the simulation.

E) Drug Class

Drug class has eighteen attributes and no operations. Most of the *drug* attributes were described in Section 2.2.4. There are seven NeuralAction-Intake-Stage and seven NeuralAction-ComeDown-Stage corresponding to the way substances alter neurotransmitter levels,

accordingly to their level of tolerance (represented by the *user's Stage*). These two sets of attributes are regrouped under the designations "NeuralAction-Intake-StageX" and "NeuralAction-ComeDown-StageX" as shown in Table 7.5.

Table 7.5. Presentation of the Drug class attributes.

Attribute	Type	Description
Drugtyp	char	Name of the substance.
NeuralAction	list (8)	List of the eight neurotransmitter modifiers. cf. p.85
NeuralAction-Intake-Stage(n)	list (8)	Values added to the NeuralBox during the Intake phase for a <i>user</i> with the drug <u>Stage</u> (n).
NeuralAction-ComeDown-Stage(n)	list (8)	Values added to the NeuralBox-ComeDown during the ComeDown phase for a <i>user</i> with the drug <u>Stage</u> (n).
Half-life	integer	Number of ticks needed to reduce the amount of substance in the brain by two.
DrugStock	integer	Amount of substances in stock (mainly for verification purpose cf. below).

F) Doctor Class

Doctors are specific agents that have only three attributes (Table 7.6) and two possible operations: **heal** and **intervene**.

Table 7.6. Presentation of the Doctor class attributes.

Attribute	Type	Description
detoxin?	boolean	Do <i>doctors</i> have treatment to heal OD?
mission	character	Type of location targeted
busy?	boolean	<i>Doctor</i> is already on an intervention or not

G) Policeman Class

As *doctors*, *policemen* are characterized by two attributes (Table 7.7) and have one main operation: **patrol**.

Table 7.7. Presentation of the Policeman class attributes.

Attribute	Type	Description
handcuffs?	boolean	<i>Policeman</i> ability to arrest an <i>individual</i> .
mission	character	Type of location targeted or type of patrol executed.

Initially, these two classes of agents were mainly created to test strategies related to harm-minimization and law enforcement even if prediction is not the objective of this model. *Doctors* and *policeman* are optional: SimUse could be run without those agents. Because several respondents explained during their interviews that being arrested, knowing that police force will be on a particular site, or seeing practitioners during music events influence their decisions (Section 6.2 and 6.3), basic scenarios should still display some of these agents but need further information before being rightfully implemented. Different types of "missions" have already been implemented to assess qualitatively *what-if* scenarios. Without any particular mission, both types of agent circulate randomly on the grid and their actions mainly depend on *individual*'s attributes and/or behaviors (see below).

H) Wholesaler Class

Wholesalers have five attributes (Table 7.8) and a single operation.

Table 7.8. Presentation of the Wholesaler class attributes.

Attribute	Type	Description
Drugtype	character	Type of drug supply
Possession	integer	Drug stash in dose
Price	integer	Price of retail
Cash	integer	Stock of virtual money
Territory	list (2)	Exact position of the agent on the grid

This special class of agents represents the source of supply for *dealers*. As it will be explained in the Section 7.1.2, *dealer* can be caught by *policeman* during transaction with *users*. This *wholesaler* class was created to stabilize the drug market: if one *dealer* gets caught, others can still sell the same type of drug(s), without a constant interruption of drug distribution. However, some policies ("Big Fish" mission, cf. below) or events ("Wholesaler Busted") can directly act on *wholesaler* creating a large and definitive disruption on the market structure. The only operation of the wholesalers, **import**, is described with the remaining operations in the next subsection.

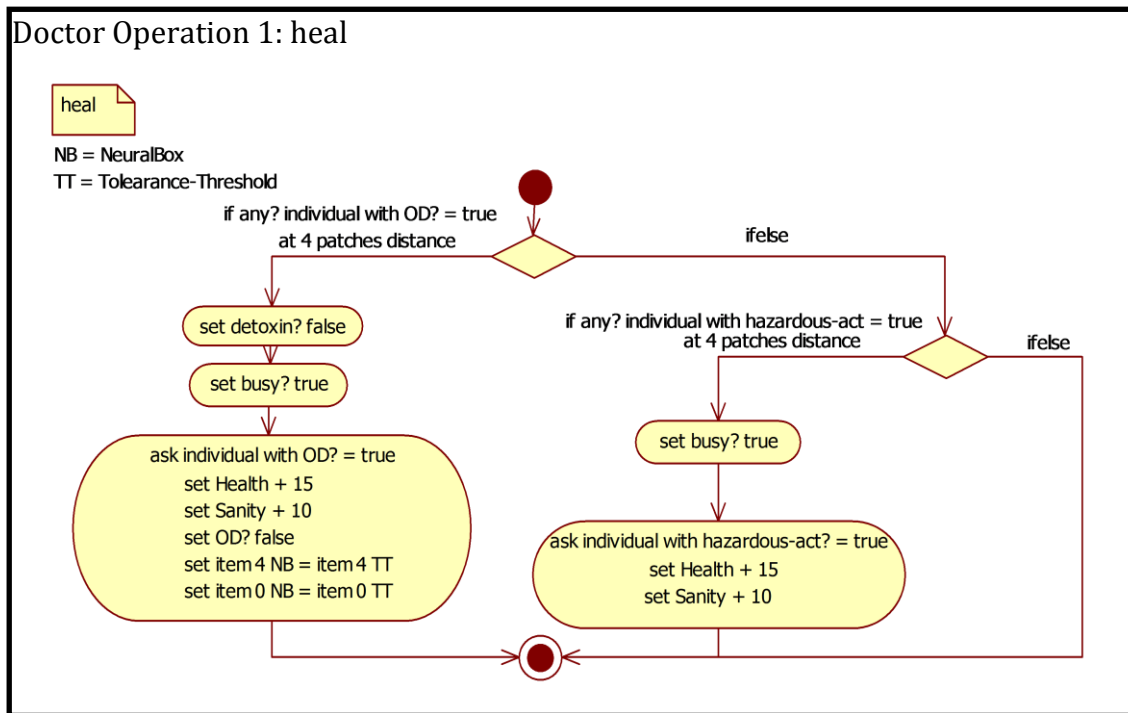
7.1.2. Conceptual model: actions and interactions of the different ontologic levels

The previous subsection presented the different classes constituting the simulation, as well as their attributes. So far, most of the *individual* operations have been described. This subsection aims to complete the description of the model with the operations of the new classes of agents and with the remaining operation of the *individual* and *network* classes.

As aforementioned (Section 7.1.1) the *societal* and *contextual* classes do not have operations, but act directly on several *individual* attributes.

A) Doctor Class

The movement of *doctors* is assured by the **intervention** operation. **Intervention** asks the *doctors* to move randomly on 'Street' locations. The main objective of these agents is to **heal** *users* in case of accidents or overdose. If any *users* see its Health or Sanity values lowered due to externalities (represented by the **hazardous-acts**, **brawl**, or **declare-OD** operations), *doctors* can intervene to restore at least a portion of the of Health or Sanity lost by the *user*:

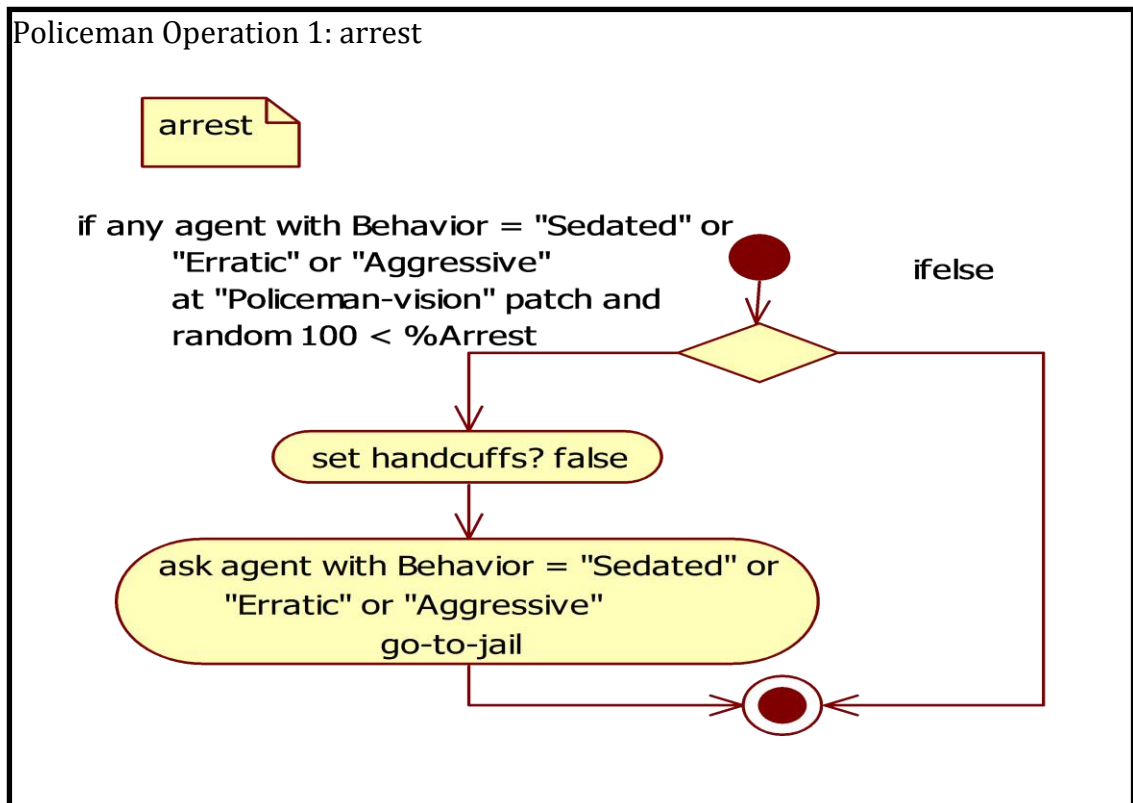


B) Policeman Class

Policemen have two operations: **arrest** and **patrol**. All capacities and actions of these agents are set through SimUse parameters (Section 7.1.4): (a) *policemen* chance of arresting *individual* is given by the "%Arrest"; (b) they act accordingly to their mission defined by the "Public Policies" inputs; and, (c) their range of intervention is set by the mean of the "Policeman-vision" slider. Concerning their mission, three strategies have been implemented in SimUse to serve as examples:

- 1) "Serve and Protect": *policemen* move randomly on street locations and arrest *users* exhibiting "Erratic", "Sedated" and/or "Aggressive" Behavior (cf. below);
- 2) "Bust Dealers": *policemen* move randomly on the grid and focus only on *dealers*. Policemen that have in their "Policeman-vision" scope at least one dealer, which is in possession of illicit substances — any element of the possession attribute except the first, which is "Alcohol" — could arrest that *dealer* if the result of a random 100 is lower than or equal to the "%Arrest" indicates in the interface;
- 3) "Big Fish" targets *wholesaler* only: the chance for a *policeman* to arrest a *wholesaler* is equal to the %Arrest plus the number of *policeman* with the same mission.

In any case, *policemen* can also apprehend *users* during a **break-in** or can be called by a 'Bar' or 'Disco' location in the case of aggravated **brawl**. The **arrest** operation is conceived as follows:



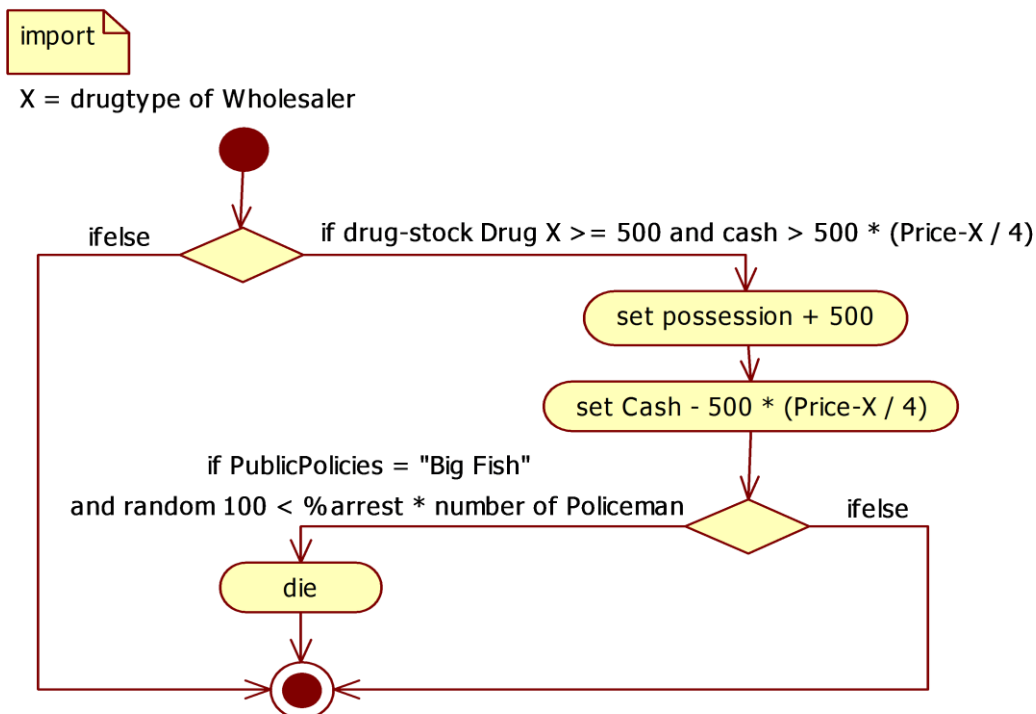
Arrested *individual* have to pay a fine (200 for *user* and the totality of their cash for *dealer*) and have all their illicit possessions seized. These possessions are "transferred" to the "Seizures" counter.

It has to be noted that these "scenarios" are purely theoretical and were mainly created to test the reactions of the model and *individual* to this kind of externalities.

C) Wholesaler Class

Wholesalers have only one operation: **import**. This method asks the *wholesaler* to buy 500 units of the substance they normally sell and, so, asks this particular *drug* to reduce its Drug-stock value by 500:

Wholesaler Operation 1: import



Wholesalers **import** a new stock of their drugtype when this one becomes too low (stock $<$ 100). *Wholesalers* could import *drug* accordingly to two conditions: *drug* is still availability (Drug-stock of the *drug* \geq 500) and they have enough Cash to buy these 500 units. The price of the *drug* is divided by 4, while *dealers* will pay 50 units for the price divided by 2: this difference of buying price insures that *wholesalers* have enough Cash to **import**.

D) Network Class

The *network* class includes five operations mainly updating its different attributes. The first element that needs to be fixed is the list of *individuals* belonging to this *network*. The **count-Members** method asks the *network* to calculate the number of *individuals* (with the *users*, *dealers*, *Deceased*, and *Insane typ?*) affiliated to it. The **update-Member-List** operation specifies the list of the different IDs of *individuals* belonging to the *network*. In the context of SimUse, belonging to a *network* means that the *individual* has the first element of its group attribute equal to the GroupID of the *network*. Once the number and identities of their members fixed, SimUse asks *networks* to update their "average" attributes.

The **update-Network-SocialRepresentations** has already been described in Section 4.1.2 and consists of updating the values of each substance average-SocialRepresentations. This allows integrating changes of opinions and beliefs induced by new experiences and interactions of the *network* members. This operation permits mimicking the interactional process of meaning formation and transformations discussed in Section 2.4. This method has been modeled as follows:

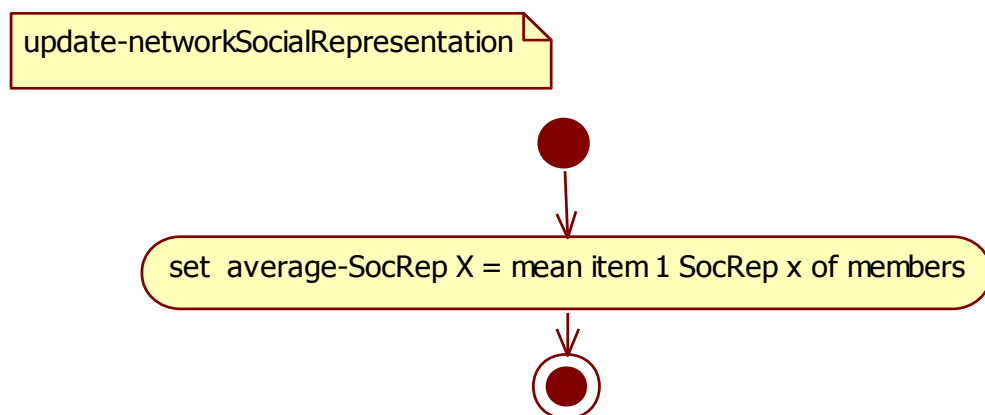
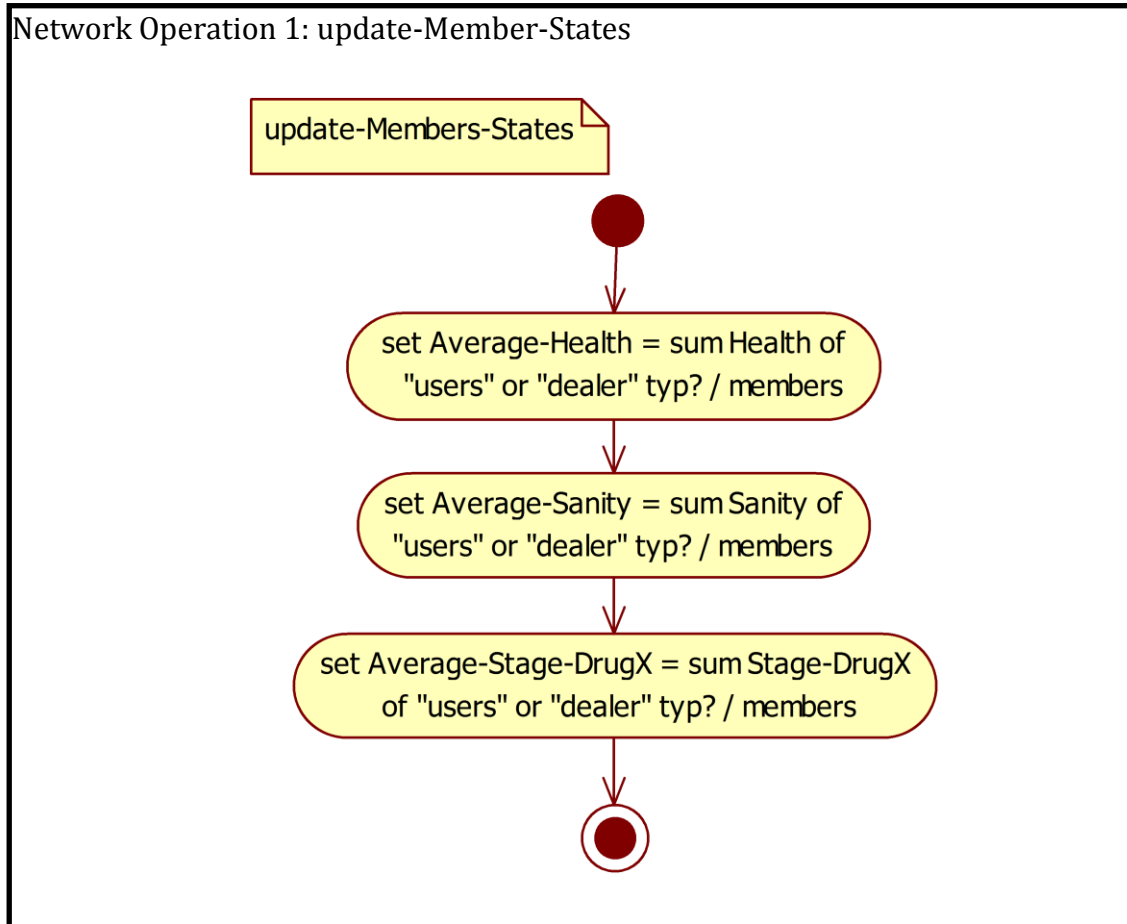


Figure 7.3. Update-NetworkSocialRepresentation Activity Diagram.

The second operation, **update-Member-States**, updates the "Average" physiologic states and stages of the different *networks* based on the

Health, Sanity, and Stage of their members. This method asks each *network* to calculate the average-Health, average-Sanity, average-SocialCapital, and average-Stages of its *users* and *dealers* members. These different averaged values are principally used to assess the influence of the group on its members through the **check-group-influence** or **check-group-SocialRepresentations** described with the operations of the *individual* class (cf. below).



E) Individual Class

Individuals play a central role in the model because they crystalize all the influences of the other classes. Their operations fall into four main categories: *update*; *decision*; *action*; and *interaction*.

1) Update

The *update* operations consist of adjusting the *user* attributes considering the "Hours" and "Day" in the simulation and considering

their actions or interactions undertaken in the previous step(s). Some of these operations are executed by the *users* at the beginning of every time step independently of the "Hours" and "Days". These operations update the "physiological" components of *users* and balance their neurotransmitter levels. To update these attributes, *users* run in a specific order several operations. The first of these methods, **check-Health** (p.391), assesses the physical health capital of the *user*. Depending on its Health score, the *user* may have to run the **decease**, **treat**, or **detoxify** operations as indicated by the subsequent activity diagram:

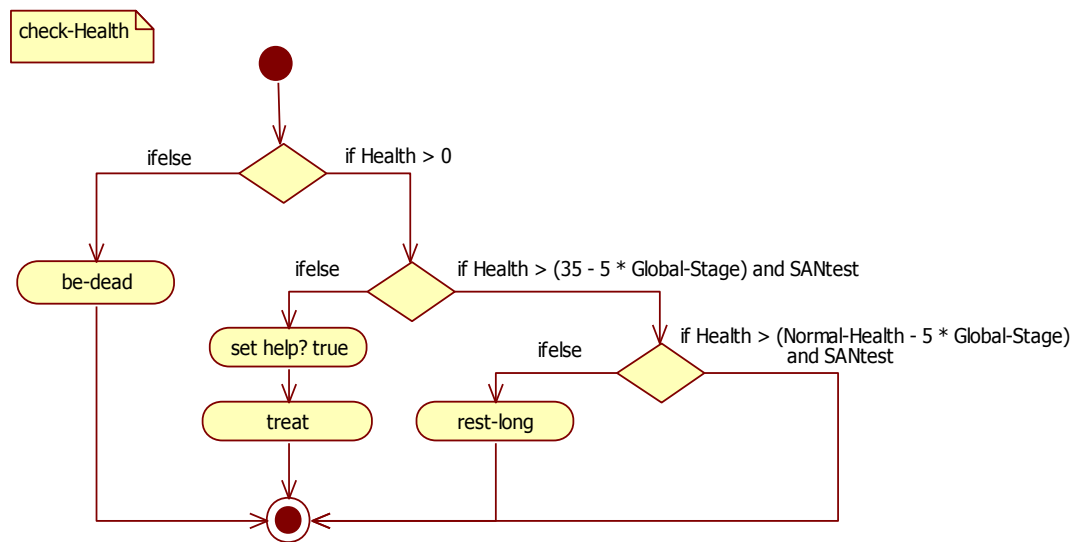


Figure 7.4. Check-Health Activity Diagram

The next method evaluates the psychological capital of the *user*. In the same manner that the previous operation, **check-Sanity** (p.391) method evaluates the mental state of the *user*. If the Sanity value of the *user* is equal or lower than zero, it runs the **commit** method (cf. below), as shown by the following diagram:

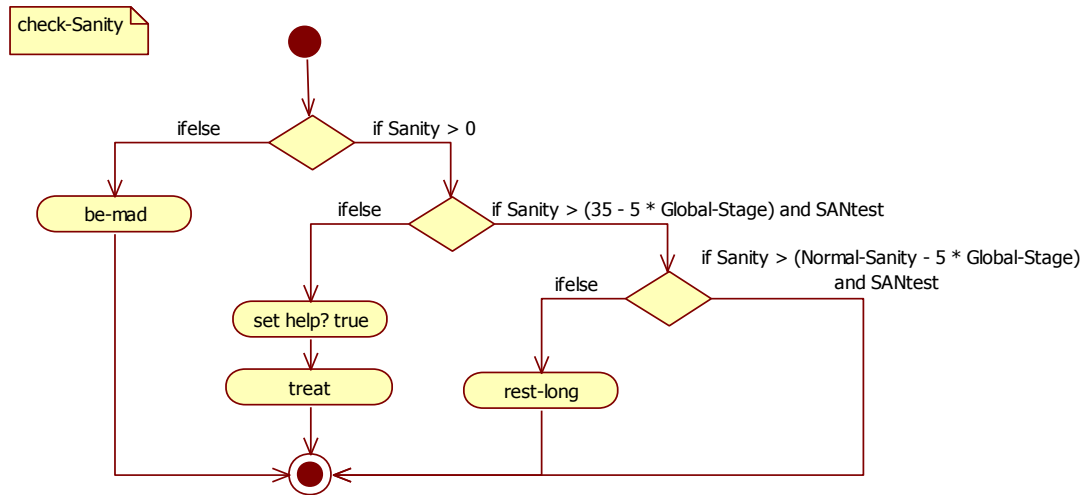


Figure 7.5. Check-Sanity Activity Diagram.

The physiological and psychological attribute update does not stop with these two operations. The user's neurological components and their associated with behaviors are checked each time step to assess the impacts and consequences of recent consumption. The **check-brain-Intake** operation is run at the beginning of each time step, if the *user* is not consuming substances (consuming? false). Conversely, if the *user* is consuming (consuming? true), the **check-brain-Intake** operation takes place once all the **consume** operations have been executed to prevent the *user* from running twice this method (cf. below).

As explained in Section 2.2.2, the natural "stocks" of neuro-transmitters are lowered after psychoactive substance consumptions. While running the **rest** operation, the *users* is meant to balance their levels of neurotransmitters and refill the "stocks" of these latter: the elements of both NeuralBox and NeuralBox-ComeDown are modified to rejoin the values of the Normal-NeuralBox. The time needed to replenish these neurotransmitter stocks mainly depends on the quantity of neurotransmitters released during the intakes. By doing so, the *users* have the opportunity to balance their neurotransmitter levels back to their initial states (represented by the Initial-NeuralBox attribute). The timeframe during which the *user* feels negative outcomes of past drug intakes takes place during this "comedown" period. In SimUse, the

duration of the comedown is based on the difference between the Normal-NeuralBox and the NeuralBox-ComeDown attributes. The consequences of the comedown are defined by the **check-brain-ComeDown**.

This method is called if any level of the NeuralBox-ComeDown list shows a difference greater than 0.1 with its related Normal-NeuralBox list element. For example, after a few doses of alcohol, a *user* may display a level of Dopamine in the NeuralBox-ComeDown of 0.9 (item 0 NBCD = 0.9) while the Normal-NeuralBox level of Dopamine is equal to 1.1 (item 0 NNB = 1.1). This *user* will execute the **check-brain-ComeDown** method; once its Dopamine NeuralBox-ComeDown level becomes greater or equal to 1, this *user* will stop calling this method.

This method also assesses the 'comedown' consequences associated with the depletion of each neurotransmitter, in terms of behaviors and physiological/psychological harms. The following diagram gives the example of the **check-brain-ComeDown** method applied to the level of Glutamate:

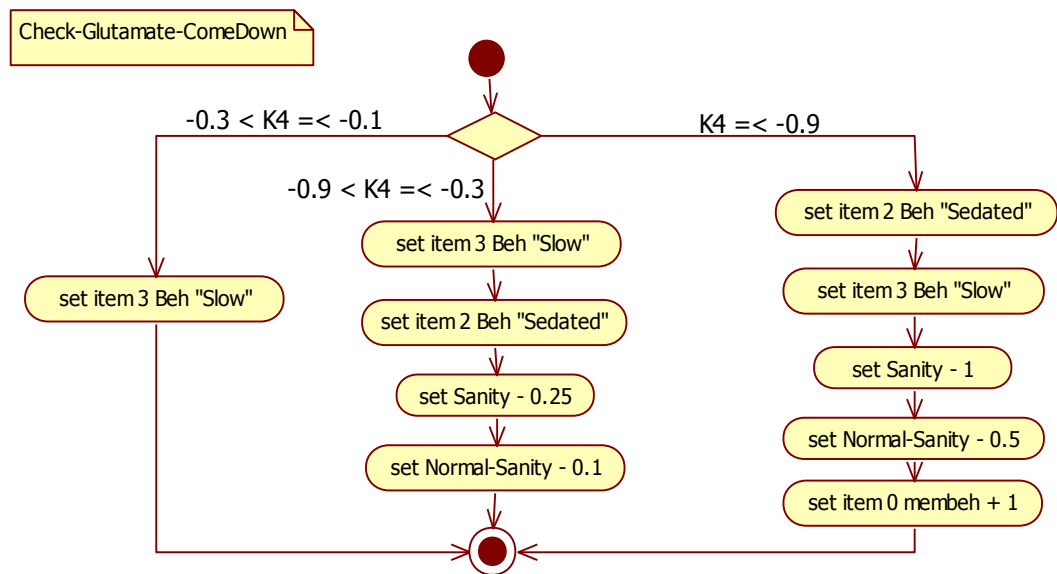


Figure 7.6. Check-Glutamate-ComeDown Activity Diagram.

Here, K4 is calculated as follows:

$$K4 = \text{abs}(\text{item 4 NeuralBox} - \text{item 4NormalNeuralBox}) - \text{abs}(\text{item 4 Normal-NeuralBox} - \text{item 4 NeuralBox-ComeDown})$$

, which represents the difference between the absolute value of remaining positive effects (score of the NeuralBox - score of the Normal-NeuralBox) and the absolute value of the negative effects (score of the Normal-NeuralBox - score of the NeuralBox-ComeDown)²²¹.

As indicated in Section 2.2.4, values of both NeuralBox and NeuralBox-ComeDown depend on *user's* tolerance. In SimUse, the tolerance to substances is represented by the Stage attribute. *Users* update this attribute once a week by running the **update-Stage** method. These Stages are calculated based on *user's* weekly consumptions. The following table describes the range of weekly dosage for each Stage (Table 7.9).

Table 7.9. Agent Stages according to their weekly consumptions.

Substance /Stage	1	2	3	4	5	6	7
Alcohol	0-8	9-14	15-25	26-40	41-60	61-90	90+
Cannabis	0-2	3-5	6-10	11-20	21-30	31-40	40+
Cocaine	0-2	3-4	5-7	8-12	13-18	19-25	25+
Ecstasy	0-1	2-3	4-6	7-9	10-13	14-17	17+
Heroin	0-1	2-3	4-5	6-8	9-12	12-18	18+
Meth	0-2	3-4	5-6	7-10	11-15	16-22	22+
Speed	0-2	3-4	5-7	8-10	11-15	16-25	25+
LSD	0-1	2-3	4-5	6-7	8-10	11-15	15+
MagMush	0-1	2	3-4	5-6	7-9	10-12	12+

²²¹ The extensive presentation of these three operations could be found in Section 2.2.4.

These values have been arbitrarily fixed, but have been assigned to mimic exponential consumption due to the development of tolerance (cf. Section 2.2.3). Obviously, a quantitative investigation would be required to validate these values. Unfortunately, we are not aware of any experimental evidence currently available and allowing for such a validation process.

It is worth underlining that the values of the different Stages do not drop several ranks at once. Each week, the Stage values could only decrease/increase by one rank: *users* cannot pass from Alcohol-Stage 5 to Alcohol-Stage 1 in a week, if they **detoxify** for example. In that case, it would take at least four weeks with none or a moderate consumption of Alcohol to reduce the alcohol-Stage value by four ranks.

Individual typ? is updated through four additional operations (cf. *typ?* attribute described p.223). As previously explained, *individuals* could display four different *typ?*, namely, "user", "dealer", "Deceased", and "Insane". These different values are exclusive and moving from one *typ?* to another is triggered by different factors:

- because *dealers* can neither consume drugs, nor assess their physiological states, *dealers* cannot decease or become insane. However, *dealers* may run the **become-user** operation if the value of their memarrest becomes higher than 5. Their present location moves from the 'Dealer-Place' *type?* to "Home" and they also "ask" all *users* to remove their IDs from their known-dealers list;
- conversely, *users* execute the **become-dealer** operation if they have sold more than 20 times to "friends" (through the **ask-friend** method) and if their cash attribute gets below 200. In that previous case, they start selling the type of substance indicated by their drugTyp attribute. Their 'Home' location becomes a 'Dealer-Place';
- *users* change their *typ?* to "Deceased", if their Health drops to zero (**deceased** method, see below);

- in the same way, *users* can become "Insane", if their Sanity attribute reaches zero (**commit** operation, see below).

Users could also change their SocialStatus during a simulation. This change is represented by the **update-SocialStatus** method. The career trajectory of *users* is simplified: *users* could only display three type of status: "Student", "Employed", and "Unemployed". These statuses define the level of money that *users* earn every fortnight (see the **be-paid** method p.69). Depending of their age, *users* have a probability of moving from the "Student" SocialStatus to the "Employed" one. *Users* move from "Employed" to the "Unemployed" status, if they exhibit inappropriate Behaviors during working hours (through the last part of the **check-rules** operation). **Update-SocialStatus** is run once every week ("Monday" at "10:00-12:00") and has been designed as follows:

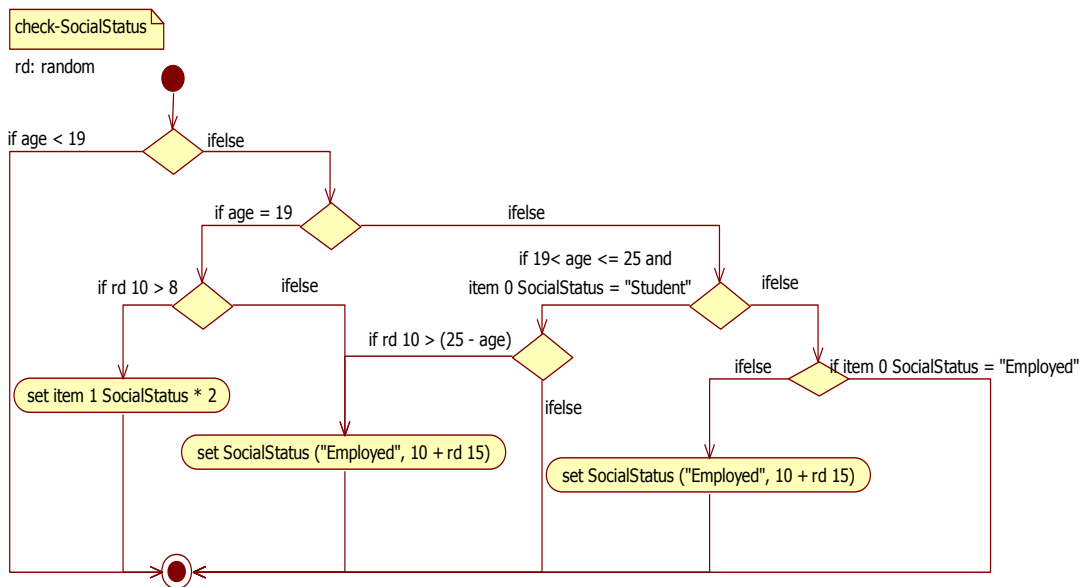


Figure 7.7. Update-SocialStatus Activity Diagram.

Users also update information about the *dealers* they know in their two social *networks*. The **update-KnownDealers** (p. 223) method searches for any *individual* with the *dealer typ?* in the *user's networks* and insert the *dealer ID* in the Known-dealers list of the *user* (Figure 7.8):

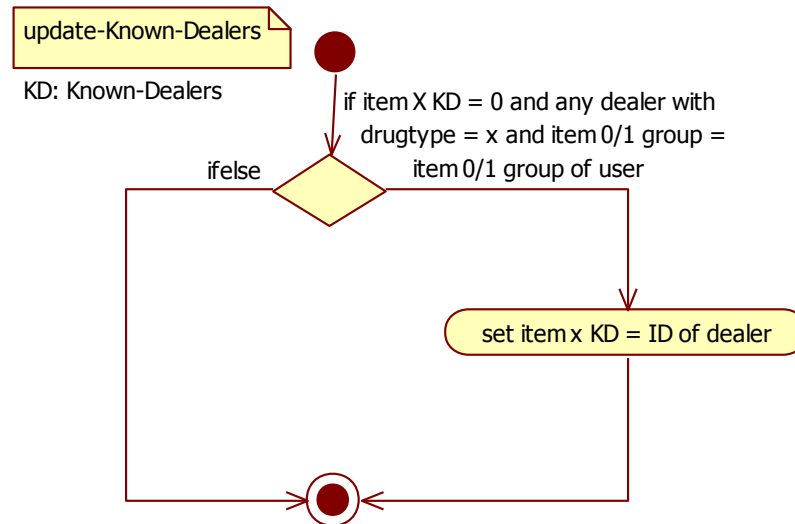


Figure 7.8. Update-KnownDealers Activity Diagram.

Users could also meet *dealers* during their consumption phase and record their ID in their known-dealers list (cf. **buy** method below). Finally, if the "full-availability?" switch is on (Section 7.1.4), the complete known-dealers list is filled up with IDs of substance-related *dealers*, allowing all *users* to have access to any kind of substances.

Finally, the *users* could change their drug routine by reconsidering their past actions. These changes take the form of rules of consumption that will prevent the *user* from consuming excessively or too frequently. The **check-rules** asks the *users* to create control techniques depending on their membehaviors scores (cf. p.96).

Once all these updates have been executed, *individuals* start their "daily routine": *users* move to their work location (last two coordinates form their Territory); while *dealers* will run the **supply** method (cf. above) at "10:00-12:00" if their substance stash is running low and start to **sell** drugs after that time. The fact that *dealers* keep selling for the whole day allows *users* to buy substances after the *decision* moment.

2) Decision

The decision process plays an important role in the daily life of recreational polyusers. It has been decomposed in a succession of operations based on the empirical findings described throughout Section 5.2 and on theoretical concepts examined in Section 2.3.2. In a nutshell, the decision process of *users* could be described as follows:

- first, *users* decide if they want to engage in a drug-related activity accordingly to the "Day" and their SocialStatus. If they are willing to consume, they choose the type of activity they want to engage into by fixing the values of their current-InstrumentalUse through the **deliberate** method (cf. Figure 7.10).
- second, *users* ask the peers of their primary *network* if any network activity is intended (**check-peers-activity** method). If so, the *user* can join the rest of its network by replacing its current-InstrumentalUse with the one proposed by the group, as indicate by the next activity diagram (Figure 7.9):

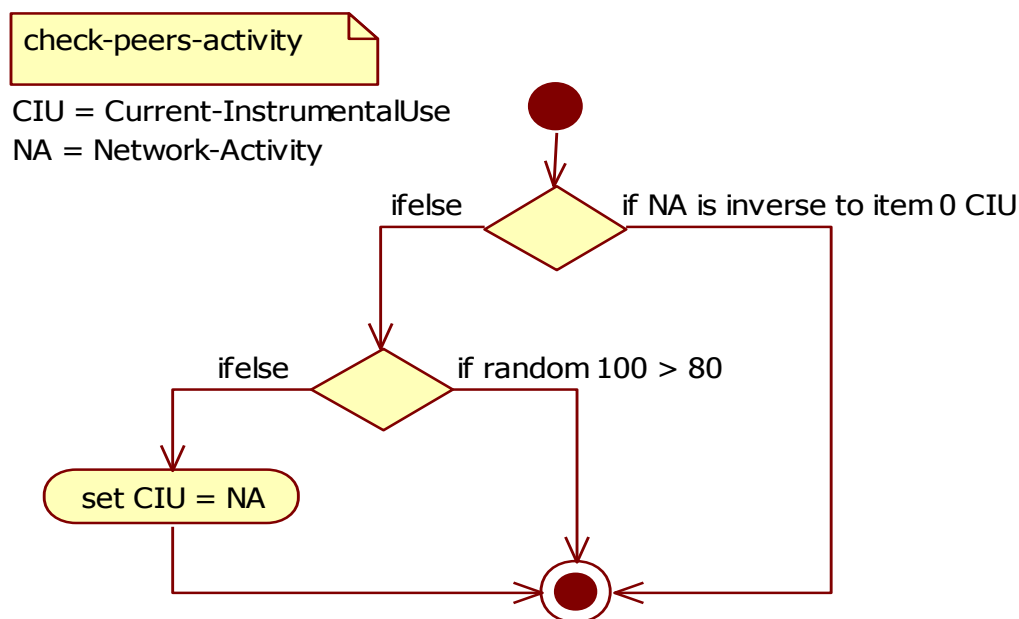


Figure 7.9. Check-Peers-Activity Activity Diagram.

- third, even if they are willing to engage in a recreational activity, *users* will not consume drugs if their Health or Sanity is too low or if their financial status cannot support a night-out. These different points are evaluated, when the *users* run the **check-states** method (Figure 7.11):

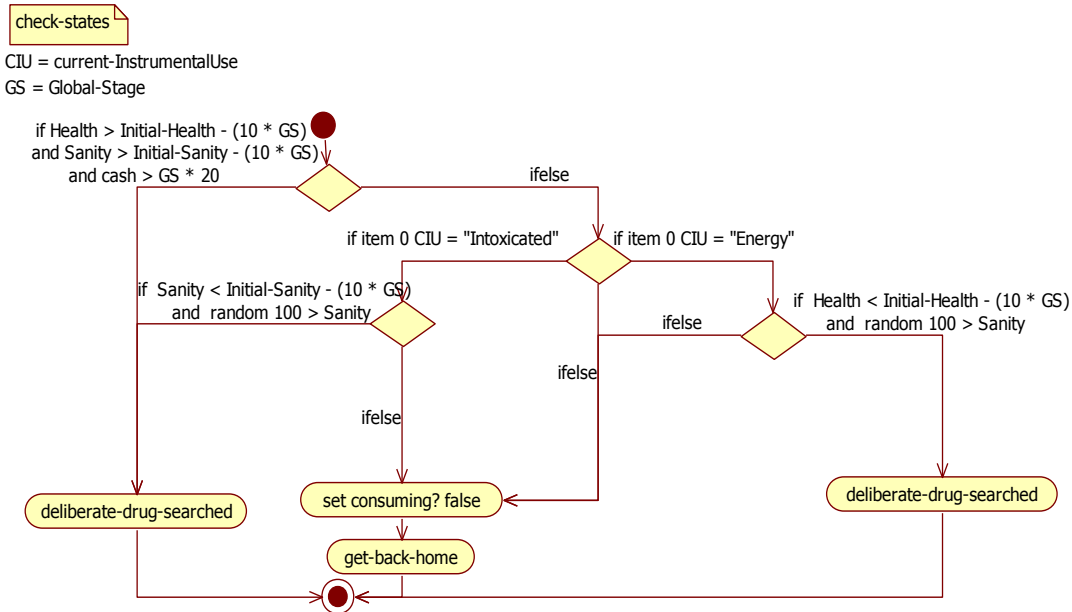


Figure 7.11. Check-States Activity Diagram.

- fourth, considering its current-InstrumentalUse, the *user* selects one or several substances with neurological properties that can bring effects the *user* is looking for. The drug choice process is represented by the **deliberate-drug-searched** method (Figure 7.12):

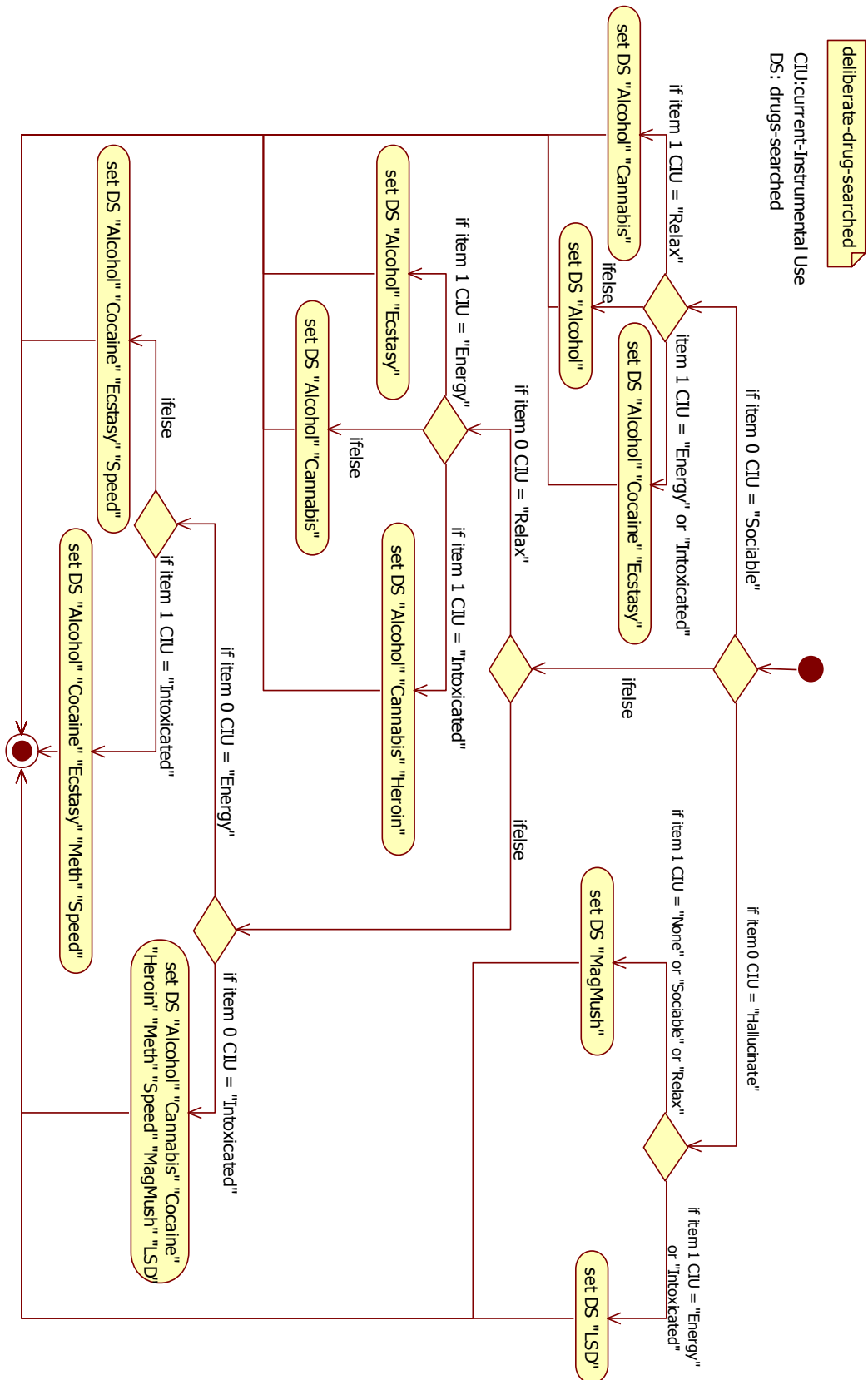


Figure 7.12. Deliberate-Drug-Searched Activity Diagram

- fifth, the *users* run the **check-SocialRepresentations** method (p.289) and discard from their drug-searched list the substances associated with a negative SocialRepresentations value (Figure 7.13):

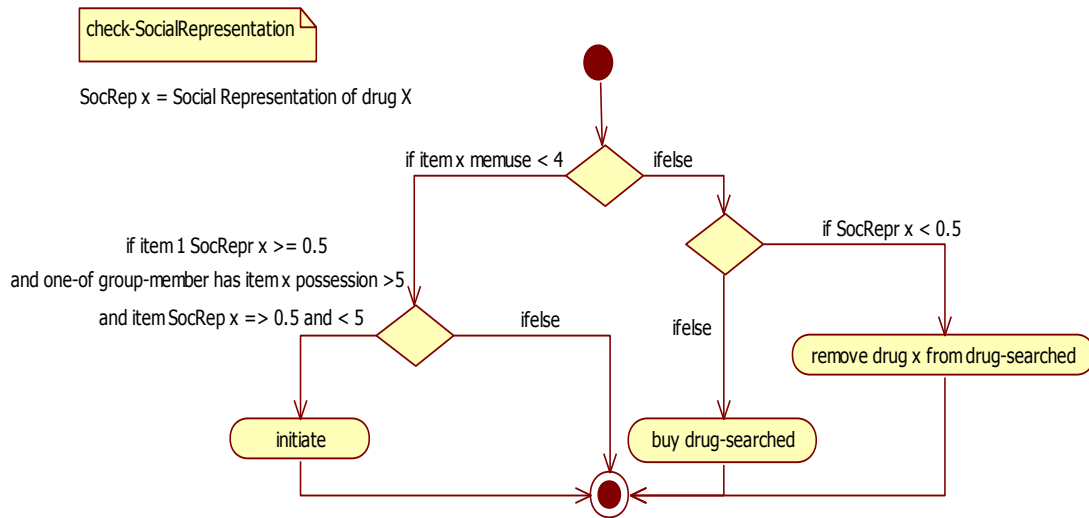


Figure 7.13. Check-SocialRepresentations Activity Diagram.

- sixth, once the definitive list of substances to be purchased is set, the *user* runs the **check-preferences** method to sort these substances into a preferred-drug list representing the preferences of the *user* (p.303). The future expenses are calculated based on this preferred-drug-list and on *user's* Stage. If the expenses exceed the budget, *user* will try to **buy** substances starting by the first element of the preferred-drug-list attribute; otherwise, the *user* will try to **buy** all substances present in the preferred-drug-list. The **buy** method involved interaction between *user* and *dealer*, hence, it is described in the *interaction* section (see below).

The previous methods and their formalization have been extensively discussed in the Chapter V and the ordered sequence of the decisional process will be detailed again in the next subsection with the sequence diagram (Section 7.1.3).

3) Action

Most of the *action* operations are associated with the substance consumption and its consequences. Depending on the current-InstrumentalUse targeted by the *user*, the **consume** operation will orient the *user* to execute one of the **consume-function-drugs** method. There are five **consume-function-drugs**, one for each of the possible instrumental use (Section 5.2.1). These operations define the actions, locations and consumptions of *users* for the whole duration of their consumption.

This diagram represents the **consume-energy-drug** operation called by *users* with their current-InstrumentalUse equal to "Energy" (Figure 7.14):

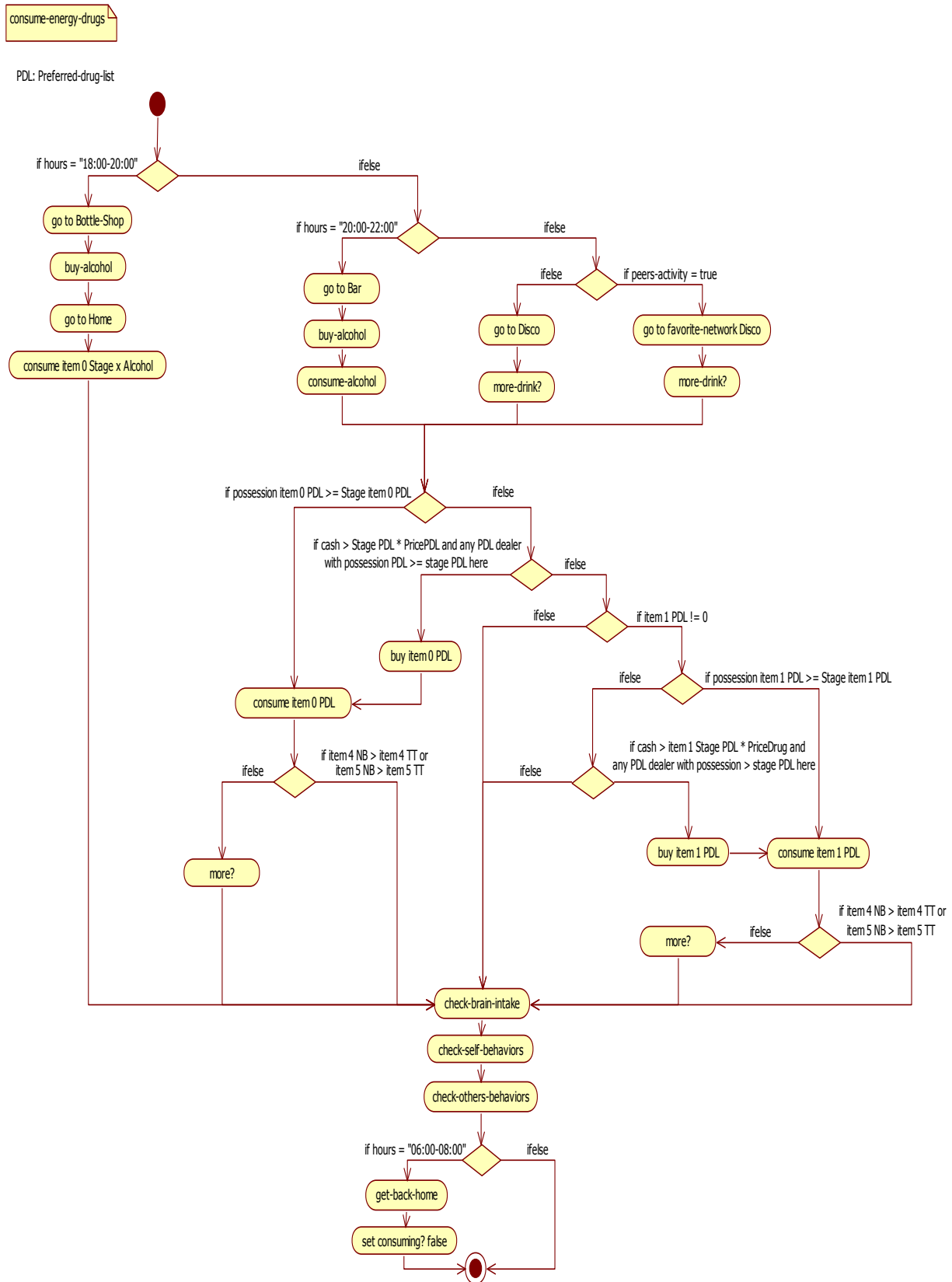


Figure 7.14. Consume-Energy-Drugs Activity Diagram

This second activity diagram represents the **consume-social-drug** method (Figure 7.15):

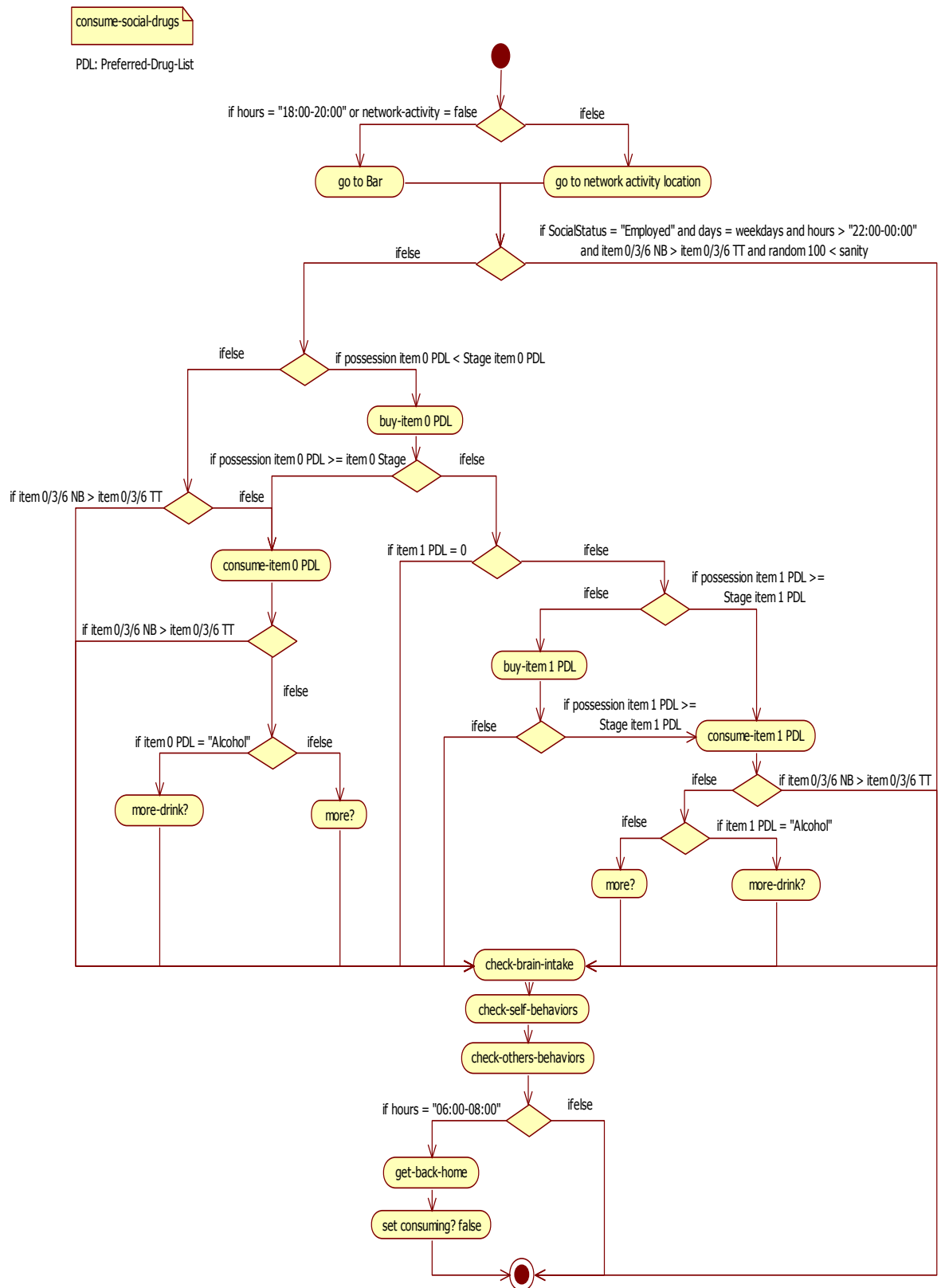


Figure 7.15. Consume-Social-Drugs Activity Diagram.

If the current-InstrumentalUse of the *user* is equal to "Intoxicated", this agent behaves as in Figure 7.16:

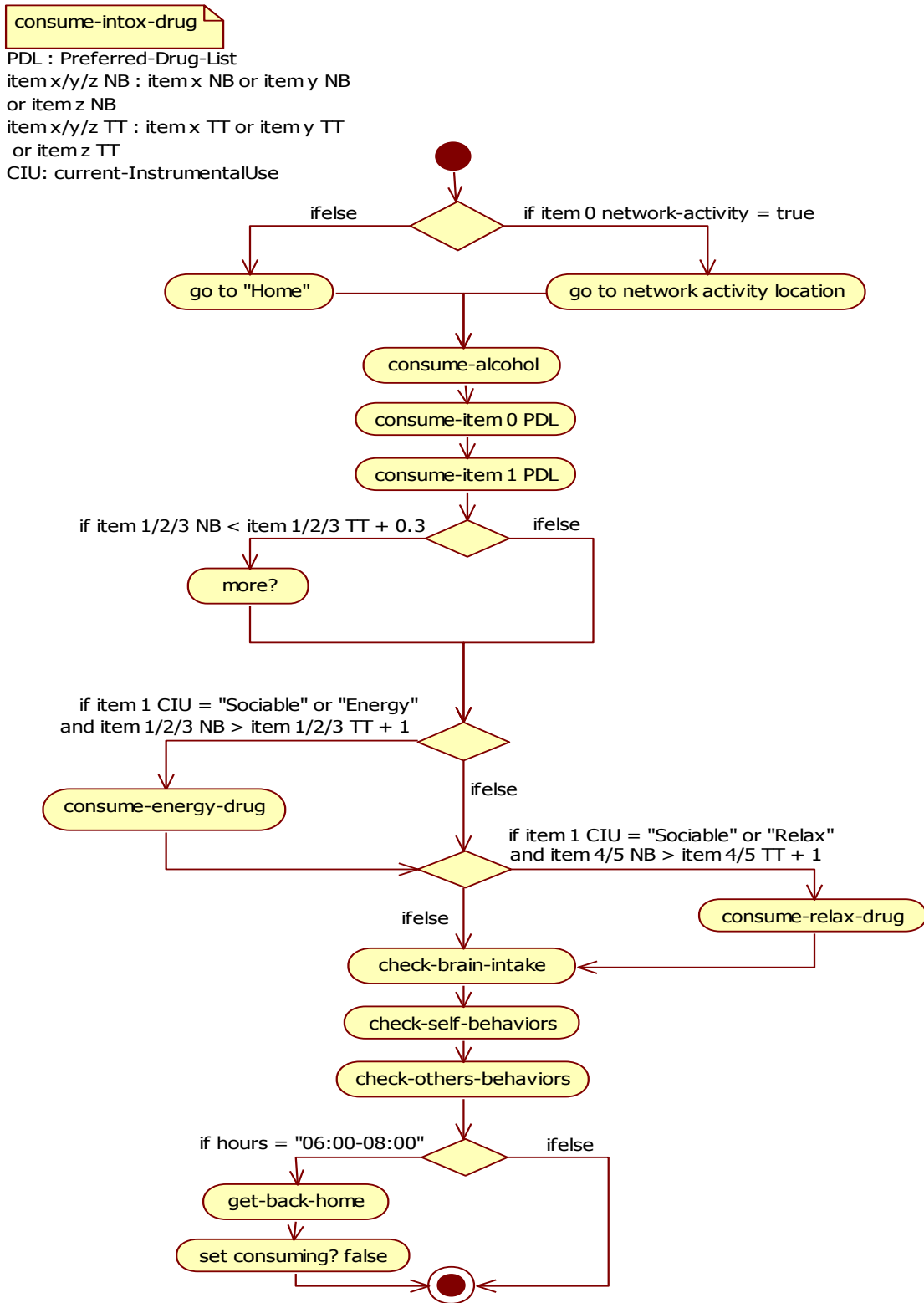


Figure 7.16. Consume-Intoxicated-Drugs Activity Diagram.

This fourth activity diagram represents the **consume-relax-drug** operation (Figure 7.17):

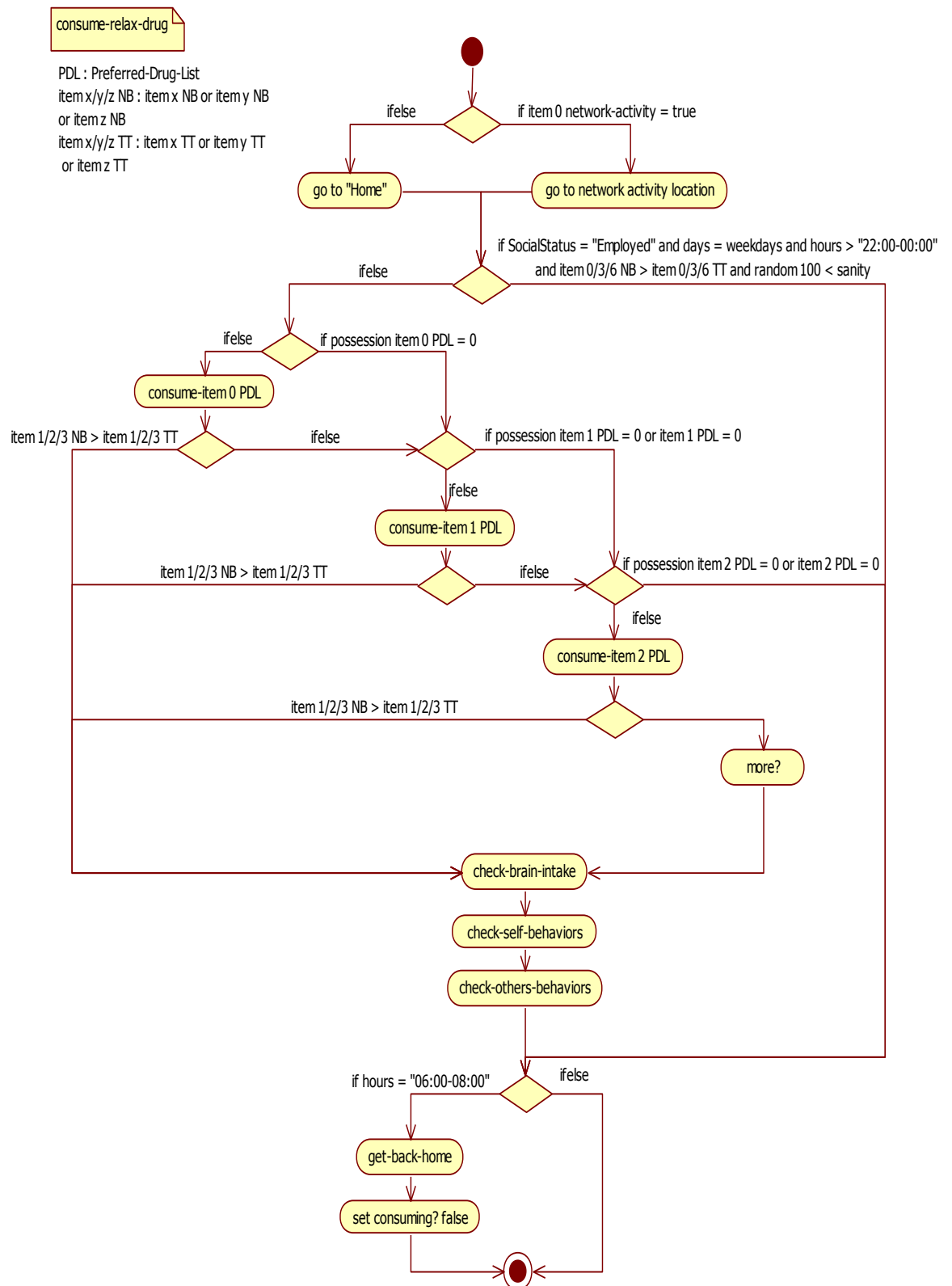


Figure 7.17. Consume-Relax-Drugs Activity Diagram.

The last **consume-function-drugs** was designed to handle the case of "Hallucinate" current-InstrumentalUse (Figure 7.18):

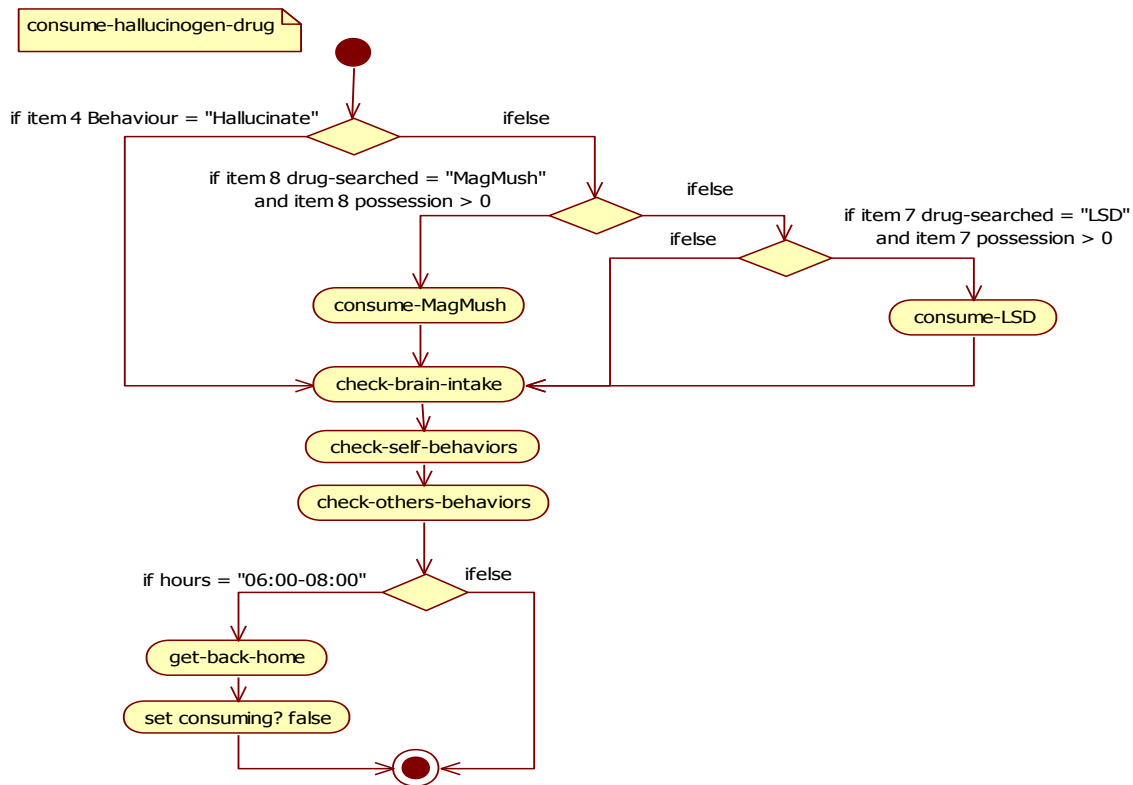


Figure 7.18. Consume-Hallucinogen-Drugs Activity Diagram.

Users with no long experience about a specific substance (with a memuse attribute inferior to four) run the **initiate** method and obtain the substance from one of its peers (*network* members):

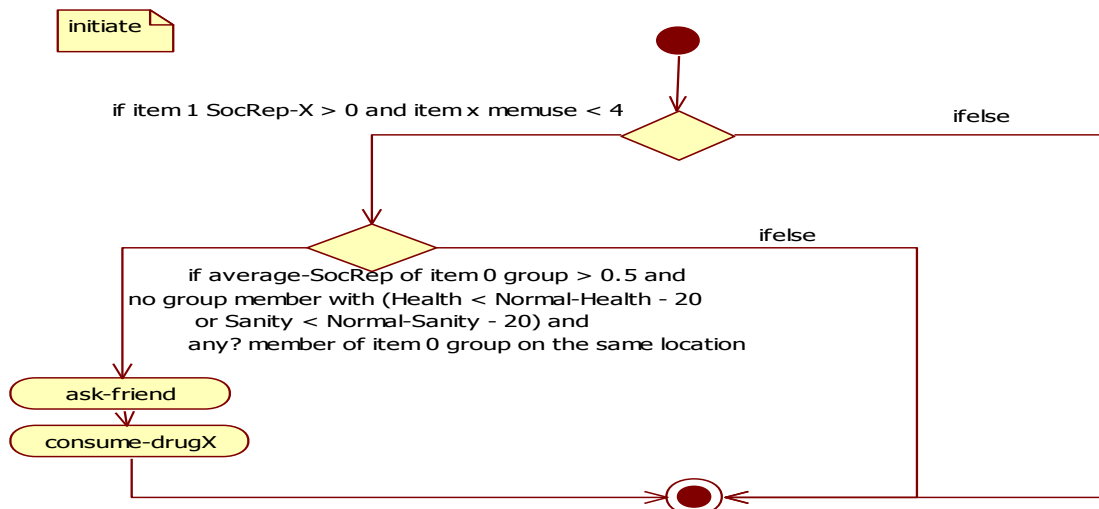


Figure 7.19. Initiate Activity Diagram

The **ask-friend** method is described with the *interactions* operation below (Figure 7.21).

The act of consuming substances has been modeled through the **consume-drug** operation that functions on the same pattern for each substance (Figure 7.20).

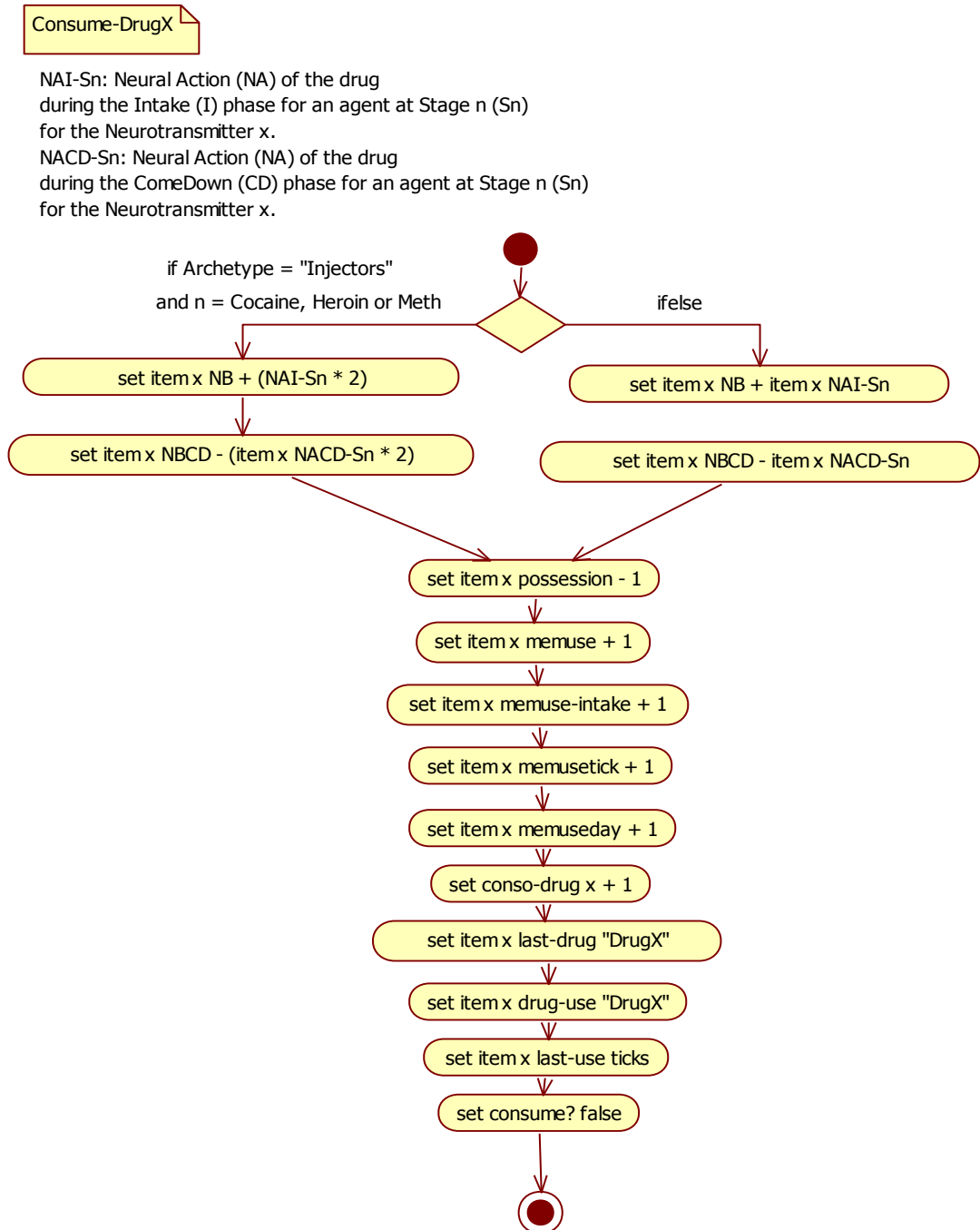


Figure 7.20. Consume-DrugX Activity Diagram

As illustrated by the previous diagrams, *users* run the **check-brain-intake** method to modify their Behaviors accordingly to their neurotransmitter levels. Then, *users* evaluate their own Behaviors through the **check-Self-Behaviors** operation, as well as the Behaviors of other *users* present on the same location by the mean of the **check-Others-Behaviors** method. These two methods are presented with the other *interactions* operations (Section 7.1.2-D).

The **consume-function-drugs** diagrams present the normal flow of consumptions. As underlined in Section 2.3.1.3, *externalities* can affect the course of every action. These externalities, based on the empirical arm of this research, could take the forms either of negative reactions (**declare-OD** (p.96), **brawl** (p.313) or **hazardous-act** (p.312)), or increased consumptions (**more?** (p. 310), **more-drink?** (p.309)). If the *user* faces a negative event or witnesses an overdose, its consuming? attribute will change to "false". In that case, this *user* will execute the **get-back-home** method or the **treat** operation if its Health becomes too low.

The **get-back-home** method (p.314) signals the end of the consumption phase. *Individuals* move to their 'Home' (or 'Dealer-Place' for *dealer*) and run the **rest** method. If the level of Glutamate and/or Norepinephrine neurotransmitters (item 4 or item 5 of the NeuralBox) is/are higher than their related Tolerance-Threshold — in other words, if *users* are too awake and energetic to be able to rest — they execute the **use-depressant** method (p.343) and try to get some sleep if they are able to balance out the level of the excitatory neurotransmitters with inhibitory neurotransmitters.

The remaining operations are **move** and **redefine-network**. The former asks the *user* to literally move from its present location to one of the nearest 'Street' location. The later modifies the values of *users* or

dealers Group attribute to mimic changes in the social environment of the *individual* (the exact description of this method could be found p.247).

Throughout the consumption phase, *dealers* continuously run the **sell** method (cf. p.294) except if they are arrested by a *policeman*.

4) Interaction

There are three different kinds of *interaction* methods: (a) interactions between *individuals* or agent of other classes; (b) self-interactions, and; (c) impact of societal obligations on the *users*, represented by the **check-SocialControl** operation (cf. p. 389).

Only interactions between different *individuals* are developed here: the interactions between *doctors* and *users* (**heal**), *policeman* and *users/dealers* (**arrest**), and *wholesaler* and *dealers* (**supply**) are described in the first subsection (Section 7.1.1).

There are three interactional operations between *users*. The first method treats the case of *users* searching for a particular substance, without connection to an appropriate *dealer*. The **ask-friend** method allows this *user* to literally ask other members of its primary *network* for one unit of the searched substance. In SimUse, the "friend" *user* accepts if it has more than enough drugs for its own consumption (possession > Stage):

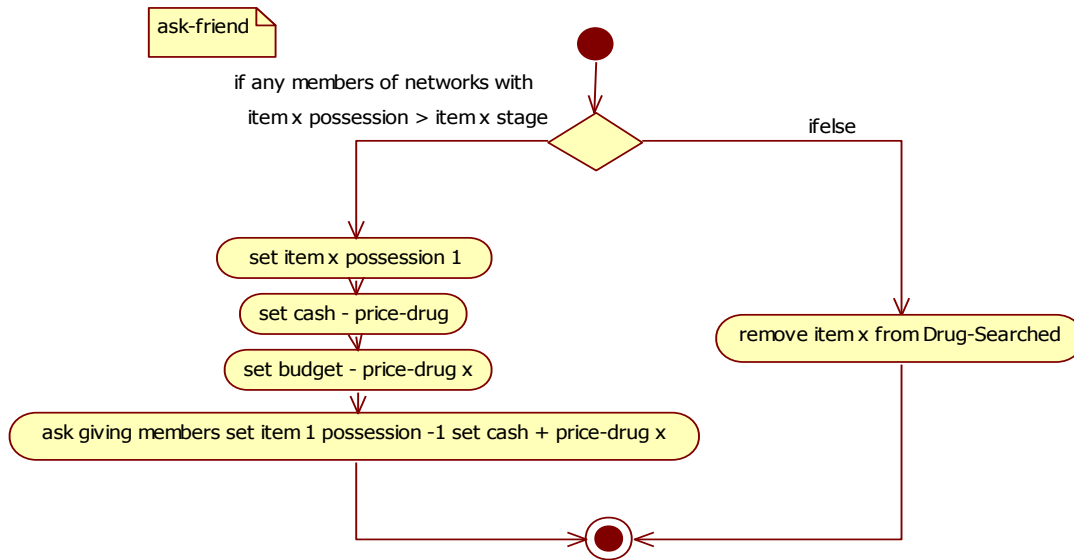


Figure 7.21. Ask-Friend Activity Diagram

As explained in the second part, interactions with other users and especially with peers play a key role in the transformation of the meanings and social representations attached to substances. This interactional process is represented in SimUse by the **check-Group-Influence** (p.204) and **check-Others-Behaviors** (p.208) methods. The former assesses the influence of *network* "average" attributes on the SocialRepresentations and future actions of the *user* (Figure 7.22):

Check-group-influences

SocRep X: SocialRepresentation of the drug X

$$y = \exp((-item\ 1\ SocRep-Drug\ X^2)/(2.5^2))/(0.8\sqrt{2\pi})$$

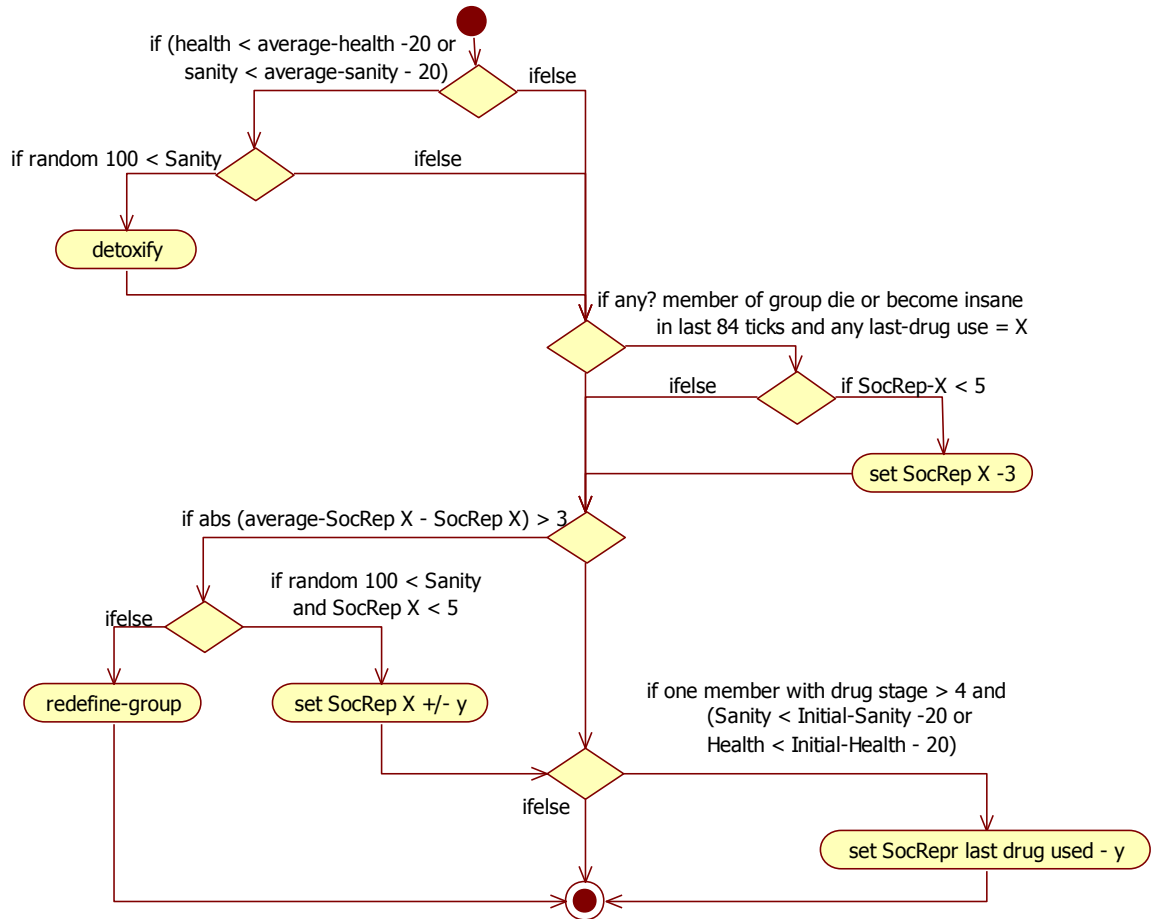


Figure 7.22. Check-Group-Influence Activity Diagram.

The second operation consists of evaluating the behaviors of surrounding *users* at the end of each consumption time step. **Check-Others-Behaviors** operation involves members of *user's* network as well as any *users* present in the same location. The behaviors perceived by the *user* are evaluated and could entail modification of its SocialRepresentations attribute (Figure 7.23):

check-other-behaviours

$$y = \exp((-item\ 1\ SocRep-Drug\ X^2)/(2.5^2)) / (0.8v2\pi)$$

SocRep-Drug x = Social Representation attached to drug x

memuse-intake x = number of dose of the drug x consume by the agent

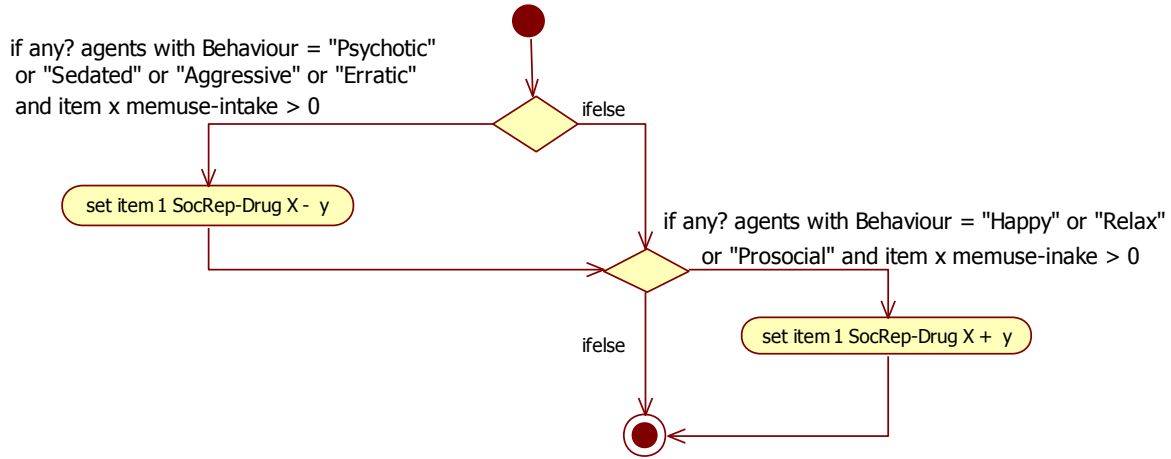


Figure 7.23. Check-Others-Behaviors Activity Diagram.

These interactional methods are not the only ones to entail a transformation in *users* SocialRepresentations. There are two operations relative to user's self-reevaluation: **check-Self-Behaviors** (p.238) and **check-Cross-SocialRepresentations** (p.244). The latter is mainly run during the initiation and first consumptions of *users*. This operation was conceived to reproduce the "gateway" effects of some substances (Section 4.3.2) and its main consequence is to increase the SocialRepresentations values of the substances sharing similar effects.

User runs the check-Self-Behaviors operation after each consuming time step to re-evaluate its own behaviors and actions. In the same way than the precedent operations, this method essentially influences the SocialRepresentations attribute of the *user*: if it exhibits the expected Behaviors considering its current-InstrumentalUse, its SocialRepresentation will be positively reinforced; conversely, if because of its consumptions, the *user* ends up being aggressive or behaving inappropriately, the value of its SocialRepresentation will be reduced as indicated in Figure 7.24.

check-self-behaviours

CIU = Current-InstrumentalUse

$$y = e^{((-item\ 1\ SocRep-Drug\ X^2)/(2.5^2)) / (0.8\sqrt{2\pi})}$$

SocRep-Drug X = Social Representation of the drug x

memuse-intake x = number of dose of the drug x consume by the agent

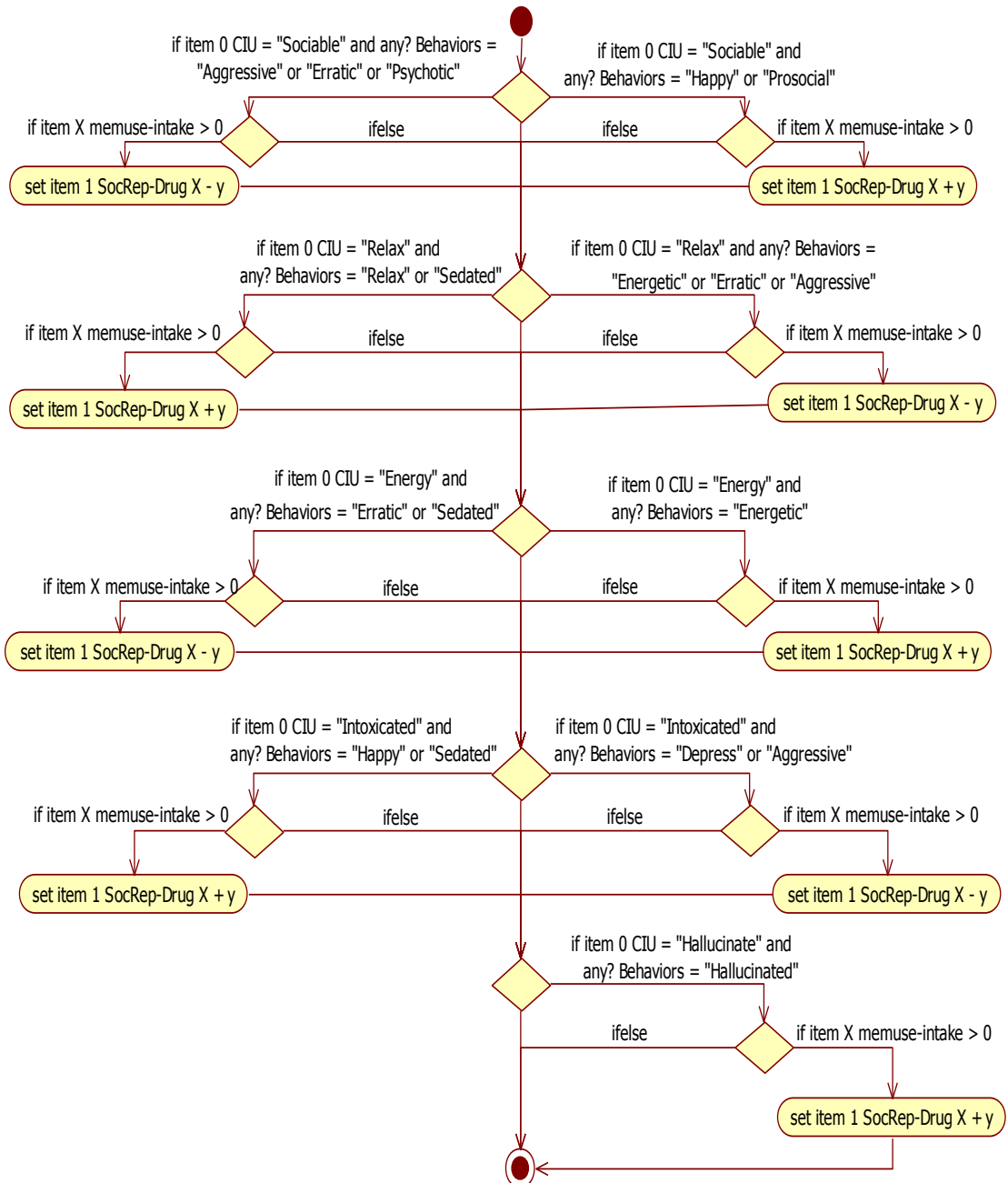


Figure 7.24. Check-Self-Behaviors Activity Diagram.

The main consequence of these interactional operations is to transform the future *user's* decisions and actions by modifying the values of their SocialRepresentations.

The *user* could also generate drug-rules and control-rules by checking its previous behaviors through the **check-rules** operation (cf. p.388). This one could entail drastic changes in the consumption routine of the *users*.

The Section 7.1.2 has presented each class operations. Section 7.1.3 details the order in which the different operations just described are structured and integrated in the model.

7.1.3. Conceptual model: temporal dynamic and sequence diagrams

This Section presents and details the sequence diagram of SimUse functioning. This is the storyboard of the simulation describing the order and the precise moments during which operations of different classes are executed.

SimUse is divided in six successive main steps:

- I. *Setup*: The different classes and agents are created accordingly to their own sets of attributes or to predefined parameters (cf. below);
- II. *Context Update*: The context and societal levels are updated: "Hours", "Day", and "Weeks" are modified accordingly to the number of time steps; the attributes of both *policemen* and *doctors* are updated and they start their routine; *wholesalers* import drugs if needed; *dealers* purchase some drugs to their *wholesalers* if needed; and any temporary "Events" is created during this first step;
- III. *Network and Individual Update*: attributes of both *network* and *individual* are updated; *users* also check the influence of their *network* and start their routine;
- IV. *Deliberation Phase*: *users* deliberate the different substances they want to use and acquire them through *dealers* that are consistently executing the **sell** operation;

- v. *Consumption Phase*: users consume the different substances accordingly to the type of function they want to achieve and return to their 'Home' location, and finally, **rest**;
- vi. *Plotting*: operation outputs of the past time step are plotted in the different monitors and graphs display on SimUse interface (see Section 7.1.4 for more details).

These six phases are embedded in the twelve time steps representing a virtual day. These time steps are repeated in the same order for each day of the simulation. Some of these time steps are equivalent in terms of method content: this is especially the case of the *consumption phase*, during which each type of agents repeat the same methods in the same order. Thus, to present the order these operations are executed, the sequence diagram has been divided into four main diagrams²²² representing the twelve steps of a typical day in the simulation, plus the *setup* phase.

Each simulation starts at "08:00-10:00" on a "Monday". During the first time step, *users* and *dealers* update their different attributes and *users* balance their neurotransmitter levels. Also, *users* are asked to run the **check-Known-Dealers**, while *networks* calculate their attributes values (Figure 7.25).

The two following time steps represent ("10:00-12:00" and "12:00-14:00") the moments during which the *dealer* and *wholesalers* are updating their stocks and could either **supply** or **import**. *Users* start their normal routine and move to the location of their work if they are 'Employed' (determined by their Territory attribute) or to the "University" location if they are 'Student'. They also perceive their "drug pocket money" once every fortnight by executing the **be-paid** operation (Figure 7.26).

²²² Some time steps are equivalent in term of operations executed.

From 14:00 until 18:00, *users* can **break-in** (optional operation made active by the "crime?" switch on the interface cf. below). If the value of their cash attribute is below 50 and if any element of their Stage is above 5, this operation asks the *users* to literally "breaking into" one of the nearby 'Home' location and virtually steal ten time the value of the SocialStatus of one of the *user* living on that location. *User* **breaking-in** could be arrested by *policeman* situated in their "Policeman-vision" range (Figure 7.27).

After the deliberation phase, the *users* are consuming accordingly to their current-InstrumentalUse attribute. At "06:00-08:00", all *users* still in the consuming process run the **get-back-home** method and start a new cycle (Figure 7.28).

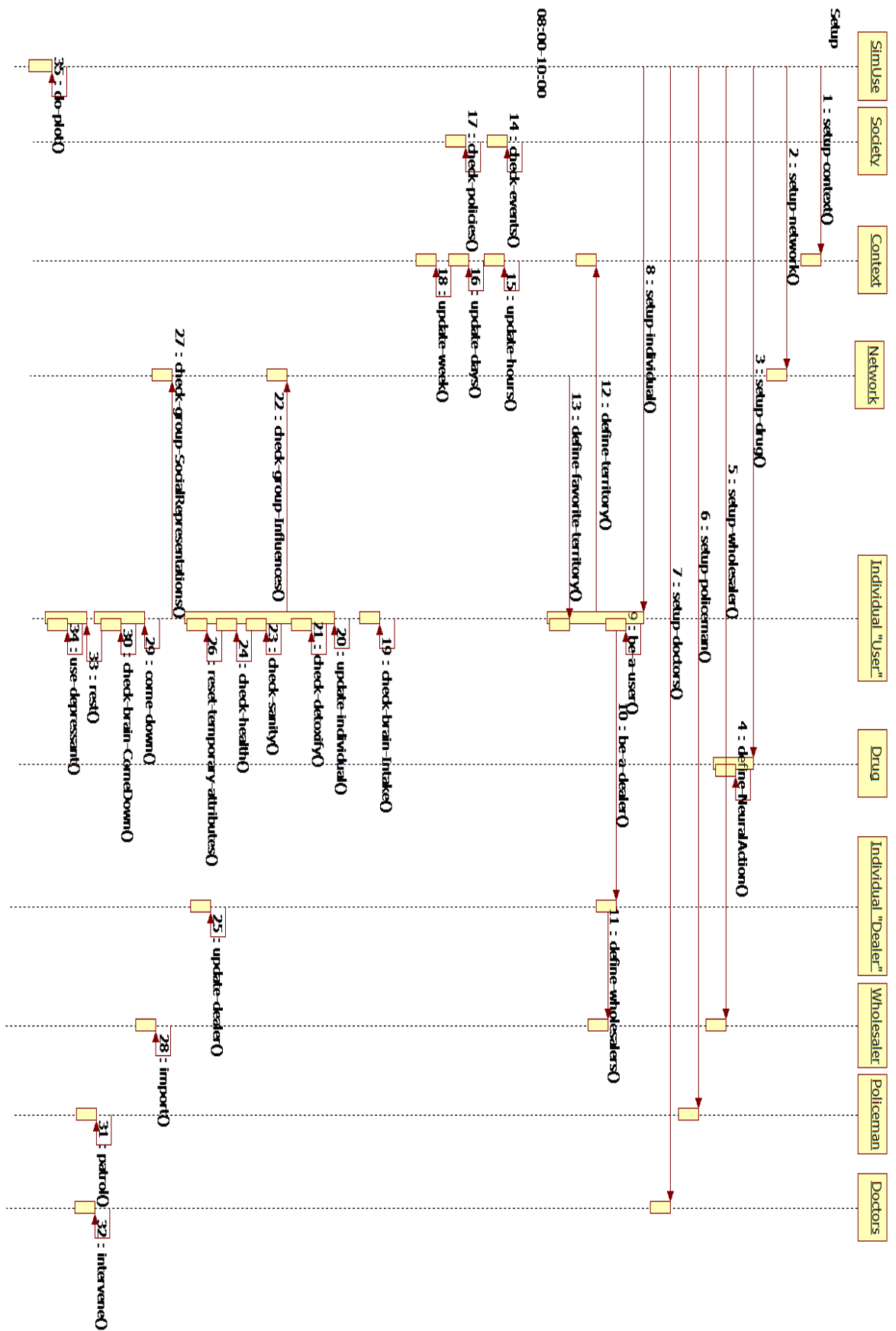


Figure 7.25. Sequence Diagram Setup and time step "08:00-10:00".

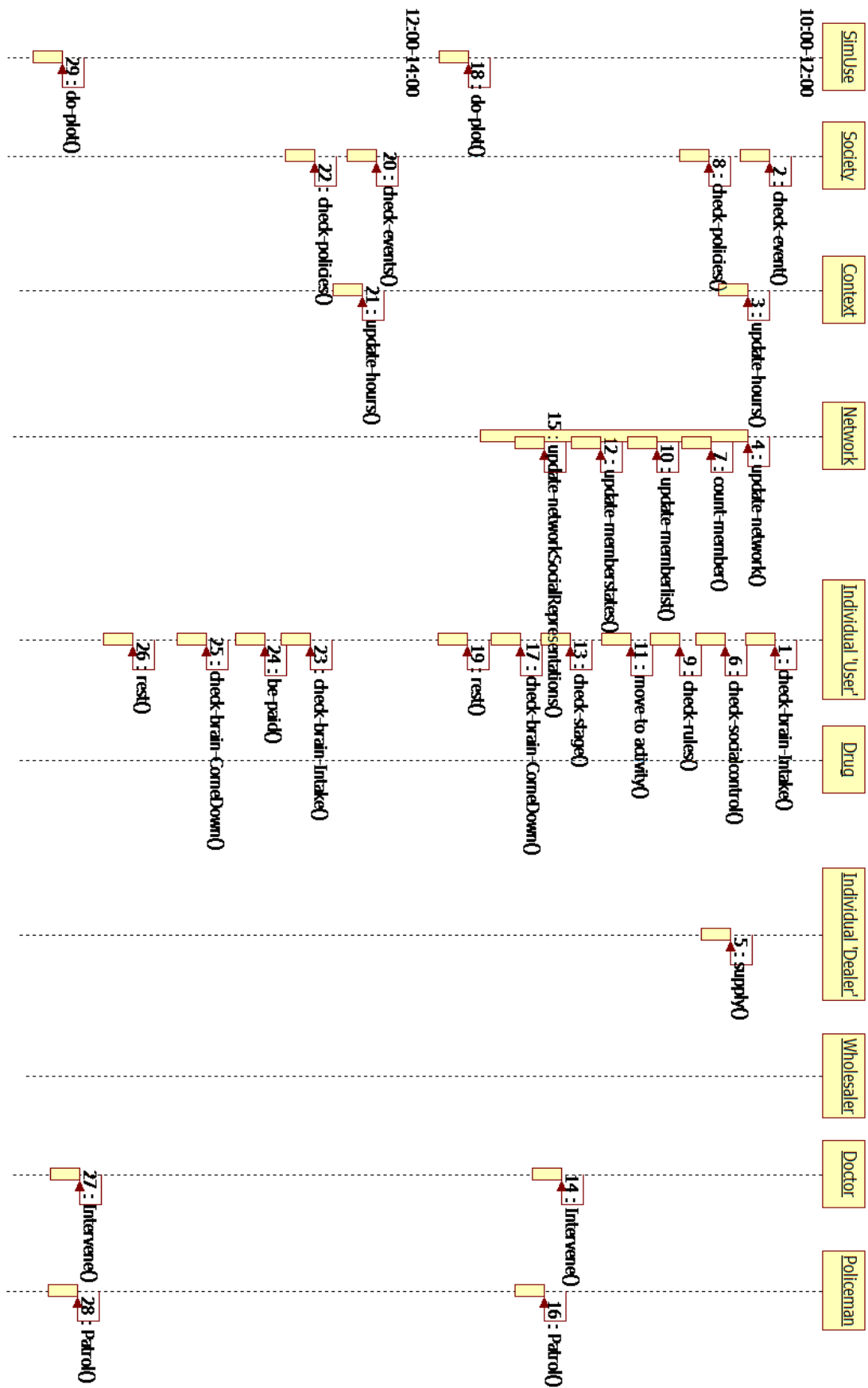


Figure 7.26. Sequence Diagram "10:00-14:00".

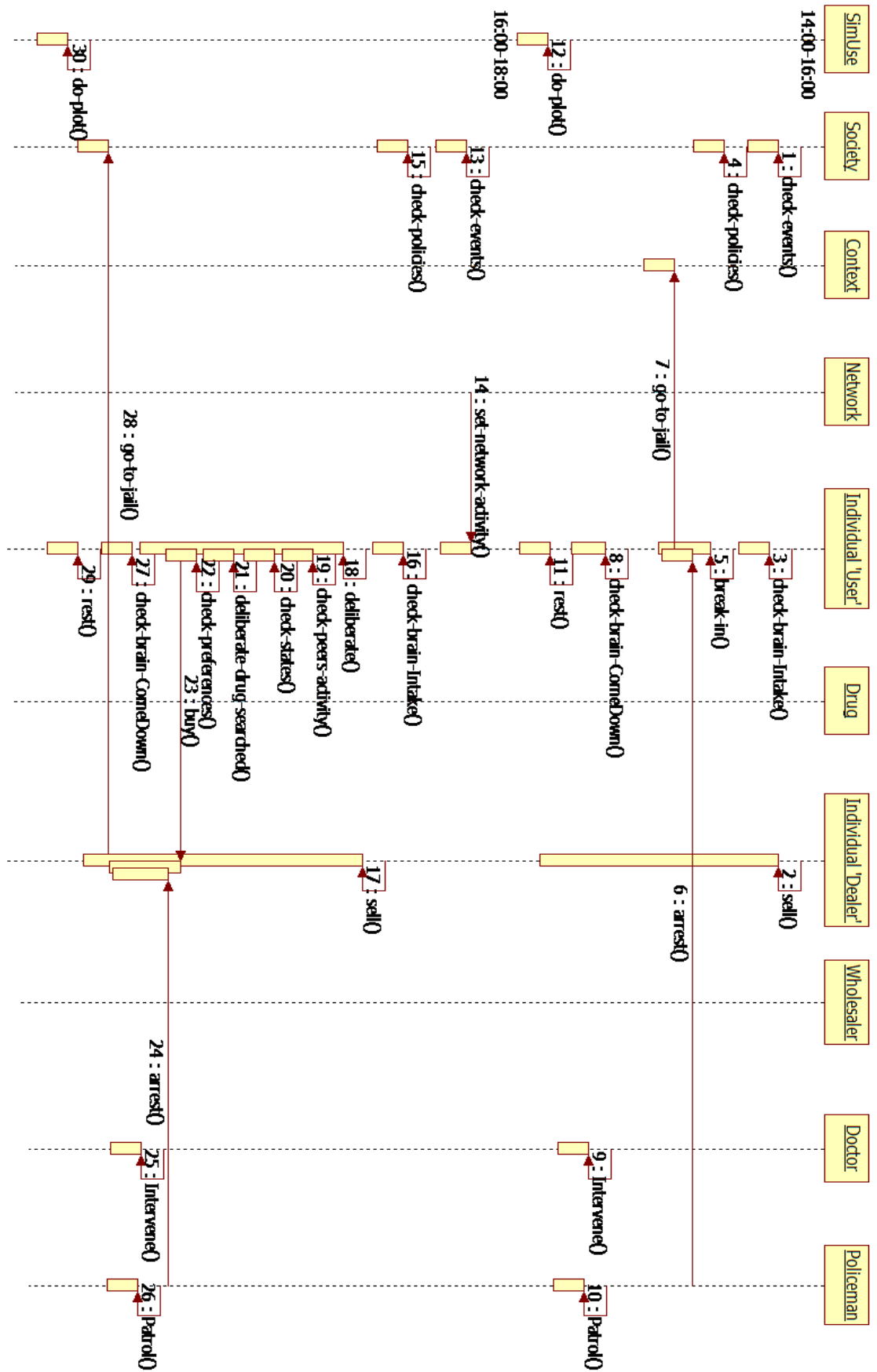


Figure 7.27. Sequence Diagram "14:00-18:00".

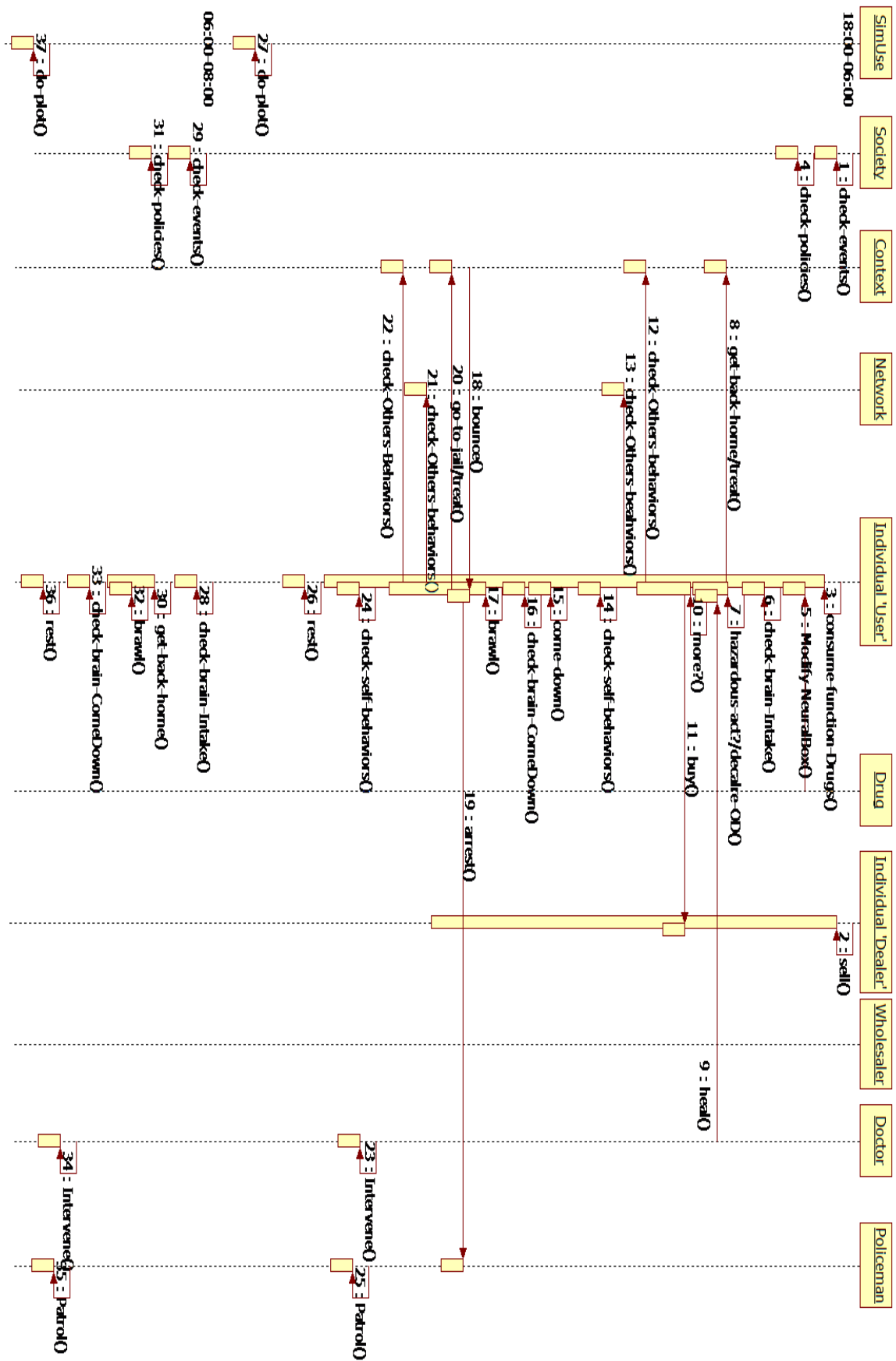


Figure 7.28. Sequence Diagram "18:00-08:00".

As indicated, the 'Society', 'Context', *policemen*, and *doctors* agents execute the same operation(s) every time step. Several update procedures or optional operations are run in time steps that do not contain an important number of operations, in order to save some calculation time.

The previous subsections have illustrated and detailed the inner functioning and architecture of SimUse. The next subsection describes the way SimUse is parameterized and launched.

7.1.4. Implementation Model: NetLogo Interface and Setup

SimUse is implemented in the version 4.1.3 of the multi-agent platform NetLogo® [118] using a variation of the StarLogo programming language. This platform is widely used amongst the community of social scientists aiming to reproduce social complex systems. The NetLogo® software could be downloaded freely at: <http://ccl.northwestern.edu/netlogo/>

The interface of SimUse is constituted of three types of elements: *parameters*, "*grid*", and *plots*. These are described in the following paragraphs.

A) Parameters

Before launching the simulation, the modeler needs to set the initial parameters of SimUse. These parameters are situated on the upper left corner of the interface (Figure 7.31) and can be set through three types of 'buttons': *slider*, *switch*, and *chooser*. The **slider** buttons are employed to fix numerical values; *switches* for parameter with a Boolean type of value; and *choosers* to set variable using a series of characters. Parameters relative to the number of agents and to the context, such as, *vertical-street*, *horizontal-street*, *Bottle-Shop*, *Bar*, *Disco*, *users*, *dealers*, *wholesell*, *constables*, *doctors*, and *average-network-*

density, cannot be modified during the course of the simulation. Some others, *%Arrest*, *%Brawl*, *Wealth*, and *Policeman-vision* could be changed during the simulation. These fifteen initial parameters are fixed by using the following sliders (Table 7.10):

Table 7.10. List and Descriptions of the Slider buttons.

Name	Description
vertical-street [10-40]	These two values set the number of streets on the grid. Streets delineate the number of blocks at initiation. Each block contains at least four "Location" patches (cf. above).
horizontal-street [10-40]	
Bottle-shop [1-20]	This value defines the number of patches at initiation with the "Bottle-Shop" <u>type?</u> (appearing in orange). The retail price of Alcohol in this location is equal to the "Price-Alcohol" value (cf. below).
Bar [1-20]	This parameter defines the number of patches at initiation with the <u>type?</u> "Bar" (blue patches). The retail price of Alcohol equal the "Price-Alcohol" value plus three (cf. below).
Disco [1-20]	This value (range 1 to 20) defines the number of locations at initiation with the <u>type?</u> "Disco" (purple). The retail price of Alcohol equal the "Price-Alcohol" value multiplies by two (cf. below).
Users [100-5000]	Number of <i>users</i> at initiation.
Dealers [10-50]	Number of <i>dealer</i> at initiation and also indicates the number of locations with the "Dealer-place" <u>type</u> (yellow patches).
Constables [0-20]	Number of <i>policeman</i> at initiation.
Practitioners [0-20]	Number of <i>doctor</i> at initiation.
Wholesell [10-20]	Number of <i>wholesaler</i> at initiation.
Average-network-density [3-10]	This value defines the average number of <i>users</i> plus <i>dealers</i> by <i>network</i> at initiation.

Name	Description
%Arrest [0-100]	Value defining the probability a <i>policeman</i> has to apprehend a <i>user</i> or a <i>dealer</i> (depending on the <i>policemen</i> mission).
%Brawl [0-100]	Probability <i>users</i> have to get involved in a brawl with other <i>user(s)</i> displaying the "Aggressive" or "Sedated" <u>Behavior</u> .
Wealth [-5 - 5]	Values modifying the <u>cash</u> earned by <i>users</i> while executing the be-paid algorithm.
Policeman-vision	Range (patch distance) a <i>policeman</i> could arrest another <i>individual</i> .

The second type of buttons — **switch** — is employed to activate a series of options. These buttons allow user of the model to test hypotheses concerning the impact of one or several algorithms implemented in SimUse. They literally give the opportunity to "switch" on and off some operations. For example, switching the button "rules?" *off* will prevent *users* from running the **check-rules** operations, and in turn, building control rules about their consumptions. SimUse user could then test if these control rules really affect the consumption of *users* and, if so, assess in what proportions (Section 7.3.2). This feature is on the same vein of Epstein idea regarding agent-based model. According to him [251], agent-based models could be used as "laboratories" for behavioral research: these switches allow creating *what-if* scenarios by increasing or decreasing the number of constrains or potential actions of *users* and *dealers* in the model. Some of these switches remain optional ("infection?", "crime?", and "group-select?"), but four of them ("rules?", "full-availability?", "Self?" and "network?") are directly related to the empirical findings. These switches are used to verify some part of the model. These switches are described in Table 7.11.

Table 7.11. Description of the different Switch buttons

Switch	Description
Infection?	Optional scenario: <i>users</i> with the "Injector" archetype have 0.03% of chance of setting their <u>infected?</u> attribute to true, losing 0.01 of their <u>Initial-Health</u> each day and can potentially infected other "Injector" in their <u>group</u> .
Crime?	Optional scenario: <i>users</i> with a high <u>Stage</u> and low <u>Cash</u> could run the break-in operation and steal <u>Cash</u> form other <i>users</i> .
Group-select?	Optional scenario: at initiation, the members of a same <i>network</i> are selected accordingly to their <u>Archetype</u> and <u>SocialStatus</u> : if the values of these attributes are not close enough to the <u>Average-Archetype</u> (+/-2) and <u>Average-SocialStatus</u> (+/-5), the <i>user</i> run the redefine-network operation.
Rules?	Empirical-based Scenario: as aforementioned, this switch prevents or authorizes <i>users</i> from running the check-rules operation and, in turn, creating consumption rules.
Full-availability?	Empirical-based Scenario: if on the "on" position, all <i>users</i> see their list of <u>known-dealers</u> entirely filled with <u>ID</u> of drug-related <i>dealers</i> . Set to "off" position, the <i>users</i> run the check-known-dealers operation normally.
Interaction?	Empirical-based Scenario: this switch allows testing the importance of other <i>individuals'</i> judgments on the behavior of <i>user</i> . Set to "off", it prevents the <i>users</i> from running the check-other-behaviors , check-group-influence , and check-group-SocialRepresentations . Furthermore, the <i>user</i> will not be affected by witnessing dramatic events (death, overdose, accident, etc.).
Self?	Empirical-based Scenario: in the same way that "Interaction?" switch, "Self-Reevaluation" prevents the <i>users</i> from executing operations that reevaluate their own behaviors through check-self-behaviors .

The last type of buttons is called **chooser**. There are two chooser buttons allowing SimUse utilizer to select temporary "Events" and the *policemen* mission ("Public Policies"). These elements and their related choices have already been developed in a previous subsection (Section 7.1.1).

All parameters appear on the upper left corner of SimUse interface as indicated by Figure 7.29.



Figure 7.29. "Sliders", "Switches", and "Choosers" of SimUse.

B) The *grid*

Once all these parameters set, pressing the "Setup" button will create the different elements of the simulation. The number of *users*, *dealers*, *wholesalers*, *policemen*, and *doctors* chosen through the parameters listed above will be created and placed accordingly to their type on the "urban" *grid*. This grid (80 x 80 patches) contains the number of settings chosen by the modeler, where agents can act and/or interact. This grid represents a set of blocks delineated by "Street" patches. As aforementioned, the design of the grid depends on the number of streets chosen by the user through the "horizontal-street" and "vertical-street" sliders in the interface (Figure 7.30).

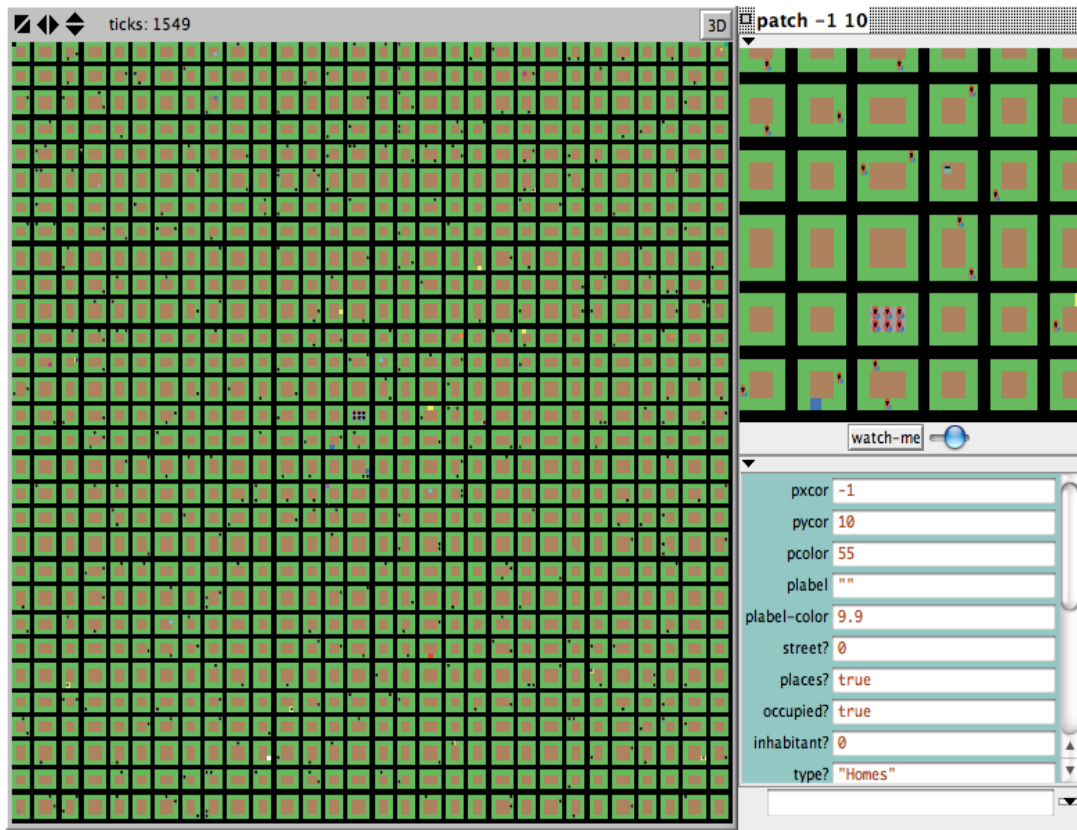


Figure 7.30. SimUse grid and example of an inspection window.

It has to be noted, that the algorithms shaping the grid construction are based on the model "Traffic Grid" developed by Uri Wilenski (this model could be found in the model library of NetLogo®). Each block is mainly composed of 'Home' patch but could also contain patches of the 'Bar', 'Bottle-shop', 'Disco', 'Dealer-Place', 'Police-Station' or 'Hospital' type?. The number of 'Bar', 'Disco', and 'Bottle-Shop' is selected by the means of sliders (cf. above). During its setup, SimUse creates one "Police-Station", one "Hospital", and one location for "University" patches. The number of "Dealer-Places" patches depends on the number of *dealers* selected by SimUse user. This number corresponds to the "Dealers" slider value (see below).

C) Plots

The Netlogo platform allows observing the outputs of the simulation by two different ways: *graphs* and *output windows*. The former display the

evolution of a variable tick by tick; the latter show the cumulated values of preselected variables and acts as a counter. The different type of graphs and output windows are as presented in Table 7.12.

Table 7.12. List and Descriptions of SimUse plots.

Variable	Description
Substance-consumption	Each unit of substance consumed are counted through output windows and plotted through graphs to observe changes in the consumption trend over time.
Dealers	Graph describing the evolution of the <i>dealer</i> population.
Treatment	Output window presenting the number of <i>users</i> that have entered treatment or have been healed by a <i>doctor</i> .
Assault	Graph describing the occurrences of fights between <i>users</i> .
Arrest	Counters presenting the number of <i>users</i> that have been arrested by a <i>policeman</i> .
SocialRepresentations	Graph presenting the changes in the substances <u>SocialRepresentation</u> values of <i>users</i> having already used the substance.
Deaths	Counter presenting the number of <i>users</i> with the "Deceased" <u>typ?</u> .
Insanes	Counter presenting the number of <i>users</i> with the "Insane" <u>typ?</u> .
Hard-Clusters	Output window plotting the number of <i>networks</i> with at least one of their <u>average-stage</u> attributes above 4.

D) Setup and Go buttons

The "setup" consists of a sequence of algorithms executed in the following order:

- create the context as shaped by the parameters described in the previous paragraphs (**setup-context**);

- generate the psychoactive substances (**setup-drugs**);
- **setup-wholesaler**;
- create *users* of different archetypes and *dealers* (**setup-individual**);
- then, generate a number of *network* based on the number of *users* created and on the "average-network-density" parameter (**setup-network**);
- and, finally, generate both *doctors* (**setup-doctors**) and *policemen* (**setup-policeman**).

The number of agents representing each class is chosen by the modeler through the different sliders presented above. These different classes' agents are created with the attributes described in section 7.1.1 and initiate with their preprogrammed values.

Once the context and the different agents created, the simulation is launched by pressing the "Go" button. Each simulation starts on a Monday at "08:00-10:00" on the week 1. *Users* are randomly dispatched on a street patch; *dealers* are positioned on the patch corresponding to the coordinates given by the two-first elements of their Territory; *wholesalers* are located inside blocks (these agents do not move during the simulation); as aforementioned, *doctors* start on the 'Hospital' patch and *policemen* on the 'Police-Station' patch. The *drugs* are situated in the upper left corner of the grid (patch coordinates: -79 79) while the *networks* are situated in the upper right corner (patch coordinates: 79 79).

By pressing the "Go" button, SimUse is run for one time step; by pressing the "Go" button with two arrows in the bottom right corner, the simulation runs until this button is pressed again. In the code, the proceeding of the simulation has been implemented through three algorithms: **go**, **routine**, and **schedule**. These three algorithms manage the ordered continuity of the simulation.

The outputs and graphs are plotted at the end of each time step (once the methods attributed to each agent are finished) through the **do-plot** algorithms. Once all plot updated, SimUse will start another time step until the "Go" button is hit again or the maximum time steps wanted by SimUse user is reached.

Section 7.1 has described the final model by presenting the different classes, classes' attributes and operations, as well as the architecture of SimUse. It detailed the ordered sequence in which the different algorithms are executed and the way to launch a simulation. Nevertheless, describing both structure and functioning of the model does not prove that the implemented version of the model fits with what was designed. The process of testing the relevance and correctness of the program are described in the two next sections.

7.2. Verification of SimUse: definitions and proposed tests

According to Hempel [321], "in the absence of unfavorable facts to a hypothesis, its confirmation will be considered as increasing with the number of favorable results when subjected to tests."²²³ Models are built on a set of hypotheses regarding the real phenomenon they are intended to represent. These hypotheses are the different attributes and algorithms implemented as well as their evolutions and interactions. Therefore, the confirmation of the model would arise from the multiplication of "favorable results" founded on tests conducted on the different operations and on the overall functioning of the model. In the field of social simulation, these processes of confirmation are named *verification* and *validation*.

In this thesis, the term validation is defined as the "substantiation that a computerized model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model" [322]. This "satisfactory range of accuracy" is evaluated by comparing the adequacy between model outputs and data observed in the real world [104]. This comparison is in most cases achieved by using statistics in order to validate the model from a macro-level perspective. However, validating SimUse appears difficult, mainly because there are no precise statistical data concerning polysubstances use. As pointed in section 1.3.3, national and international institutions investigating drug use produce data concerning the consumption rates of each substance and could indicate the proportions of users based on their frequency of use. However, these data do neither inform the categories of polyusers, nor the substances they combine and their frequency of polyconsumption. Considering that the main purpose of

²²³ C. Hempel (2002) *Éléments d'épistémologie*, Armand Colin, Coll. Coursus, p.52. [Free translation]

this thesis was not to produce such statistics, the validation of SimUse against real world data is for follow up work.

Furthermore, the role of SimUse was not to be a "predictive" model able to reproduce statistics, but a "generative" and "mediative" one (Section 2.6.4). Again, the main objective was to increase the understanding regarding the career of recreational polydrug users and to present a framework able to integrate the different sources of influence shaping the career of polyusers. The model, in its actual shape, produces qualitative outputs, as the results of algorithms built from an *emic* perspective (Section 3.1).

Considering the two precedent points, the model will be only verified. To introduce the notion of verification, the next subsection (Section 7.2.1) defines this process of confirmation in the context of simulation. The second section (Section 7.2.2) proposes a series of tests verifying if the implementation of the most complex algorithms was correct. The last subsection (Section 7.2.3) presents the different tests run to verify SimUse at a global level.

7.2.1. Verification process: correctness, errors, and artifacts

During the verification, the first task of a modeler is to ensure "that the computer program of the computerized model and its implementation are correct."²²⁴ This confirmation is even more important considering that modelers need to assume that their code will contain "bugs" [323]. The verification process, also called "computerized model verification" [324] or "program validation" [325], consists in testing the correctness of the implemented code by looking for "errors and artifacts" [326]. These latter differ in the way they affect the outputs

²²⁴ R. G. Sargent (2010) Verification and validation of simulation models, *Proceedings of the 2010 Winter Simulation Conference*, IEEE, p. 166.

of the simulation: (a) an *error* is an inaccuracy in the code, which is still correct syntactically, but that generates outputs that were not designed to be produced; (b) an *artifact* was defined by Galan and colleagues [326] as "a significant phenomenon caused by accessory assumptions in the model that are (mistakenly) deemed irrelevant to the significant results."²²⁵ In other words, errors produce "irrelevant" outputs because of a mistake in the code, while artifacts produce "relevant" results that are generated by algorithms or parameters that are not conceived to do so.

Several techniques exist to avoid most of the errors during and after the coding [323, 324, 326]. The code verification targets both syntax and semantic of the code. The semantic verification process consists in assessing if whether or not the different algorithms implemented produce what they are programmed to achieve. Throughout the construction of SimUse, numerous simulations and walkthroughs have been run to assess if newly implemented algorithms produce their expected results. The NetLogo[®] platform offers the possibility of observing/modifying directly agent attributes and asks one or several agents to execute locally a single operation without disturbing the normal course of the simulation. This is achievable by the mean of the "Inspect" functionality provided by NetLogo. Inspect gives the opportunity to compare the outputs generated by the action of a single agent or by the interaction of two or more agents to the values programmed in the code. The Section 7.2.2 presents the different tests run to test the semantic correctness of non-trivial algorithms.

²²⁵ J. M. Galan et al. (2009) Errors and artifacts in agent-based modelling, *Journal of Artificial Societies and Social Simulations*, 12 (11), 1.5.

7.2.2. Verification of the Individual and Interactional operations

The present subsection describes the verification of *individuals* and *networks* algorithms by using *walkthrough* process.

This form of verification consists of testing the inner functioning of unit of code: by going through the algorithms and assessing their outputs under specific conditions, these tests aimed to compare test outputs with normal and expected results. The algorithms tested with this method were selected because they exhibit at least one of these three criteria: (a) their functioning depends on several conditions and are not limited to simple mathematical operation (such as, **be-paid** or **count-member**); (b) they are involving at least two agents of the same or different classes; and, (c) they are part of the essential operations that guarantee the evolution of *users* (for example, **check-events** or **break-in** are optional and will not be discussed here).

This process of verification was executed using two functionalities of NetLogo. Indeed, this software allows its users to directly "inspect" agents on the grid by opening a window that displays the location and values of agent attributes. It also permits asking directly agents to run specific algorithms or check the outputs values through the "Command Center." Thus, the verification of several action and interaction algorithms has been achieved through these two components. In that case, the verification takes the form of a *narrative* explanation, presenting the modifications affecting *individuals* or *networks* when put in specific conditions and running specific commands.

These verifications involved mainly two types of tests: (a) a "positive" testing confirming that in the right conditions, the outputs fit to the expectations; and (b), a "negative" testing verifying that with a single false condition, the outputs are not corresponding to expected results. If

an operation did not behave as anticipated, its code was modified until the expected outputs of the verification tests were reached. Ten of them will be presented here, but all the algorithms of actions/interactions were tested in the same way.

The next test is presented as *narratives* where *users* and *dealers* are put in specific conditions and locations. This test presents step-by-step the parameterization of agent attributes, the different actions undertaken by these agents, and the changes affecting their attributes, through the "Command Center."

1) "**Ask-friend**" (cf. p. 293): As developed in the Section 4.2.2, the empirical data suggest that respondent first uses are determined by the presence of experienced peers in the network of future users. Therefore, its verification would guarantee that *users* with the Neutral or Rejector archetype would be able to start a consumption of drugs.

Verification:

(a) *Do users exchange money and drugs as stipulated by the code?* While executing this operation, the "Asker" should lose some Cash and reduce by one its drug possession; conversely, the "Giver" should gain the same amount of Cash and lose one unit of the drug. In the following example, one *user* asks around to his group members if one of them would be able to give him some cannabis.

First, a random *user* is selected and the different members of its primary *network* sorted by the command *show*:

```
observer> show [who] of one-of individual with [typ? = "user"]
observer: 274
observer> show [item 0 group] of individuals 274
observer: 77
observer> show [member-list] of networks 77
observer: [274 368 415 543]
```

Then, the *user 274* changes his Drug-searched attribute to add "Cannabis" to its drugs of choices (the observer "asks" individual 274 to change ("set") the first element of its drug-searched list):

```
observer> ask individuals 274 [set drug-searched replace-item 1 drug-searched "Cannabis"]
observer> show [drug-searched] of individuals 274
observer: [0 "Cannabis" 0 0 0 0 0 0]
```

Because the possession of *Cannabis* of all the *network 77* members being 0, the *user 415* is asked to set its possession of Cannabis to 3:

```
observer> show [possession] of individual with [item 0 group = 77]
observer: [[0 0 0 0 0 0 0 0] [0 0 0 0 0 0 0 0] [0 0 0 0 0 0 0 0] [0 0 0 0 0 0 0 0]]
observer> ask individuals 415 [set possession replace-item 1 possession 3]
```

```
observer> show [item 1 possession] of individuals 415
observer: [[0 3 0 0 0 0 0 0]]
observer> show [possession] of individuals 274
observer: [0 0 0 0 0 0 0 0]
```

Then, the amount of Cash of the *individuals 274* and *415* are verified:

```
observer> show [cash] of individuals 274
observer: 280
observer> show [cash] of individuals 415
observer: 160
```

Finally, the *user 274* is asked to run the **ask-friend** algorithm:

```
observer> ask individuals 274 [ask-friend]
observer> show [possession] of individuals 274
observer: [0 1 0 0 0 0 0 0]
observer> show [cash] of individuals 274
observer: 277
observer> show [possession] of individuals 415
observer: [0 2 0 0 0 0 0 0]
observer> show [cash] of individuals 415
observer: 163
```

As shown in the precedent lines, these two *users* exchange one dose of Cannabis and 3 points of Cash, which is consistent with the code.

(b) *Do agents modify their attributes, if one or all the conditions are not met?* In the cases in which the "Asker" does not have enough Cash or the "Giver" does not have enough drugs, the "Asker" should not obtain any drug and the attributes of both agents should remain unchanged.

The following example tests the case where the "Asker" has no Cash to buy Cannabis from his friend.

To do so, first, the Cash and possession attributes of all *users* of the *network 77* are set at their initial values:

```
observer> ask individuals 415 [set cash 160]
observer> ask individuals 274 [set cash 280]
observer> ask individual with [item 0 group = 77] [set possession [0 0 0 0 0 0 0 0]]
```

Second, the Cash of *user 274* is fixed to zero and the *Cannabis* possession of *user 415* is set to 3:

```
observer> ask individuals 274 [set cash 0]
observer> show [cash] of individuals 274
observer: 0
observer> ask individuals 415 [set possession replace-item 1 possession 3]
observer> show [possession] of individuals 415
observer: [0 3 0 0 0 0 0 0]
```

Third, the *user 274* runs one more times the **ask-friend** algorithm, with the following results:

```
observer> ask individuals 274 [ask-friend]
observer> show [possession] of individuals 274
observer: [0 0 0 0 0 0 0 0]
observer> show [possession] of individuals 415
observer: [0 3 0 0 0 0 0 0]
observer> show [cash] of individuals 415
observer: 160
```

As indicated by the precedent results, the *user 274* was unable to obtain Cannabis.

The second negative test consists of giving Cash to the *user 274* and removing all *possession* for *network 77*'s members:

```
observer> ask individual with [item 0 group = 77] [set possession [0 0 0 0 0 0 0 0]]
observer> ask individuals 274 [set cash 280]
observer> show [cash] of individuals 274
observer: 280
observer> ask individuals 274 [ask-friend]
observer> show [possession] of individuals 274
observer: [0 0 0 0 0 0 0 0]
observer> show [cash] of individuals 274
observer: 280
```

Again, the *user 274* was unable to obtain Cannabis from its peers, mainly because those one have no cannabis in their possession.

The tests of nine other complex algorithms are presented in Annex 7. This form of verification aimed to prove that the implementation of the most complex algorithms was correct. Displaying the code of these tests is long and repetitive, but it guarantees that other researchers can verify the correctness of the codes by reproducing these tests.

The verification of some algorithms, especially the *update* and *setup* algorithms will not be presented here. The main reason lies in the fact that these algorithms generated their outputs by using a single mathematical formula (for *update* operations), for example, the **update-Network-States** (p. 454) or **update-members-list** (p. 453) algorithms, or by simple attribution (for *setup* algorithms). Furthermore, these algorithms (a) are not subject to specific conditions and (b) their outputs could be verified by comparisons with known and predictable results.

The following tests do not use the 'Command Center' and aimed to test the functioning of SimUse at a global level.

7.2.3. Verification of global parameters of SimUse

The following tests verify the correctness of the code at a global level by using "dummy tests" and assessing if there is no leakage concerning the money and substances exchanged by the agents.

A) Dummy tests

These "dummy" tests consist of setting particular parameters to trivial values in order to verify if the simulation outputs are concordant with logical results. For example, if the cash of *users* is initially set to zero and if they are unable to earn money (by preventing them from running the **be-paid** algorithm), would they be able to buy and consume

drugs? The next tests are not looking to verify the robustness or the impact of some parameter uncertainty; therefore they have been repeated 10 times with a reduced number of *users* (200) and for a reduced number of ticks (840 ticks equal to 10 weeks). The results of these different tests are presented in the Annex 8 with their name on the first line.

The first test, "NoMoney" has already been described: it aims to verify the correctness of the **be-paid** and **buy** algorithms by setting the Cash attribute of *users* to zero. As shown in Annex 8, the consumption rates of all the substances are equal to zero which proves that *users* are unable to earn money and, correlatively, to buy drugs.

The second test, "NoDealers", verifies if *users* can buy and consume illicit substances if there is no *dealer* inside the simulation. To do so, all *dealers* are removed from the simulation at the first ticks and *users* are prevented of executing the **become-dealer** algorithm. As expected, the consumption rates of illicit substances remain equal to zero.

The third test, "NoEffect" consists of setting the NeuralAction of *drugs* to 1 which means that the NeuralBox and NeuralBoxComeDown of *users* cannot change. Indeed, the results of that test show that the outputs "Treatment", "Assault", "OD", "Arrest", and the number of rules created by *users* remain equal to zero because *drugs* cannot have any negative (nor positive) effects on *users*.

The fourth test, "NoAlcohol", fixes the Price-Alcohol parameter to a value unreachable by the *users* (500.000) to verify that none of them is able to buy and consume alcohol. As expected, the consumption rate of Alcohol remains equal to zero for all iterations of the test, which indicate the price of the substances constitutes a limitative factor for consumption.

B) Global indicators verification: Money and substance doses

Some verification can also be achieved by observing global results of the model. As aforementioned in Section 7.1.4, NetLogo proposes a plotting system permitting to obtain outputs at the end of every tick or at precise moments specified by the modeler. Using this plotting system, two tests were conducted to verify if the substance consumptions or the amounts of cash exchanged by agents were consistent with what expected. These tests ask to create temporary indicators. The first one, *Check-"Drug"-Stock*, aims to verify if the total quantities of substances remain unchanged throughout the simulation. It calculates for each substance, the sum of the drugs own by the 'Wholesaler', 'dealer', 'user', 'Deceased' or 'Insane' agents (possession or stock attributes), plus the totality of the drug seized (Seizures Society attribute), plus the units of drug consumed by 'user' agent (through their memuse attribute) and the remaining Stock of each substance. If these values differ from a week to another, it indicates that there is a "leakage" of substance either in the consumption or in the **buy/supply/import** operations.

The second indicator, *"Totality-Cash"*, verifies if there is no money created or that disappears during exchanges between agents. Two counters were created to assure this verification: the first one sums the Cash earn by *users* (through the **be-paid** algorithm), subtracts the money not exchanged between agents, but "disappearing" from the simulation (through the **arrest**, **treat**, **import**, **decease**, or **commit** operations); the second counter sums the totality of the Cash owned by the *user*, *dealer*, and *wholesaler*. There is no money leakage if these two values remain equal during the totality of the simulation. These different counters are calculated once a week and can be found in the "Output" monitor. The latest version of the model, SimUse 6.0, does not exhibit such leakage of substances or money.

The next section (7.3) tests the degree of agreement between SimUse outputs and the empirical findings.

7.3. SimUse verification against qualitative trends

SimUse has been built based on (a) theoretical data coming from neurosciences and sociology, and (b) qualitative material collected and formalized into computational model. SimUse took the roles of "generative" and "mediative" models searching to encompass data from several disciplines and looking for gaps in the simulation that would require further investigations. The previous Section 7.2 presented the verification of the implementation. The present section checks if the implemented model is able to reproduce the results coming from the theoretical construct and empirical analysis.

The agreements of the model to the empirical findings are presented through four different kind of test:

- The first test aims to evaluate the behavior of the model when subject to shocks or to modification in its initial parameters;
- The second test consists of scenarios testing to what extent the algorithms related to the generation of ControlRules and modification of SocialRepresentations influence the choices and consumptions of *users*;
- The third subsection (7.3.3) looks to the agreement between the evolution of global SocialRepresentations of users and the different substance consumption rate;
- The last section (7.3.4) presents the verification of the neurological engine of SimUse.

The results of these tests were compared with outputs produce by a "Standard" simulation. The Standard scenario is run with "minimal" parameters to save computation time. There are 500 *users* with the minimum number of *dealers* and *wholesalers*. The "network-density"

was set to 4 in order to create a large variety of *networks*, while the other parameters are set to their minimum values. This Standard scenario has been parameterized as indicated in Table 7.13.

Table 7.13. Parameters of the Standard simulation.

Parameters	Values	Parameters	Values
Users	500	Price-Alcohol	5
Dealer	11	Price-Cannabis	3
Wholesaler	12	Price-Cocaine	40
Policeman	2	Price-Ecstasy	10
Doctor	1	Price-Heroin	20
Bar	2	Price-Meth	25
Disco	1	Price-Speed	10
Bottle-Shop	1	Price-LSD	10
Network density	4	Price-MagMush	5
%Arrest	5	%Brawl	5
Wealth	0	Policeman-vision	2

Fifty standard simulations were run for 2400 ticks, which represent 200 days. The Table 7.14 shows the results of the Standard scenario. It presents the total consumptions for each substance with their standard deviation into parentheses and the number of "negative events" — e.g. deaths, *users* losing their reason, brawl, *users* that entered treatment, hazardous behaviors, and overdose — that happened during the simulation. It also presents the percentage of *users* having experimented each substance (Exp.) and the number of *users* that were

still consuming regularly (Regular) the substance at the end of each SimUse run. *Users* with a single or more consumption are considered to have experienced the substance and *users* with a substance Stage greater to one are considered as regular users of that substance. Because they already have a history of consumption (Section 7.1.1), "Curious" *users* are considered having "experienced" a substance, only if they have consumed at least, ten times that substances. It is important to underline that these tests have been run in a "full-availability" context ("full-availability?" switch sets to the "on" position) to test only one parameter at a time, the lack of constant availability could have created unwanted fluctuations in the outputs.

Table 7.14. Outputs of the Standard scenario.

Output	Value	Output	Value
Alcohol	26654 [1070]	Exp. Cannabis	19.4%
Cannabis	2146 [301]	Exp. Cocaine	8.2%
Cocaine	479 [102]	Exp. Ecstasy	10.5%
Ecstasy	646 [128]	Exp. Heroin	3.2%
Heroin	79 [22]	Exp. Meth	3.1%
Meth	73 [32]	Exp. Speed	2.5%
Speed	36 [52]	Exp. LSD	2.8%
LSD	60 [26]	Exp. MagMush	1.9%
MagMush	4.6 [4]	Regular Alcohol	46.1%

Output	Value	Output	Value
Death	0.4 [0.5]	Regular Cannabis	12.3%
Insane	5.4 [2]	Regular Cocaine	3.7%
Assault	60 [13]	Regular Ecstasy	5.1%
Treatment	51 [10]	Regular Heroin	0.7%
Hazardous-act?	26 [7]	Regular Meth	0.6%
Memod of <i>users</i>	0.1 [0.3]	Regular Speed	0.4%
Arrestnum	2 [1.7]	Regular LSD	1.3%
Exp. Alcohol	95.9%	Regular MagMush	0.05%

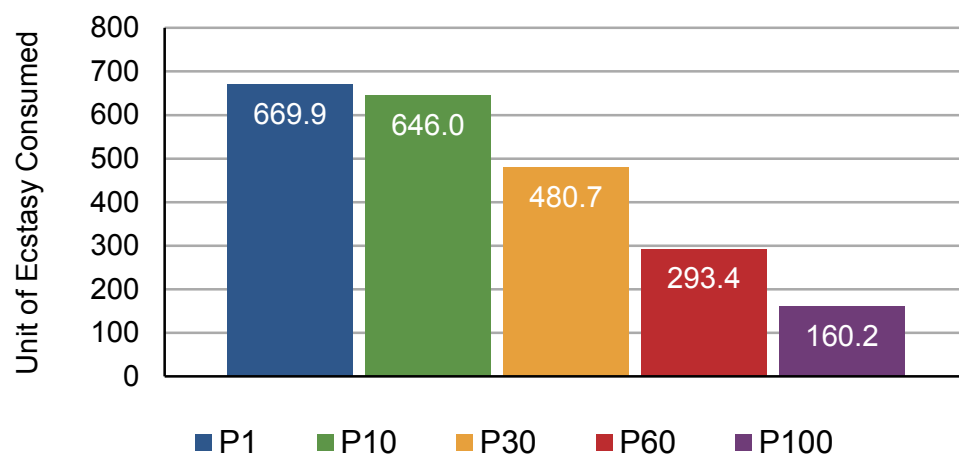
The preceding results do not match the statistics presented in Table 5.2 (cf. p.298). Nonetheless, they remain within reasonable ranges and display neither irrational rates of consumption (e.g., there is still less cocaine consumed than cannabis and alcohol remains the drug the most commonly used), nor unrealistic rates of experimentation or regular usage. As aforementioned, these results were produced to create a reference for the next verification tests. These take the forms of scenarios built to evaluate the inner reactions of the model and assess if the outputs observed are plausible.

7.3.1. Reactivity of the model and Adaptation of the *users* to external shocks.

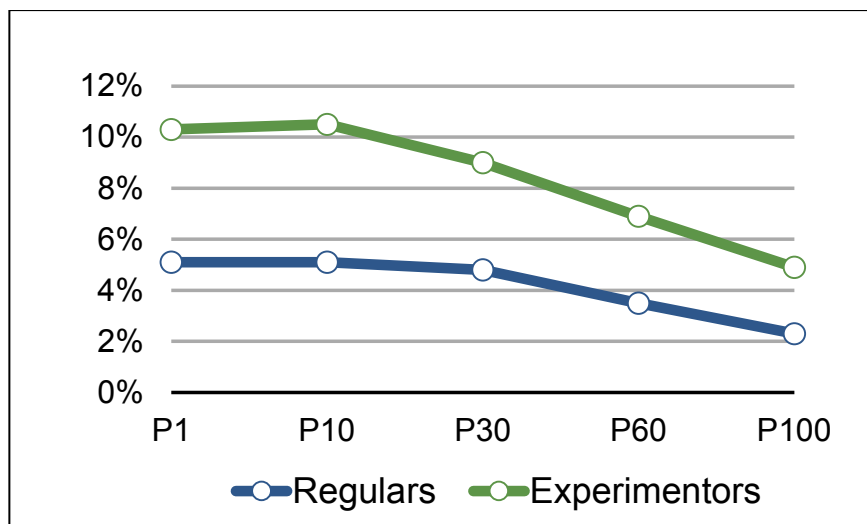
This first category of tests controls if the model outputs remain plausible despite changes in the initial parameters or "shocks" during the simulations. Three scenarios are proposed: "EcstasyPrices", "CannabisDepletion", and "CocainePurity".

A) "EcstasyPrices" Scenario

The first scenario "EcstasyPrices" tests the impact of substance price on the consumption rate. Five prices were tested to assess if the number of consumptions decreases with the increase of the price. These values are 1, 10 (standard value), 30, 60, and 100. Each scenario was run fifty times with parameters (except "Ecstasy-Price") equal to the standard scenario. The first result consists of assessing the impact of the price on the different consumption rates of Ecstasy (cf. Graph 7.1):

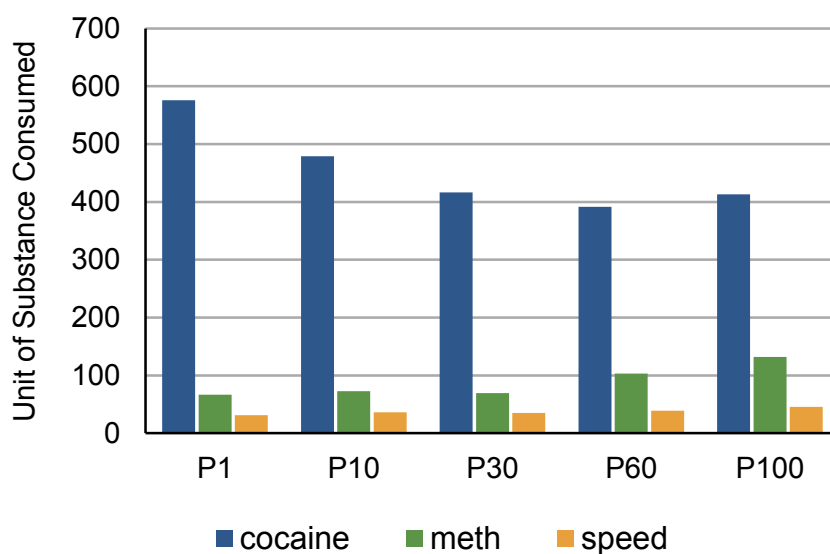


Graph 7.1. Impact of Ecstasy Prices on its Consumption Rate.



Graph 7.2. Impact of Ecstasy Prices on Experimentation and Regular Use Proportions.

As could be expected the ecstasy consumption and the rates of experimentations and regular uses decrease with increasing price (Graph 7.2). However, these fluctuations in the price of ecstasy appear to have little impact on the consumption of other stimulants, while it could have been reasonably expected that other stimulants consumption rate should have increased (Graph 7.3):



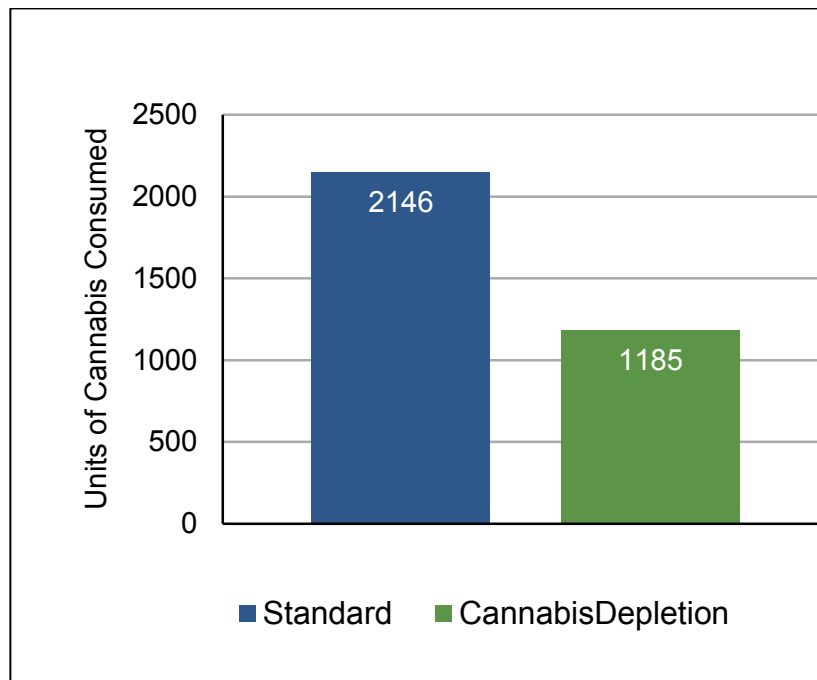
Graph 7.3. Effects of Ecstasy Prices on other Stimulant Consumptions.

This could be partially explained by the fact that ecstasy generally acts as a "gateway drug" for other stimulants (Section 4.3.2). During the initiation, the social representations of substances with similar effects are positively modified to represent an increase the curiosity toward new substances. SimUse integrates this fact through the **Check-cross-SocialRepresentations** operation. It could be conjectured that if neophyte *users* have not access to a drug such as ecstasy, the values of the SocialRepresentations of other stimulant substances (Cocaine or Speed) would not increase. If these values remain negative, "Rejector" and "Neutral" *users* will not be able to engage in the consumption of these stimulants.

In SimUse, the SocialRepresentation of "Meth" is not affected by the gateway effect of Ecstasy (as indicated by the **check-cross-SocialRepresentations**). In other words, a *user* that had good experiences with Ecstasy will not change its Meth SocialRepresentation as it would do for Speed or Cocaine. Therefore, Meth consumption increase comes from a switch of preferences amongst *users* with current-InstrumentalUse equal to ["Energy" "Energy"] or ["Energy" "Intoxicated"]. Indeed, the preference (drug-value) associated with Ecstasy decreases with its Price: *users* displaying similar Ecstasy and Meth SocialRepresentations and Stage values will prefer Meth to Ecstasy if the price of Ecstasy goes above a certain threshold. For example, when the price of ecstasy is equal to 10, *user* with Ecstasy and Meth SocialRepresentations equal to 1 and both Stage value equal to 1 have an Ecstasy-value equal to 0.13 and a Meth-value equal to 0.05; while when the price of Ecstasy changes to 60, the Ecstasy-value moves to 0.021. In fact, when the price of Ecstasy becomes greater to 25, *users* with the "Energy" current-InstrumentalUse will be more inclined to choose Meth. Nevertheless, these last hypotheses require further work.

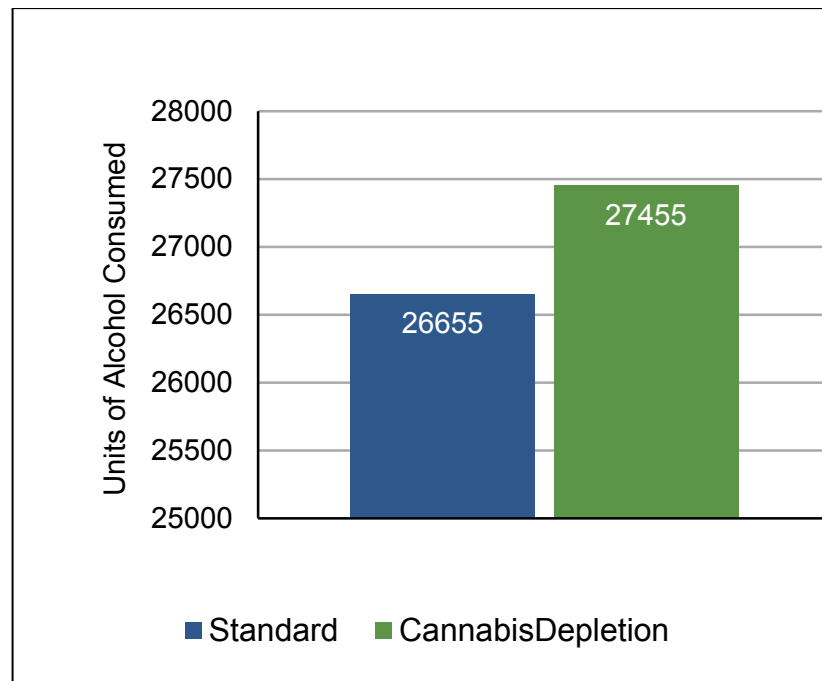
B) "CannabisDepletion" Scenario

The second scenario, named "CannabisDepletion", aims to observe the behavior of the model if one drug becomes suddenly unavailable, due to a disruption of cannabis distribution. To observe the impacts of cannabis depletion on *user* behavior, the possession of *dealer* and Drugstock of *wholesaler* were set to be zero after 1200 ticks. This is to prevent *users* from buying Cannabis. As a result of this scenario, the consumption rate of Cannabis for the "CannabisDepletion" is lower than the "Standard" (see Graph 7.4).



Graph 7.4. Impact of the Cannabis Depletion on Cannabis Consumption.

This disruption in the availability of Cannabis seems to induce an increase of the Alcohol consumption, as shown by the following graph (Graph 7.5):



Graph 7.5. Impact of the Cannabis Depletion on Alcohol Consumption Rate.

Respondents frequently described alcohol as a substitute for cannabis, these two drugs being consumed to achieve similar functions (Section 5.1.2). Therefore, this higher rate of alcohol consumption seems rational in the case of “CannabisDepletion”: *users* replace "Cannabis" by "Alcohol" when looking for relaxant drug.

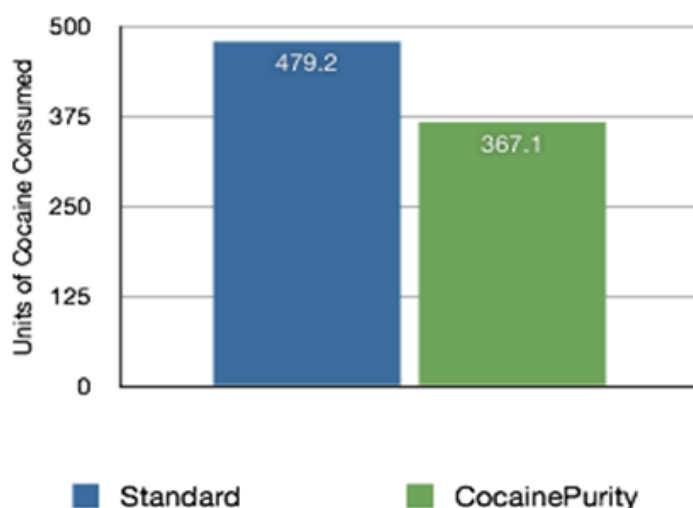
C) "CocainePurity" Scenario

The third scenario evaluates the plausibility of model changes when a large augmentation in the potency of a particular substance is created. This scenario mimics the arrival on the drug market of an "uncut" drug (with a high degree of purity) to assess the reactions of the *users* to that kind of shock. To mimic this sudden increase of potency, the purity of *Cocaine* is almost tripled after 1200 ticks. Purity is not modeled in SimUse (Section 2.2.4), but this increase can be reproduced by increasing the values of *Cocaine NeuralAction*. The initial values and those used for this scenario are described in Table 7.15

Table 7.15. Values of Cocaine Neural Action for the Standard and "CocainePurity" scenarios.

	DA	EnCa	Endo	GABA	Glu	Nore	5-HT _{1A}	5-HT _{2A}
Standard	1.14	1	1	1	1.1	1.1	1.1	1
Cocaine Purity	1.45	1	1	1	1.3	1.3	1.3	1

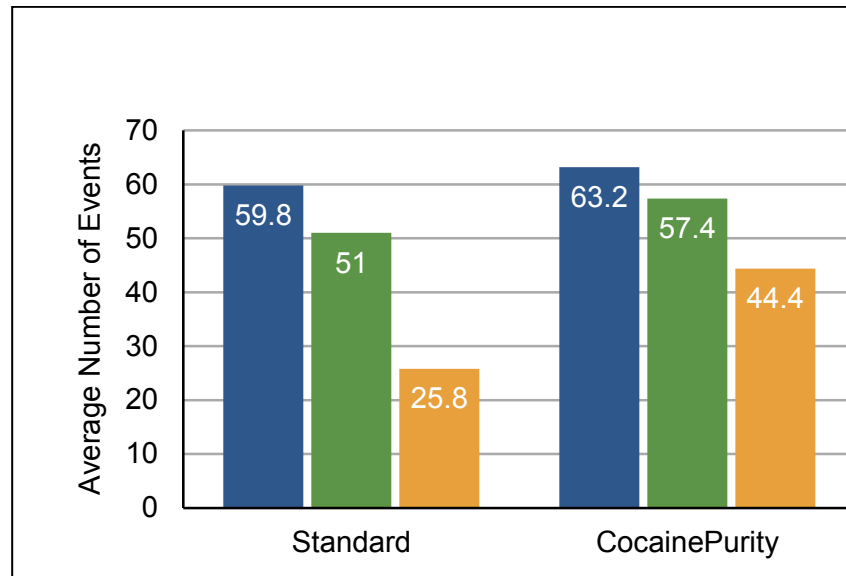
As indicated below, the quantity of cocaine consumed in the "CocainePurity" scenario is lower than in the Standard one (see Graph 7.6):



Graph 7.6. Variation in the Consumption of Cocaine for Standard and CocainePurity.

This decrease could be explained by two facts: (a) *users* require a lower dose to obtain the targeted effects due to Cocaine increased potency; (b) this decrease could also be explained due to the accumulation of problematic situations or dramatic events following the purity augmentation. Indeed, the number of overdoses occurring (mean of 3.7 compared to 0.1 for the Standard case) as well as the number of "Deceased" (2.7 compared to 0.6) and "Insane" (14.2 compared to 5.8) *users* increased during the "CocainePurity" scenario modifying negatively the SocialRepresentations of *users* experiencing these events. It also affects the SocialRepresentations and decision process of those witnessing these cocaine adverse consequences. Furthermore, this

higher purity also affects the average negative events as indicated in Graph 7.7:



Graph 7.7. Impact of the Cocaine Purity on adverse events.

The two last points underline the capacity of *users* in adapting their consumptions in consideration of their interactions and experiences. The totality of the "CocainePurity" results could be found with results of the previous scenarios in the Annex 9.

These different scenarios were designed to judge the ability and *accuracy* of SimUse to generate plausible results if confronted with external shocks or changes in initial parameters. The next tests verified if the different forms of social control have an impact on the behavior of the model.

7.3.2. Verify the algorithms regarding SocialRepresentations and ControlRules.

The empirical material has shown that recreational polyusers are re-evaluating their actions and actions of others after their intake. These reevaluations influence their future decisions. Furthermore, they create "rules" and "sanctions" to remain in control of their use. Several algorithms have been implemented in SimUse to reproduce these two

processes. This subsection investigates the weight of these operations on the *user* actions and on the model outputs. To achieve this, several "switches" (Section 7.1.4) were implemented to allow or prevent agents from executing one or several algorithms, which provides the opportunity to test *what-if* scenarios. Four have been implemented and tested:

- "NoRules": as aforementioned (Section 7.1.4), this switch prevents the *users* to run the **Check-Rules** algorithms and build ControlRules and DrugRules;
- "NoSelf": when set to "off", this button disables the **Check-Self-Behaviors** algorithm and removes all the consequences regarding **go-to-jail**, **declare-OD**, or **treat**.
- "NoInteraction": this scenario prevents the *users* from running the **Check-Group-Influence**, **Check-Group-SocialRepresentations**, and **Check-Other-Behaviors**. Moreover, the fact of seeing another *user* declaring an OD, has no impact on the observing *user*;
- "NoControl": this scenario encompasses the previous three scenarios by setting the preceding three switches to the "off" position.

These scenarios were run 50 times with the same parameters as the Standard test previously described (Table 7.13). The following paragraphs display the main results of each of these scenarios.

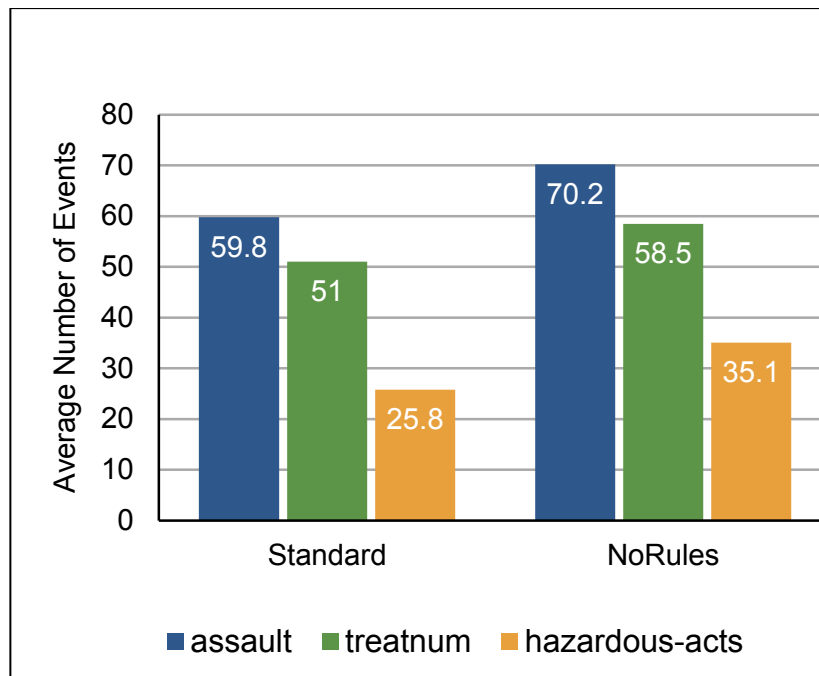
A) NoRules Scenario

In SimUse, "rules" reduce the quantity and/or frequency of intake or even prevent *users* from consuming substances. This scenario aims to test the importance of these consumption rules on the model outputs. The average rates of consumption and their standard deviation are presented in Table 7.16.

Table 7.16. Comparison of the Consumption Rates between Standard and NoRules Scenarios.

Values	NoRules	Standard
Alcohol	27277 [942]	26654.3
Cannabis	2276 [335]	2145.9
Cocaine	482 [115]	479.2
Ecstasy	693 [130]	646
Heroin	77 [24]	78.8
Meth	93 [36]	72.7
Speed	66 [25]	36.3
LSD	74 [30]	59.8
MagMush	6 [4]	4.6

As it could be expected, the results of the "NoRules" scenario tend to indicate that *users* consume more drugs without ControlRules and DrugRules than in the Standard scenario (except for Cocaine, with a slight decrease of its consumption). In turn, these increased consumption rates also affect the number of negative events experienced by *users*, as illustrated in Graph 7.8.



Graph 7.8. Negative Events Means for Standard and NoRules Scenarios.

The impossibility of building rules of control does not affect significantly the rate of "regular" *users* or the rate of experimentation, which seems to be logical considering that the rules are generated by recreational polyusers because of their consumption and not prior to it. In SimUse, both ControlRules and Drug-Rules are built as a result of adverse experiences that may happen over a longer time period, which could explain the moderate effect of ControlRules on the consumption of *users*: only 5.75% of the *users* have already developed rules of control after 2400 time steps.

B) NoSelf Scenario

As underlined in Part II, individuals reevaluate their actions and behaviors after positive or negative experiences. The **Check-Self-Behavior** operation was created to reproduce this reevaluation process. Disabling this algorithm should entice an increase in the consumption rate. The results concerning the rate of consumptions show a large increase in the rate of Alcohol consumption, but a low or moderate influences on other substance consumption rates. The results of the "NoSelf" scenario are shown in Table 7.17.

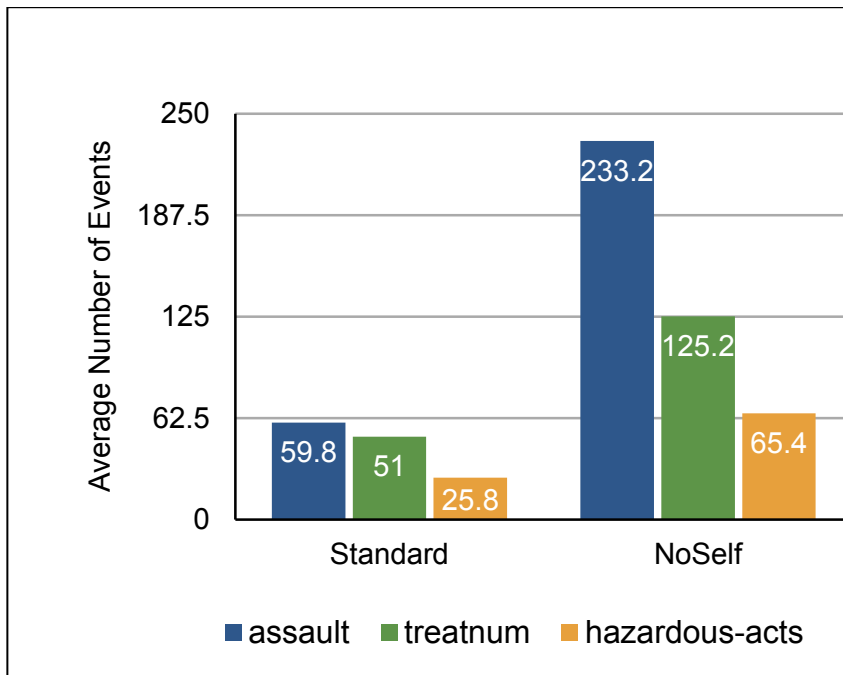
Table 7.17. Comparison of the Consumption Rates between Standard and NoSelf Scenarios.

Values	NoSelf	Standard
Alcohol	37523 [1513]	26654.3
Cannabis	1875 [215]	2145.9
Cocaine	372 [100]	479.2
Ecstasy	618 [146]	646
Heroin	61 [15]	78.8
Meth	54 [29]	72.7
Speed	27 [19]	36.3
LSD	52 [28]	59.8
MagMush	5 [4]	4.6

It should be noted that, except the consumption of Alcohol, other substance consumption rates do not seem to be influenced by the lack of self-reevaluations. The mild influence of this method on the consumption of *users* may be explained by the fact that *users* are unable to assess the pleasure and beneficial outcomes of their intake. Therefore, they are unable to increase their SocialRepresentation values by themselves and rely only on the interactions with peers.

Negative events are considered as *problematic* situations, which, once reevaluated, could modify the *user* routine of action. In the context of drug use, these problematic situations arise from uncontrolled consumption, and entail a reduction of the social representations attached to the substances incriminated. Without any form of retro-judgment concerning their misbehavior, *users* are not able to reduce the value of their SocialRepresentations, and will not stop their detrimental

consumption and dangerous conduct. This translates to an increase in the number of negative events experienced by the *users* as shown in Graph 7.9:



Graph 7.9. Comparison of the number of Negative Events between the Standard and NoSelf Scenarios.

C) NoInteraction Scenario

The analysis of the empirical material demonstrated that the interactional level could either facilitate or constrain drug taking: the group of peers could either introduce neophytes into drug use (Section 4.2) or sanction members exhibiting signs of loss of control or addiction (Section 6.3). By extension, witnessing unknown other's behaviors could also influence the decision of users and modify the meanings they attach to substances. This scenario aims to test if the fact that *users* are unable to modify their opinions regarding substances through interactions affects their consumption. "NoInteraction" switch to the 'off' position prevents *users* from executing algorithms that mirror these interactional processes of formation and transformation of social representations. Considering the double role of the interactional level, the results of "NoInteraction" seem to be concordant with the empirical findings Table 7.18).

Table 7.18. Comparison of the Consumption Rates between Standard and NoNetwork Scenarios.

Values	NoInteraction	Standard
Alcohol	25010 [978]	26654.3
Cannabis	2003 [232]	2145.9
Cocaine	558 [94]	479.2
Ecstasy	589 [93]	646
Heroin	109 [27]	78.8
Meth	94 [38]	72.7
Speed	27 [20]	36.3
LSD	43 [17]	59.8
MagMush	2 [3]	4.6

The above table shows that the absence of influence from the interactional level plays a negative role for drugs associated with lower dangerousness (Cannabis, Ecstasy, Speed, Hallucinogens) and seems to be involved in an increase of the "hard" drug consumption (Cocaine, Heroin, and Methamphetamine). In the former case, the *network* cannot take its role of facilitator by modifying positively the SocialRepresentations of its members (there is no *peer's influence*); while in the latter case, the *users* of "hard" drugs are not sanctioned by the group for their consumption and potential misbehavior which facilitates the continuation of these practices (the rate of regular users for these drugs are higher for the NoInteraction scenario than for the Standard one. cf. Annex 9).

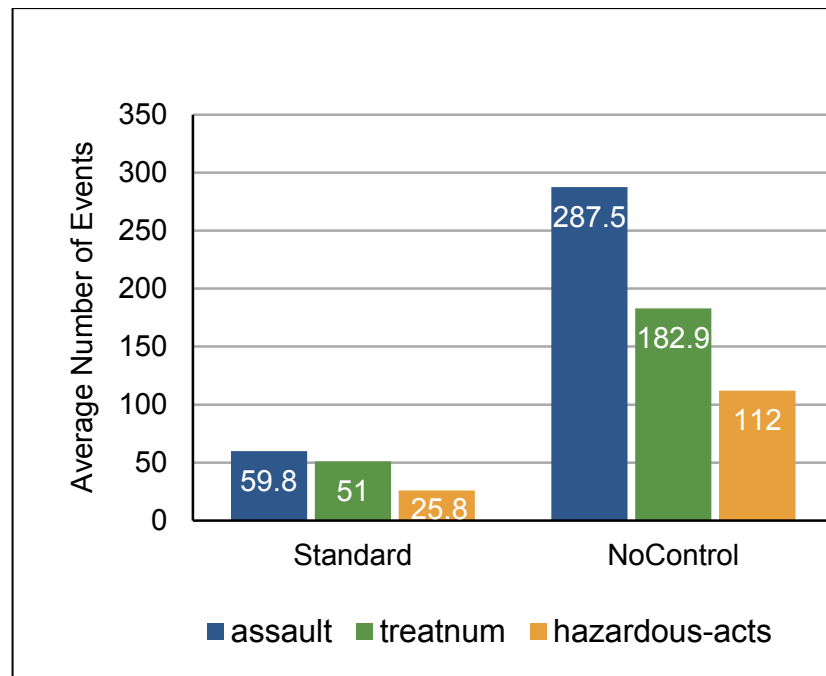
D) NoControl Scenario

This scenario crystallizes the three previous one. It aims to reproduce a situation where *users* would not be able to control their actions, reevaluate their own behaviors, and evaluate others' behaviors while under the influence of drugs. In other words, the *users* would be only guided by the neurological actions of drugs and would not consider both physical and social impacts of their acts. As it could be expected, the consumption rates of most of the substances (except Cocaine and hallucinogens) are greater than the Standard scenario, as shown in Table 7.19.

Table 7.19. Comparison of the Consumption Rates between Standard and NoControl Scenarios.

Values	NoControl	Standard
Alcohol	40562 [1475]	26654.3
Cannabis	2249 [396]	2145.9
Cocaine	435 [104]	479.2
Ecstasy	764 [154]	646
Heroin	104 [24]	78.8
Meth	58 [39]	72.7
Speed	49 [16]	36.3
LSD	39 [17]	59.8
MagMush	5 [4]	4.6

Correlatively, the number of negative events is largely greater to the Standard scenario (Graph 7.10).



Graph 7.10. Negative events occurring during the Standard and "NoControl" scenarios.

This scenario demonstrates that the simulation would be particularly inaccurate if these algorithms were not implemented: the outputs from the Standard scenario may not match the reality, but they remain in a reasonable range compared to the outputs produced by the last scenario. It proves that this one contains elements that allow *users* to control their consumptions and modify their drug routine. It also shows, in accord with the empirical findings (Sections 4.3, 5.3 and 6.1) that the reevaluation of actions and control over substances results from a set of processes and cannot be reduced to a single mechanism.

Overall, on their own, these operations have a moderate effect on substance consumption, but combined, they seem to be able to reproduce the form of control developed by recreational users.

7.3.3. Looking for agreement between

SocialRepresentations and substance consumption rates

Verifying the concordance of the implemented algorithms could also be achieved by looking at the macro-level "signature" of average simulations. As illustrated during the Chapter 5, the respondent's consumptions were dependent of the social representations they carry regarding psychoactive substances. These findings are consistent with the symbolic interactionist theory (cf. Section 2.4.1), which considers that the meaning attached to objects orients individual choices and actions of the individuals. SimUse aims to reproduce this correlation through several operations (cf. Section 7.1.2). The following results evaluate if SimUse is able to simulate the impact of SocialRepresentation evolution on the consumption trends²²⁶. To assess this concordance, SimUse has been run 30 times for 8760 time steps in the condition of the Standard test and measure consumption trends and evolution of *user's* SocialRepresentations of each substance. The results of Alcohol, Cannabis, Cocaine, and Ecstasy are presented together²²⁷.

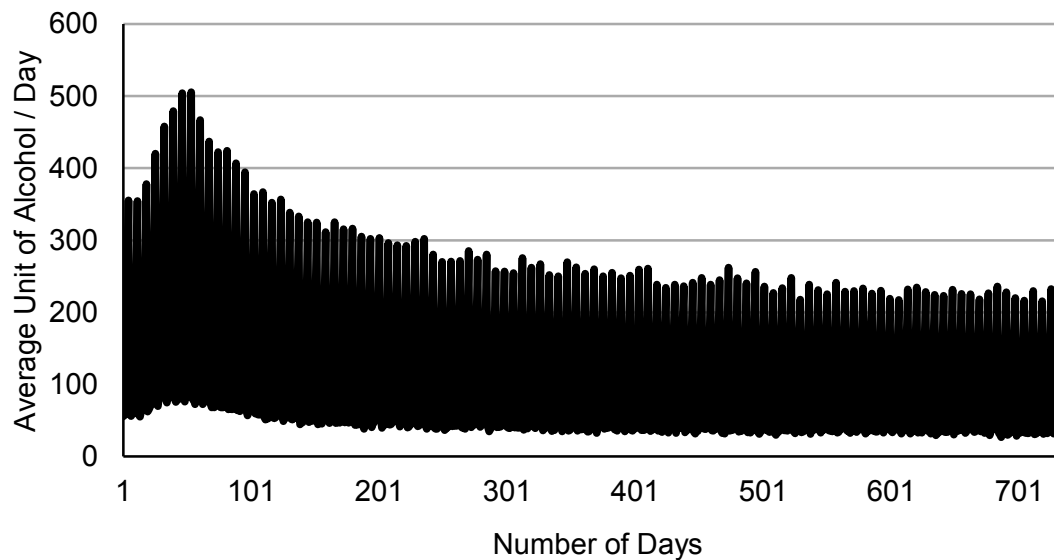
The following graphs represent the evolutions in the SocialRepresentation of *users* that have consumed at least once the substance during the simulation (in other words, 'Neutral' and 'Rejector' with a memuse superior to 0 or 'Curious' with a memuse superior to 9). These graphs are compared with consumption trends produce by the simulations at "18:00-20:00", this moment being the time step where the maximum of substances are consumed.

²²⁶ The trends of consumption present the number of substance unit consumed during each time step, which permits evaluating more precisely the evolution of the consumption rate through time.

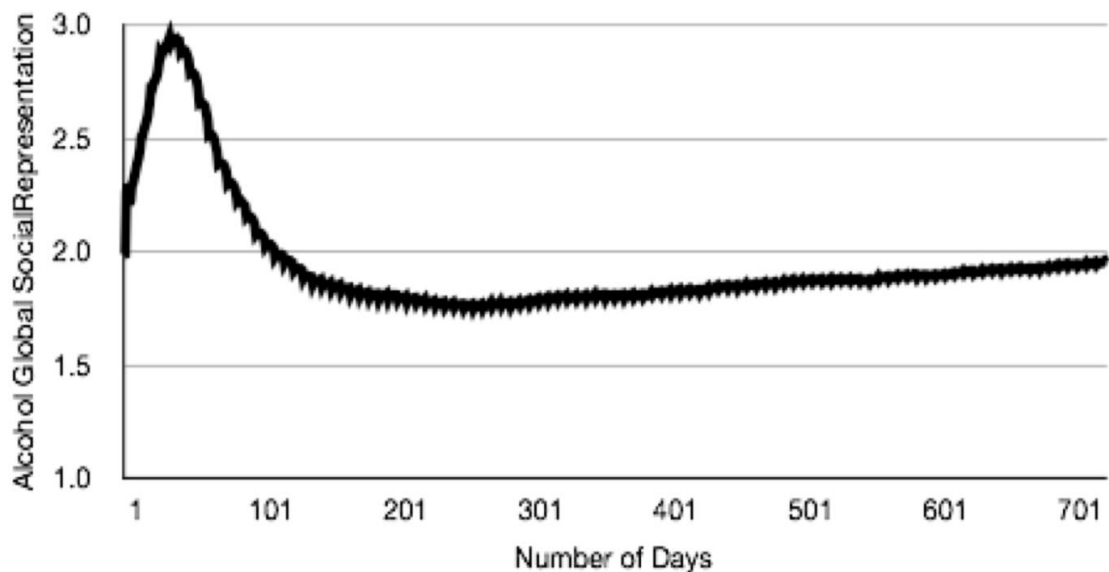
²²⁷ The consumption trend and the evolution of the global SocialRepresentation of "Heroin", "Meth", "Speed", "LSD", and "MagMush" could be found in Annex 10.

A) Alcohol

The Graph 7.11 and Graph 7.12 present SimUse outputs concerning the consumption trend and changes in the global representation of Alcohol users:



Graph 7.11. Consumption Trend of Alcohol.

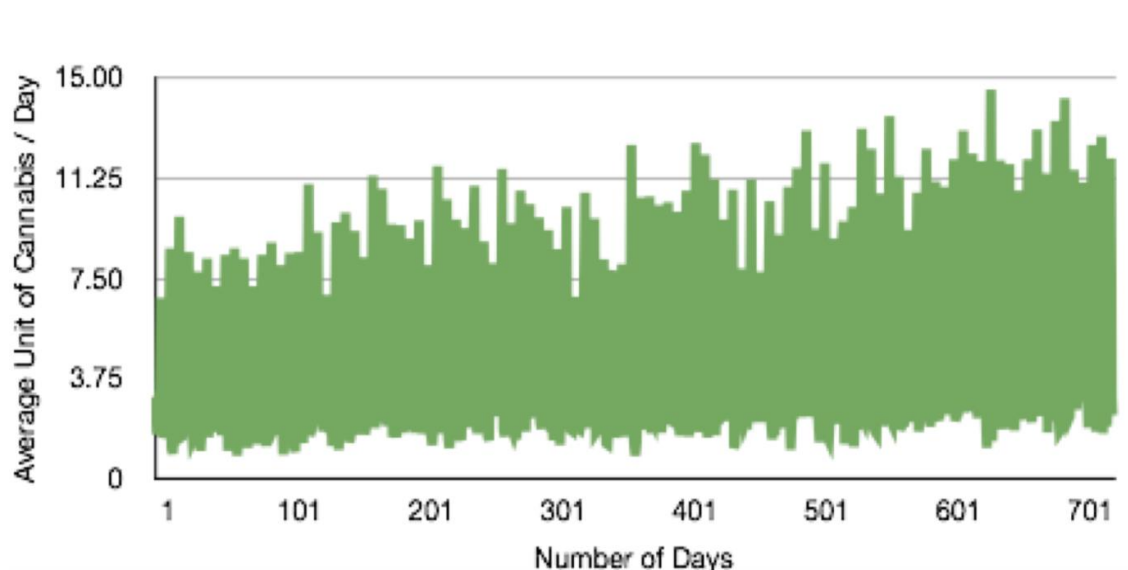


Graph 7.12. Evolution of the Alcohol SocialRepresentations of Users.

As it could be noticed, these two graphs present a similar increase in terms of magnitude and duration in the first fifty days of the simulation before a similar decrease in the next fifty days due to the first negative events induced by Alcohol. However, its consumption continues to decrease, while its SocialRepresentation tends to slowly re-increase. Considering the structure of SimUse, this could be explained by the apparition of the first Alcohol-Rules and the diminution of "negative events" attributable to Alcohol.

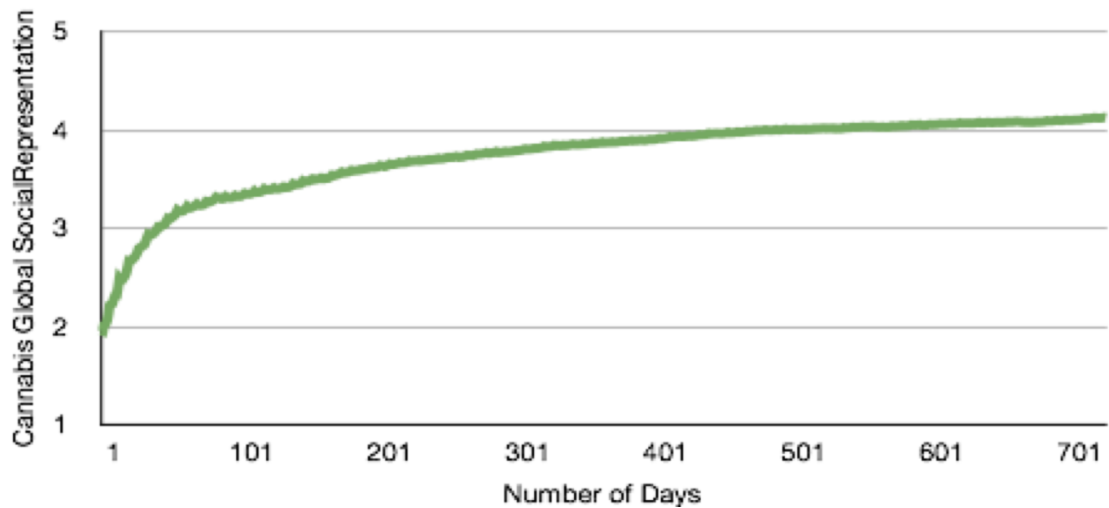
B) Cannabis

Concerning Cannabis, SimUse outputs show a constant increase in the consumption level as shown in Graph 7.13.



Graph 7.13. Consumption Trend of Cannabis.

This constant increase of Cannabis consumption trend could be explained by the proportional augmentation of the SocialRepresentation of *users*, as indicated by Graph 7.14:

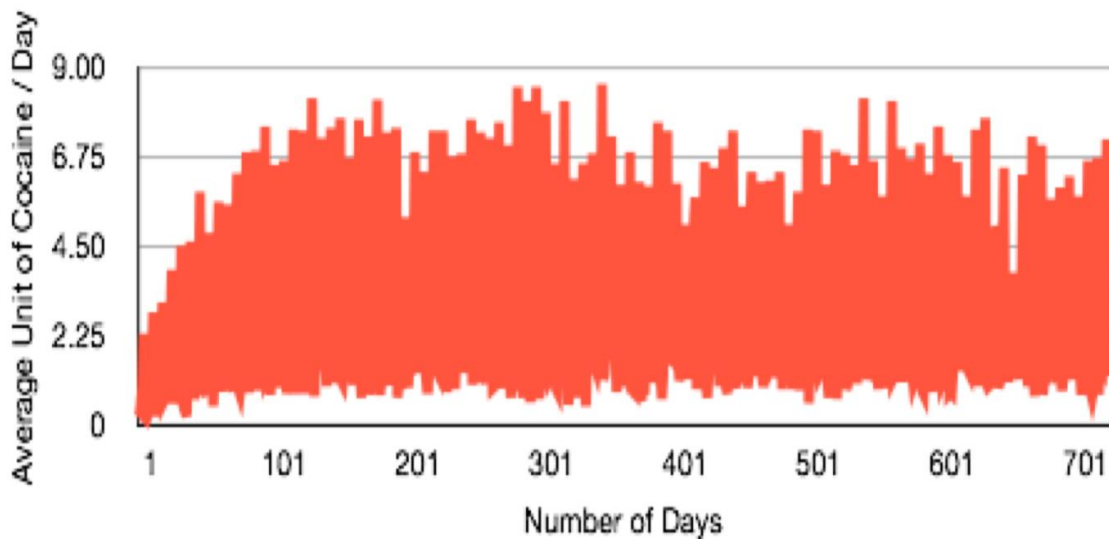


Graph 7.14. Evolution of the Cannabis SocialRepresentations of Users.

As opposed to Alcohol, the global SocialRepresentation of Cannabis does not exhibit a peak then a decrease, but a slow and constant increase. In SimUse, cannabis is less likely to induce risky or inappropriate behaviors for its *users* and, consequently, to generate negative perception in *non-user*. Except two cases (Diane and Sony), most of the respondents have not developed a negative perception about Cannabis even if they have stopped its consumption.

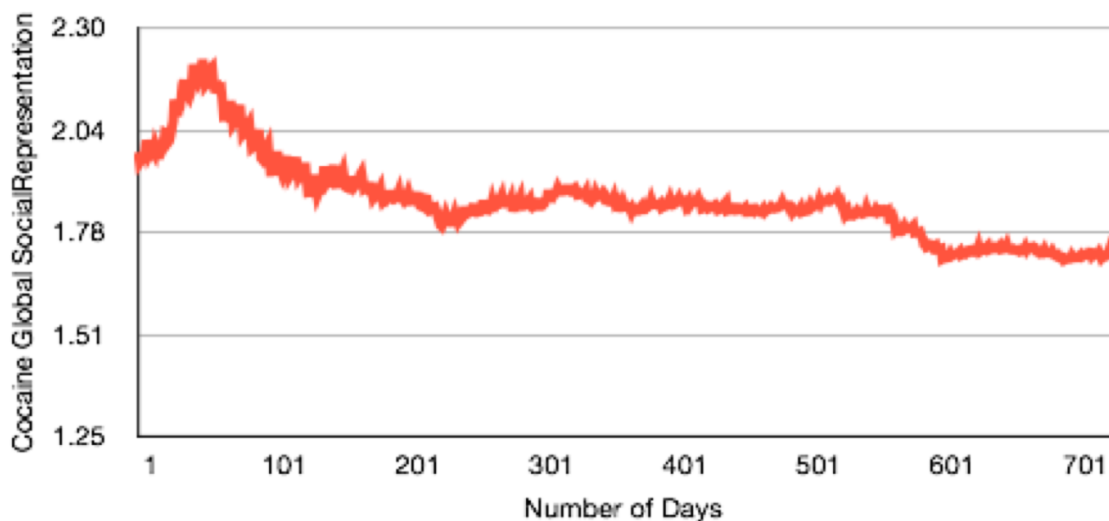
C) Cocaine

Contrary to Cannabis, Cocaine consumption seems to increase in the first hundred days, before exhibiting a slow reduction of its rate, as illustrated in Graph 7.15.



Graph 7.15. Consumption Trend of Cocaine.

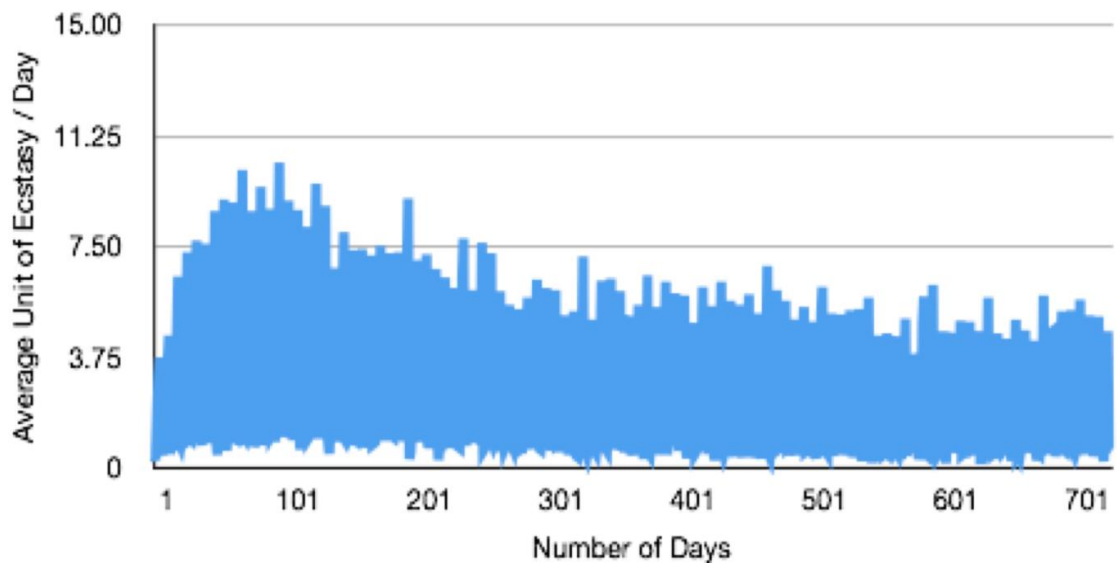
This one seems to follow the slow decline of the SocialRepresentation values amongst its *users* (Graph 7.16).



Graph 7.16. Evolution of the Cocaine SocialRepresentations of Users.

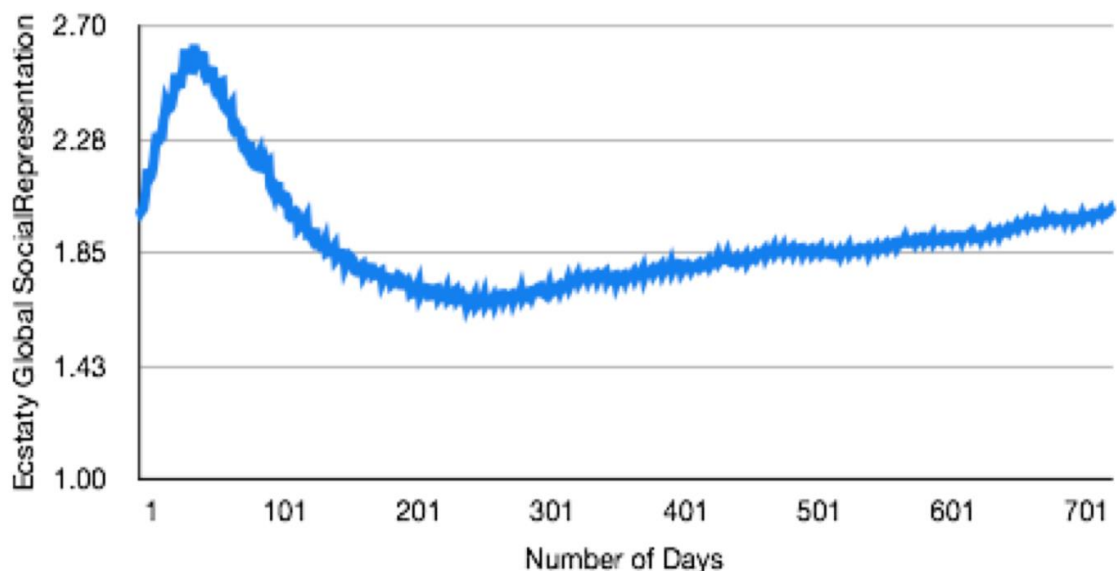
D) Ecstasy

Ecstasy seems to follow the same pattern as Alcohol: a large and quick increase of its consumption rate in the first few weeks followed by a drop, as shown in Graph 7.17.



Graph 7.17. Consumption Trend of Ecstasy.

Again, this pattern follows the SocialRepresentation of *users*. Their opinions tend to become more positive during the first few weeks before decreasing to 1.6. This period is followed by a slow increase that almost reaches its initial value (Graph 7.18).



Graph 7.18. Evolution of the Ecstasy SocialRepresentations of Users.

This test aimed to judge the ability of the model to mimic the causal relation between the SocialRepresentations of *users* and the evolutions

of consumption rate. Considering the previous graphs it could be said that this concordance is well represented by SimUse.

Before reaching that point, the neurological engine of SimUse needs to be verified. Indeed, considering the originality and complexity of the neurological component of SimUse, as well as the number of external algorithms that could influence its outputs, the functioning of the NeuralBox is presented by itself in the next subsection (Section 7.3.4).

7.3.4. Verification of the neurological engine through NeuralBoxSim

An important part of SimUse functioning is based on the behavioral responses exhibited by the agents while under the influence of one or several substances. This subsection aims to verify the correctness of the neural motor outputs. Its verification is assessed by comparing the generated outputs with data coming from neuroscience theories (Sections 2.2.1 and 2.2.2) and descriptions coming from the interviews.

To test the sole neurological engine, the different algorithms related to the NeuralBox (Section 2.2.4) and its operating were extracted and re-implemented in a sub-model of SimUse. This neurologic model, *NeuralBoxSim*, is a drastic simplification of the different neurologic mechanisms intervening during (poly)drug consumption. This model allows testing the behaviors generated by the consumption of precise dosage(s) of substance(s). These dosages are selected by NeuralBoxSim user, who can also select the level of tolerance of the agent, by choosing stages for each of the nine substances modeled in SimUse. It is worth noting that the different algorithms on which are based NeuralBoxSim do not use any randomness. Therefore, the tests presented in the next paragraphs will always give the same outputs and can be easily reproduced. The model interface appears as follows (Figure 7.32):

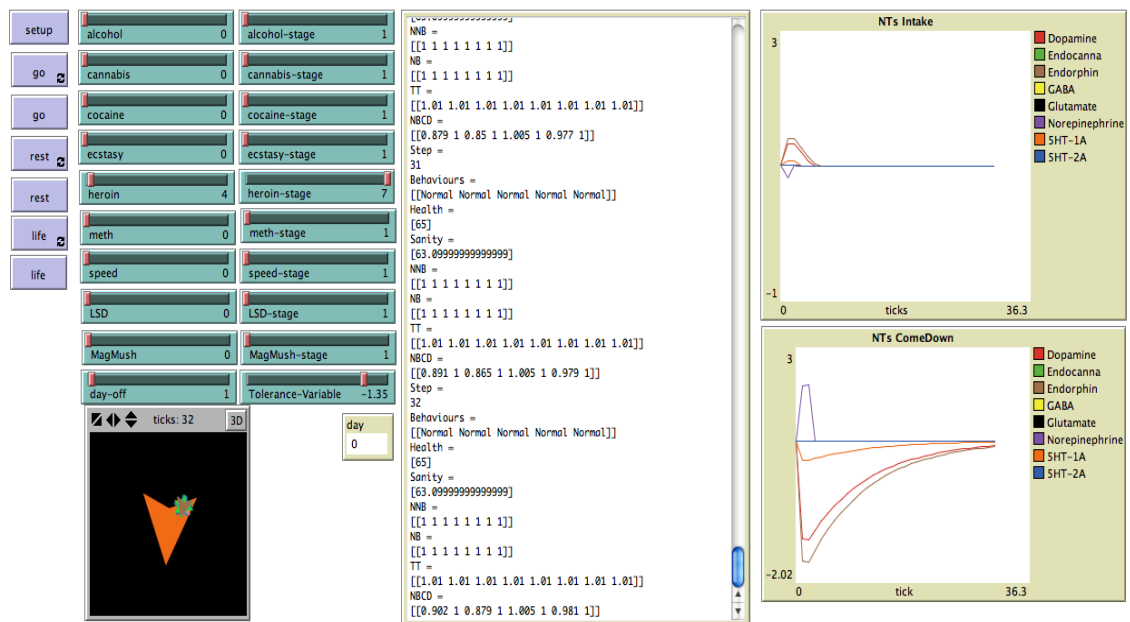


Figure 7.32. Interface of NeuralBoxSim.

The "Setup" button permits creating a unique agent, called *brain*, which exhibits only a part of the normal *individual* attribute. For every simulation, *brain* has Health and Sanity values equal to 70, and all elements of the Initial-NeuralBox are equal to 1.

The user selects the drug dosage and *brain* stages by the means of the sliders button on the upper left corner. By hitting the "Go" button, the *brain* will, in the following order, (1) consume the drugs chosen by NeuralBoxSim user, (2) plot the Intake results, (3) proceed to the comedown inherent to the drugs consumed, and (4) plot the ComeDown results. Clicking on the "Rest" button makes the *brain* execute one or several times the **rest** algorithm. Processing this way allows observing the effect of one or several use of each substance and evaluate the duration of both intake and comedown effects.

The upper right graph displays the levels of the different neurotransmitters during the Intake and the bottom right graph, during the ComeDown. The central monitor presents different attributes of the *brain*: Health, Sanity, levels of neurotransmitters during Intake (NB),

ComeDown (NBCD), as well as the Tolerance-Threshold (TT), and more importantly, the Behaviors exhibited by the *brain*.

One of the first elements of NeuralBox to test is its ability to reproduce the evolution of tolerance as proposed by the Opponent-Process theory (Section 2.2.3). According to this theory, the positive effects felt tend to fade with the level of tolerance built by users. In SimUse, the tolerance to substances is reproduced by the Stage attribute: the higher the stage, the lower will be the positive effect and the higher will be the negative outcomes. Therefore, if the *brain Stage* is low, NeuralBoxSim should exhibit higher levels of neuro-transmitters during the Intake phase, and low levels of neurotransmitters during the ComeDown phase, and *vice-versa*, if the *brain Stage* is elevated. The following graphs show the level of neurotransmitters for both Intake and ComeDown for *brains* taking 4 doses of Heroin, the first two for a Heroin Stage 1 brain (Figure 7.33 and Figure 7.34) and the last two for a Heroin Stage 7 brain (Figure 7.35 and Figure 7.36).

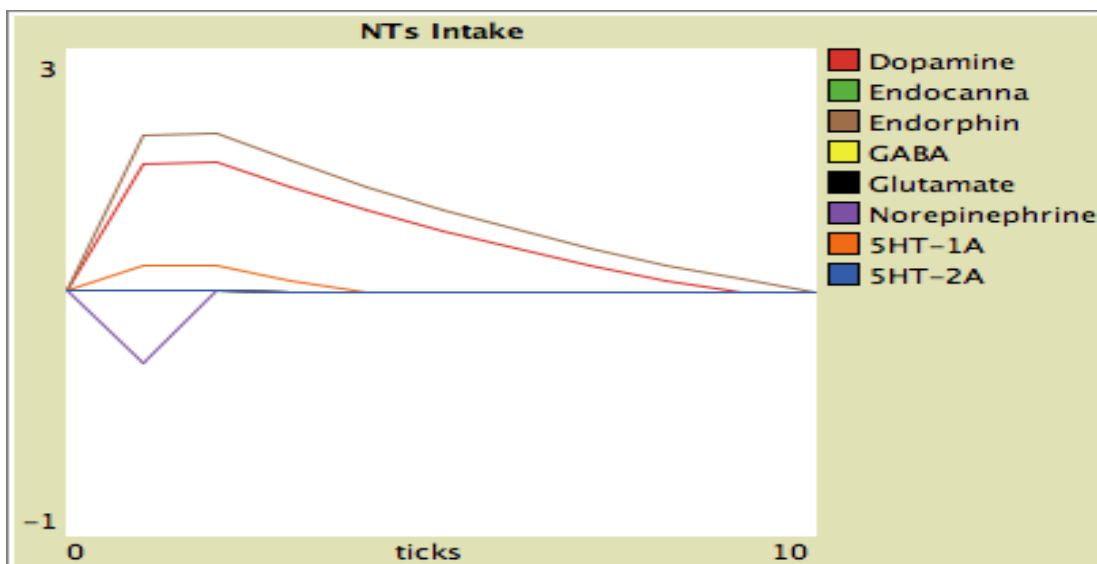


Figure 7.33. Intake results for a Stage 1 *brain*.

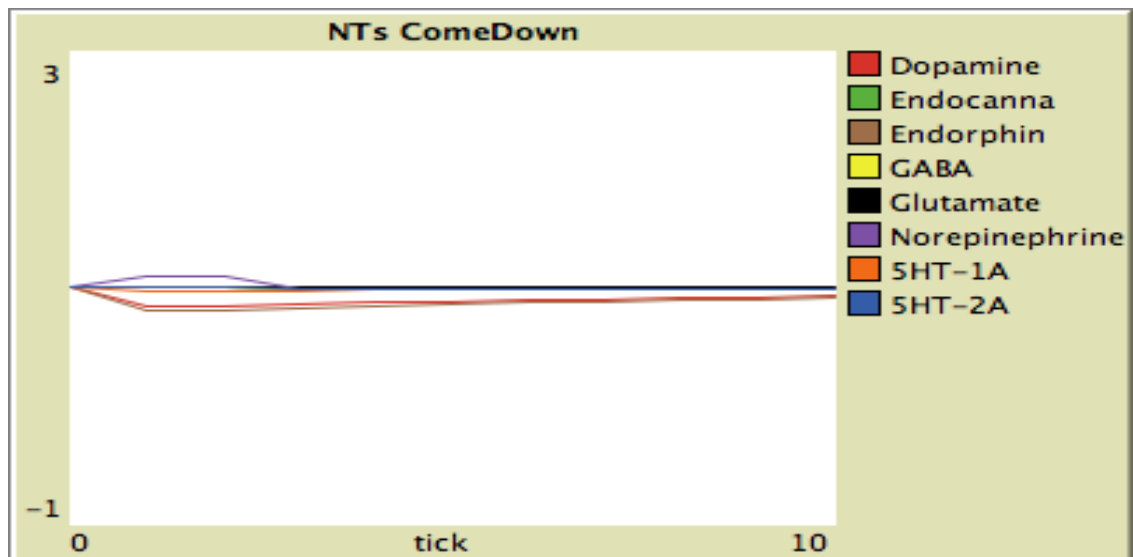


Figure 7.34. ComeDown results for a Stage 1 *brain*.

Stage 1 *brain* exhibits a state of elation and sedation during the Intake (["Normal" "Happy" "Sedated" "Normal" "Prosocial"] as Behavior values), and remains sedated for the following few ticks ["Normal" "Normal" "Sedated" "Normal" "Normal"] with no signs of side-effects.

Conversely, Stage 7 *brain* display short positive effects ["Normal" "Normal" "Sedated" "Normal" "Normal"] and large negative effects ["Painful" "Depress" "Anxious" "Normal" "Aggressive"] that progressively wear off.

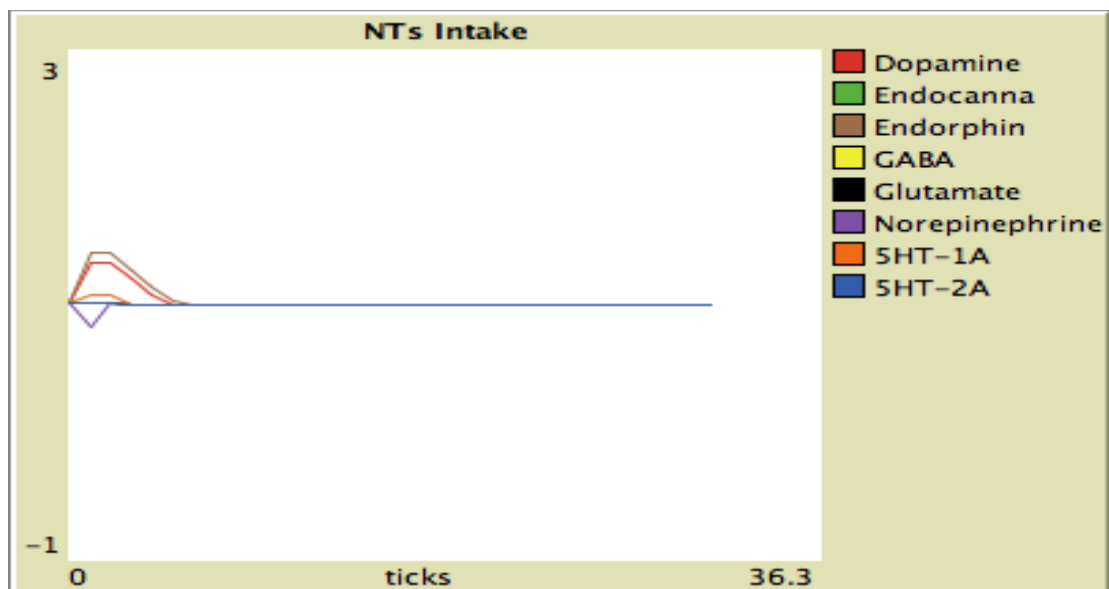


Figure 7.35. Intake results for brain Stage 7.

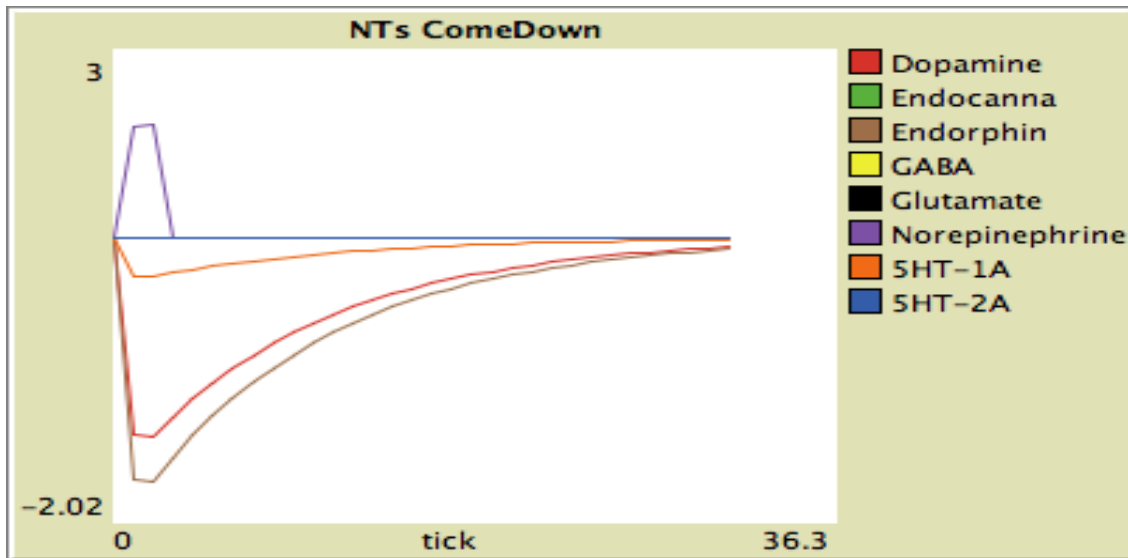


Figure 7.36. ComeDown results for *brain* Stage 7.

The period of comedown continues for a longer time for Stage 7 brain than for Stage 1, which does not suffer the same intensity of side-effects. These four graphs tend to reproduce the different phases described by the Opponent-Process Theory (cf. Section 2.2.3) and the evolutions of the neurotransmitter levels accordingly to the Stage value follow the same patterns for all the different substances modeled in SimUse.

The second point to test is the agreement between drug dosages and behavioral effects. The verification has been done as follows: for each substances, several dosages were tested — 1, 2, 4, 8, 12, 20, 40, and 100 — on *brain* at Stage 1, 3, 5, and 7. The different levels of neurotransmitters at the initialization of the *brain* were modified to represent the increased level of tolerance of higher stage agents: the Initial-NeuralBox, Normal-NeuralBox, NeuralBox, and NeuralBox-ComeDown attributes of *brains* were augmented by 10% of the value of their Stage (i.e. Stage 3 will start with all elements of the NeuralBox equal to 1.3; Stage 5 with all elements equal to 1.5, etc.). In the same way than in the complete model, the Tolerance-Threshold values are equal to the NeuralBox values plus 10% (e.g., if the NeuralBox equal

1.2, the Tolerance-Threshold would value 1.32). The outputs produced by NeuralBoxSim are presented in Annex 11.

The results concerning Stage 7 brains could be surprising: most of these agents are dead or insane with elevated doses that agents of Stage 5 could tolerate despite a substantial loss of Health and/or Sanity. However, it has to be noted that the Health and/or Sanity of these Stage 7 users do not fall to zero just after the intake: the values of their attributes reach score below zero after a reasonably long period of comedown. In their case, it is the consequences related to the depletion of the stock of neurotransmitters that is lethal. Unlike what happens in NeuralBoxSim, *users* in SimUse with such situation could have run the **ask-help** operation and enter into treatment or be **healed** by a *doctor*. Furthermore, extreme dosages, such as 40 units and above, consumed in two hours did not appear in the interviews and in the drug related literature. These values were mainly tested to observe if there were no unexpected results coming from the model. Moreover, in the empirical material, most of the respondents with what could be considered as a high tolerance regarding one or several substances, use other substances to palliate their comedown, balancing their neurotransmitter levels (cf. P.Boy and Picasso interviews in section 6.3) to limit the damages due to acute consumptions. Overall, these tests had the objectives of describing the different behaviors *users* could exhibit in SimUse and verifying the adequacy of these exhibited values with the literature and the respondent descriptions.

The neural engine integrated in SimUse allows testing the behaviors and physiological reactions of *users* while polyusing psychoactive substances. However, considering the large number of combinations²²⁸ that could be produced through NeuralBoxSim, this point of verification

²²⁸ The number of possibilities that can be tested through NeuralBoxSim equal to: (Dosages * Stage) ^ Substances, which represent 101 possibilities of dosages multiply by seven stage, the whole to the power nine (for the nine substances in SimUse) equal to approximately 4.413 x 10²⁵.

will remain limited to four cases. These examples present an agent with no built tolerance, which tests several drugs in the same session. These examples aim to illustrate the neurologic part of individual responses to the drug: there are no externalities, judgments, or peers influences affecting the *users'* intakes.

The first example aims to reproduce the behaviors of a *brain* using 3 doses of alcohol in one time step, then a tick with no intake, then 3 more doses of alcohol, immediately followed by 1 unit of ecstasy (Figure 7.37):

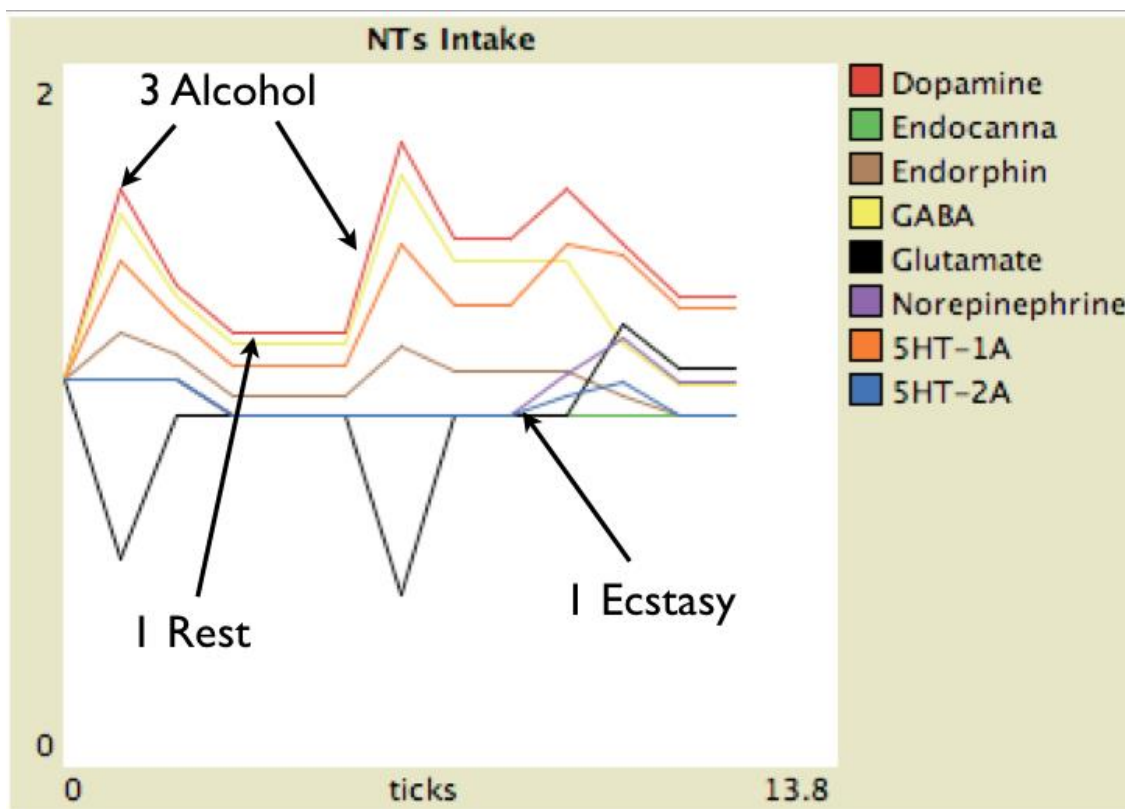


Figure 7.37. Evolutions of the Neurotransmitter levels for the Changing scenario

The Behaviors display by the agent are as follows:

First alcohol intake: [Normal Happy Relax Normal Prosocial]

Resting time step: [Normal Happy Relax Normal Prosocial]

Second alcohol intake: [Normal Happy Sedated Normal Prosocial]

Ecstasy intake: [Normal Happy Normal Energetic Prosocial]

This preceding test illustrates the *changing* form of SPU employed by recreational users to switch from one state to another: as just shown, the "Sedated" Behavior that appears after the second intake of alcohol is replaced by the "Energetic" Behavior following the ecstasy use. The extract of Mike (p.234) illustrates this kind of SPU.

The second example asks the *brain* to consume 2 units of speed, have 3 steps with no substances, and finish with 3 doses of cannabis (Figure 7.38).

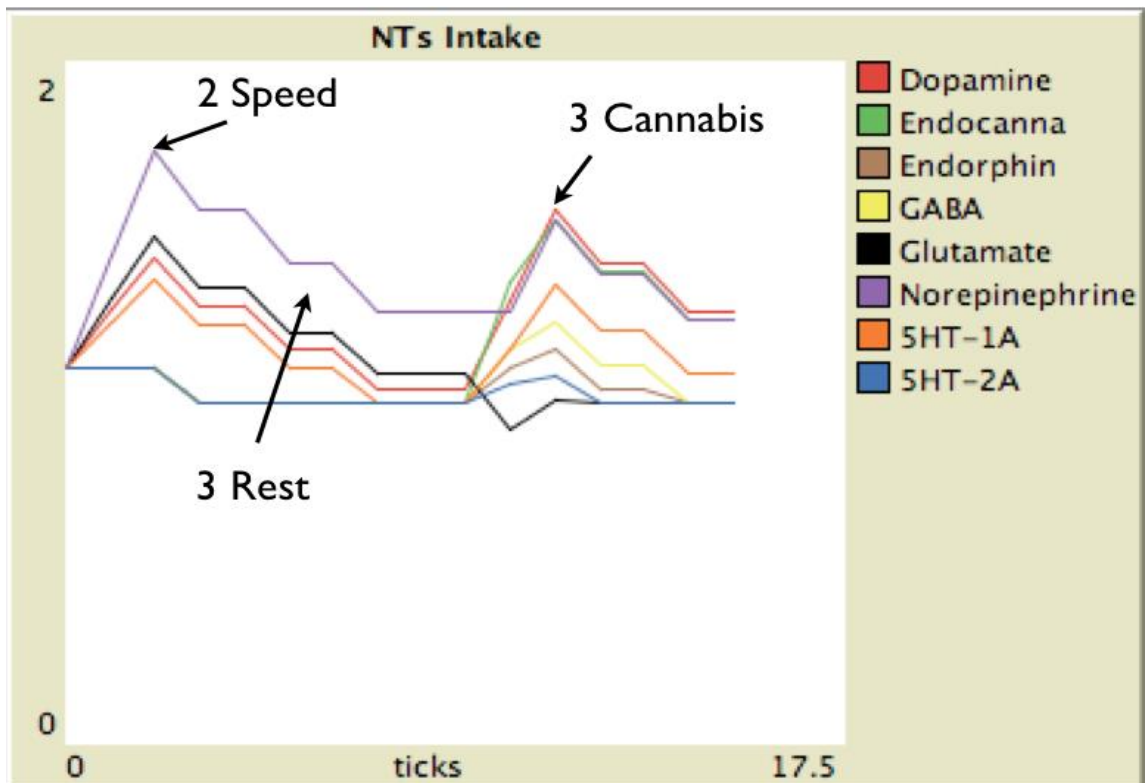


Figure 7.38. Evolution of the neurotransmitter levels for the Changing scenario

The Behaviors display by the *brain* are as follows:

Intake of speed: [Normal Happy Normal Energetic Prosocial]

Rest phases: [Normal Happy Normal Energetic Prosocial]

[Normal Happy Normal Energetic Prosocial]

[Normal Happy Normal Energetic Normal]

Cannabis intake: [Normal Happy Relax Normal Prosocial]

The "Energetic" element of the Behavior attribute is replaced by the "Relax" value after cannabis intake. This shift happens due to the agonist action of cannabis that brings back the balance between GABA and glutamate in the Central Nervous System and allows the *brain* to remove the "Energetic" value. This example describes the **use-depressant** operation. This one is called by *users* before the **rest** algorithm. It aims to reproduce the *counteracting long-term effects* SPU.

The third example describes the difference between an intake of three units of alcohol and an intake of the same dose of alcohol in conjunction with three doses of cannabis (Figure 7.39).

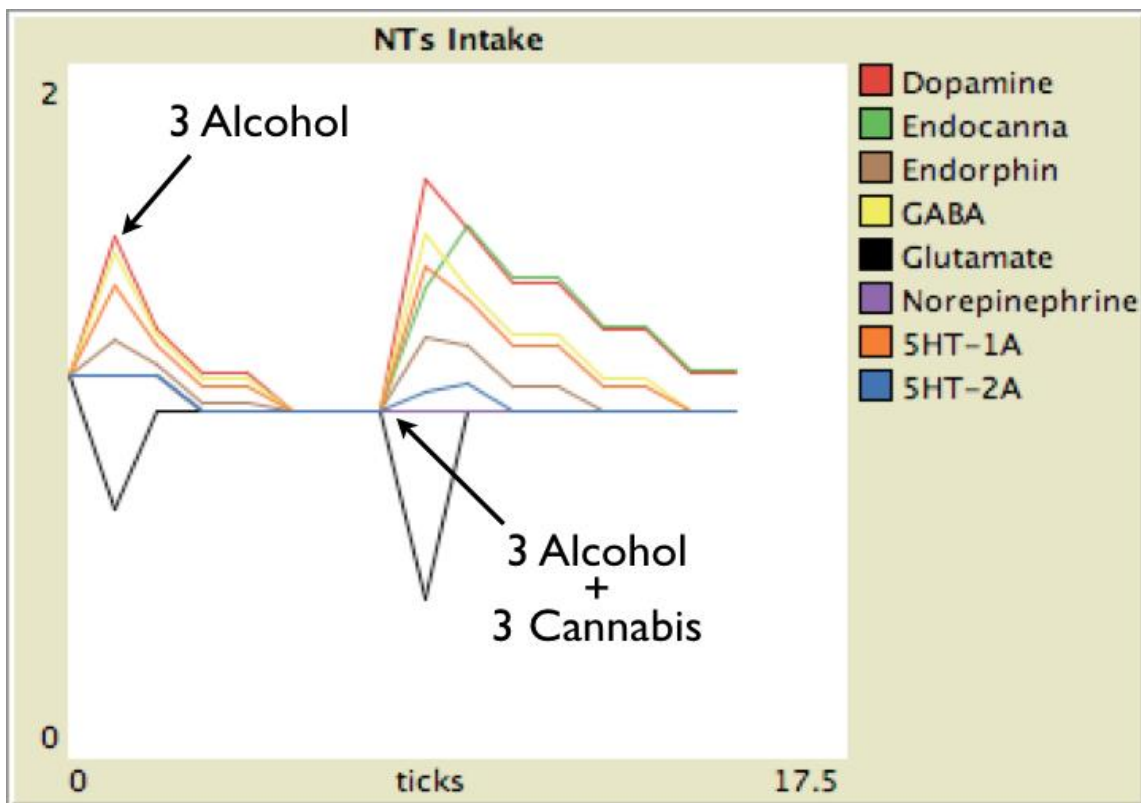


Figure 7.39. Evolutions of the neurotransmitter levels for the Counteracting long-term effects scenario

The *brain* exhibits the following Behaviors:

Alcohol intake only: [Normal Happy Relax Normal Prosocial]

Alcohol plus cannabis: [Hallucinate Happy Sedated Normal Prosocial]

Combining these two depressant substances increases significantly the level of GABA, which, in turn, augments the effect of sedation and drowsiness. This type of polyuse practice, related to the *enhancing* SPU, permits the individual to obtain faster targeted effects (cf. the extract of Neron p.345 for an example).

The last test aims to represent the *pilling up* form of SPU. To do so, NeuralBoxSim will try to reproduce the session depicted by Gourou in Section 5.4.2 (p.346-347). This respondent explained the way he was generally mixing drugs depicting the order he gave to his intakes to "jump off a stratum of consciousness to another" (Figure 7.40):

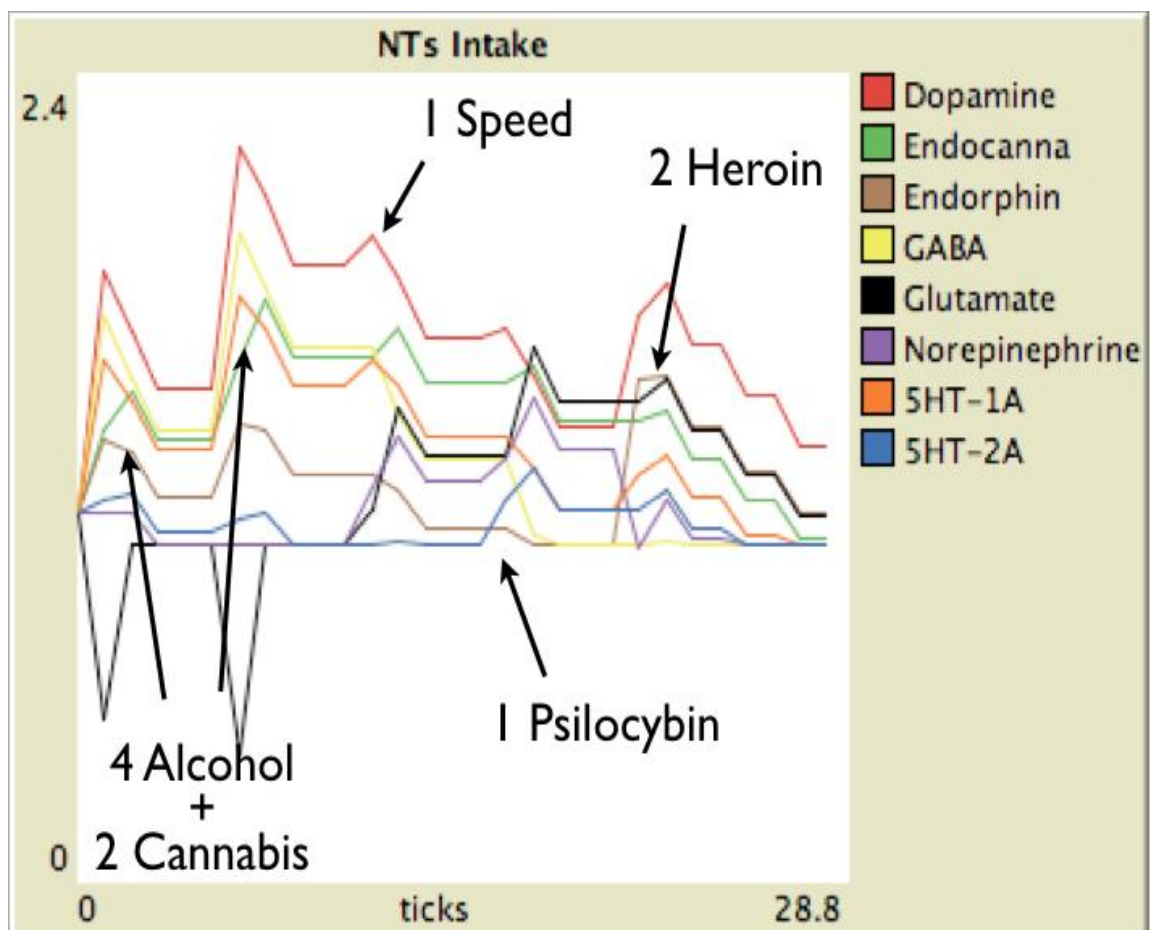


Figure 7.40. Evolution of the neurotransmitter levels for the Pilling up scenario

First Intake 4 Alcohol + 2 Cannabis: [Normal Happy Relax Normal Prosocial]

Phase of Rest: [Hallucinate Happy Relax Normal Prosocial]

Second Intake 4 Alcohol + 2 Cannabis: [Hallucinate Happy Sedated Normal Prosocial]

Phase of Rest: [Hallucinate Happy Sedated Normal Prosocial]

Third Intake 1 Speed: [Normal Happy Relax Normal Prosocial]

Phase of Rest: [Hallucinate Happy Relax Normal Prosocial]

Fourth intake 1 Psilocybin: [Hallucinate Happy Normal Energetic Prosocial]

Phase of Rest: [Hallucinate Happy Normal Energetic Prosocial]

Fifth intake 2 Heroin: [Normal Happy Relax Normal Normal]

Phase of Rest: [Normal Happy Relax Normal Normal]

The different states obtained by these combinations started from "Prosocial" and "Relax" with the first intake; the second intake leads to "Sedation"; which is removed by the use of Speed (move from "Sedated" to "Relax"); this one is followed by the use of magic mushrooms that procure the "Hallucinate" value; finally, the "Energetic" Behavior induced by the adjunction of speed and psilocybin is reduced by the intake of two units of Heroin. This "pilling up" needs to be mitigated given the fact that neophytes (Stage 1 agent) would consumed that much drugs.

This last example illustrates the capacity of NeuralBoxSim to reproduce the behavioral responses induced by single or combined psychoactive substances. The different tests run in this subsection tend to indicate that the NeuralBox could mimic the reactions of individuals while under the influence of psychoactive substances. Nevertheless, NeuralBoxSim is a module of the *individual* class and the 'Brain' agents were not subject to externalities, peer pressure, nor factors related to drug availability and financial cost.

Conclusion:

In Section 7.1, the final version of SimUse was presented and detailed. The Section 7.2 has been dedicated to verify the implemented version of the model looking for errors in the code. This part of the verification has been accomplished by the mean of walkthrough and "dummy" tests. The section 7.3 aimed to continue the process of verification by looking for the concordance of the algorithms outputs with the empirical findings. The different tests and their positive results tend to indicate that the actual implementation of SimUse is correct and that the outputs of the actions/interactions algorithms are concordant with the empirical findings.

Chapter 8. Discussion

According to the scientific literature, drug use is a complex and constantly evolving social phenomenon resulting of the interactions of numerous risk and protective factors. These factors originate from different levels of understanding. From neurosciences to economy, each discipline has produced concepts and theories that tried to explain the influence of one or several of these factors. However, little research has tried to encompass these different levels of influence into a single framework, which could capture this complexity [327]. Building such a framework is one of the primary goals of this thesis.

Furthermore, these last two decades have been marked by different phenomena that have increased the level of complexity characterizing drug consumption. Drug use has spread beyond the "deviant" margins of society and seems to have become "normalized" [134]: the largest group of contemporary drug users are socially-integrated, consuming drugs on a recreational basis and remaining unnoticed from police or health institutions (cf. Section 1.3.2). Moreover, added to the constant presence of the classic drugs (cannabis, cocaine, heroin, amphetamine, etc.); new substances are frequently appearing on the drug market, creating a context of "hyper-availability" where users could experiment with a large panel of substances (cf. Section 1.3.1).

As a consequence of this normalization and hyper-availability, the drug-related institutions (UNODC, EMCDDA, and NDARC) consider polysubstance use as being the actual "norm" of consumption. Despite this statement, research studying polydrug use remains scarce and is generally focused on the risks caused by this practice. Indeed, little is known about the reasons for users to polyconsume drugs and about the different forms that this practice can take. The main objective of this

thesis is to understand the reasons of polyconsumptions and their impacts on a long-term basis.

Concerning polysubstance use, the literature differentiates the mixing of substances during the same session, named Simultaneous Polysubstance Use (SPU), from the individual history of polyconsumption, called Concurrent Polysubstance Use (CPU) (cf. 1.3.3). This work argues that these two dimensions have to be considered together and proposes to grasp the CPU by using the sociological concept of career and the SPU by integrating elements from neurosciences into a sociology-oriented theoretical framework (cf. Chapter 2).

Based on the literature, this thesis took for granted that polyusers intentions to consume drugs are partially based on expectations regarding substance effects and that users attach functions to the substances they consumed [73]. Based on this analysis, adding neuroscience elements appeared to be a *sine qua none* condition if this thesis wanted to understand the user's reasons to consume simultaneously several psychoactive substances. Indeed, getting down to the neurotransmitter level has allowed capturing the way drugs interact and increased the understanding of behavioral and physiological outcomes inherent to their combinations (cf. Section 2.2).

Nevertheless, these functions are not the only factors influencing drug consumption. Some of the factors influencing substance use are situated at the interactional level. Numerous studies have demonstrated the importance of the "peer pressure" or "peer influence" on substance initiations. More importantly, the symbolic interactionist theory has proved that individuals based their actions on the meanings they developed about things, and that these meanings are shaped and modified through both interactions and experiences (cf. Section 2.4). Therefore, the second condition needed for understanding (poly)drug

use was to capture these meanings, their transformations, and the reasons inducing them.

Finally, the sociological literature indicates that the life events and contextual changes affecting the "biographical situation" of the users appear to play a major role in shaping their consumption. This thesis proposes to use a diachronic and sequential perspective to capture the life span of the individuals by using the sociological concept of "career" (cf. Section 2.5). It allows contextualizing the evolution of user's consumption, in terms of expectations, functions, and representations. Moreover, re-creating the career of recreational polyusers will ease the process of assessing the impact of polysubstance use on the life of these users.

However, the career of recreational polyusers has been poorly studied and requires more information. Therefore, the current research has investigated the career of recreational polydrug users to evaluate the impact of polysubstance consumption on the life of these individuals. It has employed a qualitative method to re-create their career and provide more information regarding their choices and perceptions about psychoactive substances, as well as the contextual changes that have influenced their consumption.

This framework informed by the collected empirical data should be able to encompass these different levels of influence, at least in theory. This thesis proposed to test the relevance and accuracy of this theoretical framework by integrating this latter in an agent-based social simulation with the main objective to "generate" the career of recreational polyuser's. The results of the empirical arm of this thesis are presented in the next section (8.1).

8.1 Sociological Key Findings

8.1.1 The "career" of recreational polydrug users

The interview sample of this thesis consisted of 38 users (19 in France and 19 in Australia) of at least 18 years of age, socially integrated, with no history of treatment, and who had combined at least two psychoactive substances in the six months prior to the interview. Volunteers were either students or work full-time. Only two respondents were unemployed at the time of their interview.

Studying the career of drug users consisted of "dissecting" in several ordered stages the life of these users through the prism of their consumption. These stages capture the particular user's rationales, practices and representations on drug use and contextualize their formation and transformations. However, the concept of career was initially employed to study "mono-substance" use. Based on the work of Measham, Parker and Aldridge [133], the interview guideline was built to inform the reasons for stopping and/or changing of substances (referred as, "switches"), capture polyconsumption patterns, and understand the rationales behind this practice, while connecting these to the biographical situation of the respondents.

The empirical findings indicate that the recreational polyusers career could be characterized by three main stages: "Starting and Learning" (Chapter 4), "Instrumenting and Switching" (Chapter 5), and "Slowing and Selecting" (Chapter 6). This chapter discusses four transversal themes, which appeared as salient: *changes in substance's social representations* (8.1.2); *instrumenting of psychoactive substances* (8.1.3); *perception of risks and techniques of control* (8.1.4); and *the construction of the recreational status* (8.1.5). Subsection 8.1.6 gives some comments

on the impact of polysubstance use on the career of recreational users. Subsection (8.1.7) presents the strengths and the limitations of the sociological empirical research.

8.1.2 Evolution of Substance Social Representations amongst recreational polydrug users.

Based on a symbolic interactionist perspective, this thesis assumes that to understand the reasons of drug initiations or cessations, the meanings attached to these substances need to be known and analyzed. This thesis employed the sociological concept of social representations to capture these meanings. Social representations represent the opinions and beliefs an individual develops concerning a particular object or practice. These representations orient the actions of the individual by providing a practical knowledge regarding the way to act. They are socially constructed and reshaped throughout the interactions and experiences of the individuals (cf. Section 2.4.2).

Before their first initiations, respondents perceive substances through the dichotomy licit/illicit drugs. These latter are encompassed under the term "Drugs" and are perceived as "bad/detrimental/addictive". This primary representation becomes fragmented after the first initiations. New users start to differentiate substances and modified their representations to be consistent with the behaviors and actions of other users/peers and with their own experiences. This fragmentation of the primary social representation affects the representations attached to untested substances creating a "gateway effect" (cf. Section 4.3.2) that could facilitate further initiations. It also appears that the few first initiations condition the future use of the substances: individuals do not continue using substances if the outcomes of their first uses are judged negative (in terms of feelings and consequences).

If they continue their consumption, recreational users move to a "honey moon" period during which the frequency and doses of their consumption increase. In turn, this "honey moon" period sees the social representations of substances used become increasingly positive. From that point, the evolution of the social representations is twofold. According to the empirical material, these social representations start to be connoted with negative terms, either (a) when the individual reevaluates negatively the outcomes of his intakes or (b) when the individual observes detrimental effects of the substance on other users. Concerning (a), this negative reevaluation arises from the individual perspective and could be triggered by comedown effects outweighing the positive ones or by acute drug-related harm inherent to excessive doses. Here, the addition of some basic notions of neurology has been fruitful: by consuming more frequently, the user builds up a tolerance to substances. This tolerance requires from the users to consume more of the drugs to feel expected and known effects and these increased doses heighten the intensity of the comedown effects. Concerning (b), the modification is inherent to the interactional process: other users are perceived as "mirrors" reflecting their own behaviors to the user. By witnessing the adverse effects of a substance on others, the risks induce by these substances become visible to the individuals, which will modify their social representations and reevaluate their future decisions. As a consequence, the users may "switch" from one substance to another (cf. Section 5.3) or develop techniques of control concerning that particular substance. Indeed, in the interviews, the respondents that maintain a social representation connoted positively are those who have been able to stay in control of their consumption by creating rules and sanctions (cf. Section 6.2.2).

Applying the sociological concept of social representations in order to study the opinions and perceptions of recreational polyusers has permitted (a) characterizing the meanings attached by individuals to drugs; (b) formalizing the opinions of users regarding substances, and;

(c) understanding the reasons and events that influence the initiation or cessation of substances. However, if studying the social representations of respondents had shed some light on the drug decision process, this one does not only depend on the social representations of the users.

8.1.3 Drug of Choices, Instrumental Functions, and Social Injunction in the "late modernity" context

The topic of polyconsumption asks to address the question of drug choices and to identify the modifications operated by recreational users throughout their career. During the "Starting and Learning" phase, the first uses are oriented toward socialization: drug use is a group activity creating common memories and reinforcing the group cohesion (cf. Section 4.2.1). Correlatively, the first substances used are these proposed by the group of peers. The interviews converge around the key role of "experienced" peers in the initiation of illicit substances. These "experienced" peers are designated as suppliers and safe keepers by the respondents, but they also play the role of mentor teaching to neophytes the different techniques to supply and consume the drugs (cf. Section 4.2.3). The empirical data reveal that the "learning" process varies from one substance to another, for example, ecstasy pill does not need any consumption technique, while drugs such as cannabis, or stimulants in a powder form require the user to learn from peers.

Once the techniques regarding the different substances are learnt and the neophytes become able to supply and manage effects of the substance, they enter the "Instrumenting and Switching" phase. The analysis of the interviews revealed that the respondents consider drugs as "help", facilitating the achievement of specific functions. Consistent with the findings reported in other studies [43, 73], the respondents develop expectations regarding substances and attribute functions to each of them. In contrast to Boys and colleagues, this thesis argues that these four functions — "Sociable", "Relax", "Energy", and "Intoxicated"

— are *only achievable by using specific substances*. For example, stimulant drugs do not appear in the interviews as being consumed to achieve the "Relax" function, nor opiates or benzodiazepines used to achieve the "Energy" one.

It is worth stressing that there is a convergence between the instrumental functions and the neuropharmacology of substances chosen by respondents to achieve these functions. In other words, the users, without necessarily being aware of that convergence, consume substances with the right neuropharmacology properties to obtain the desired effects. This convergence reinforces the interest that neurosciences could have for this specific area of social sciences [328]. It also reinforces the idea of integrating a neurological "engine" into the model to increase the accuracy of this latter while generating the career of recreational polyusers.

These different *functions* shaping recreational drug usage seem to find their roots in the contemporary social norms as presented by Ehrenberg [292, 293, 297, 298]. This thesis argues that psychoactive substances are employed as means by recreational polyusers to handle difficult situations inherent to the daily life in "late modernity" [215]. They allow the users to abide by several social norms. Indeed, these four instrumental functions could be connected to the different aspects of actual social norms:

- The 'Social' function is associated with a better presentation of the *self* and to increased self-confidence, allowing the individual to interact "freely" with random individuals and connect easily with unknown people;
- Substances facilitating to the 'Relax' function are in most cases used to create a breach between the daily public sphere and the private life of the users;
- The 'Energy' function permits extending this private time and to get rid of the tiredness inherent to the daily obligations of recreational

polyusers;

- The 'Intoxicated' substances are used as "societal shock absorbers" [295], to release daily anxiety, pain, and overwhelming stress induced by human condition in the late modernity.

This thesis also claims that if the recreational polyusers choose their drugs based on the instrumental function they target, they discard substances with a negative representational scheme, and estimate the "pros and cons" of their consumption considering their daily obligations (cf. Section 5.2). This decision process does not change for the last stage of their drug career. However, the next stage, "Slowing and Selecting", is characterized by a phenomenon of "maturing out" of substance use and by the development of rules, sanctions, and techniques of control structuring substances consumption, constraining their choices and limiting the risk associated with substances use (cf. Section 6.2).

8.1.4 Evolution of the Risk and Control Notions during the Career of Recreational Users.

The notion of risk is central in the topic of drug use and all the respondents were aware of the risks associated with their practices. Asked about their drug initiations and continuation, they came up with arguments that palliate the dangerousness of their mode of consumptions [66]. These "risk denial" techniques evolve throughout their career. Studying the variations of "objects" of these risk denial and control techniques allowed capturing the changes about users' perception on drug's risks.

During the "Starting and Learning" phase, the perceived risks are immediate and irremediable (i.e. death, overdose, constant psychotic disorder), which reflect the initial social representation regarding drugs and the lack of knowledge of neophytes. Once the techniques of consumption are learnt and the effects identified, the users are less

frightened by the immediate risks. During the "Instrumenting and Switching" stage, the perception of risk shifts to long-term harms and consequences, such as addiction, depression, lung cancer, and permanent loss of memory. Reaching the "Slowing and Selecting" phase, respondents indicate that they reduce their consumption for fear of becoming addicted or "lose control".

Indeed, the analysis of the interviews shows that respondents also consider the social risks related to their consumption. It appears that the recreational users try to control their *face* and behaviors in public for not being designated as compulsive users unable to control their usage, and, conversely, operate a "labeling" toward the compulsive and dependent users.

8.1.5 The Construction of the Recreational Status through the Labeling of the 'Addicts'

As indicated in Section 8.1.4, one of the main risks designated by the older respondents was "to lose control" over their consumption. The interviewees who were economically- and socially-integrated (e.g. employment, responsibilities, and/or partner) at the moment of their interview, perceived some substances or practices as a risk of "jeopardizing" the bases of their social integration. In the last stage of their career, the respondents tend to develop further "rules" and "sanctions" to avoid any adverse consequences and losses of control that could possibly affect the achievement of their life project (cf. Section 6.2.3). The recreational users have to build a "middle status" between abstinence and addiction in order to manage their social image and justify their practices. Indeed, the recreational users perceive the addicts, as individuals who have lost their autonomy and are unable to be reflexive about their own life [215].

To create this middle status, recreational users delimit "acceptable" behaviors, define "controlled" usage and target elements requiring control based on the behaviors and characteristics they attribute to the "addicts" (cf. Section 6.3.2). By doing so, the recreational users define the signs of controlled usage and the appropriate behaviors while under the influence of drugs (i.e., remains unnoticed, reasonable frequency and quantity of consumption, social aspect of drug use), but they also "label" the users they consider as compulsive.

These findings are consistent with the literature [316, 317, 329]: exhibiting the characteristics and practices of a recreational and controller user, while scapegoating the addict, appears as the most common neutralization technique that respondents employed to legitimize and justify their mode of consumption. This labeling of the deviant inside the deviance also induces, as a perverse effect, an ostracization of users labeled as 'compulsive' or 'addict', which can, in turn, lead to their dissocialisation or to the integration in a group of compulsive users. Nonetheless, this thesis has not investigated the career of dependent users; therefore, the precedent development needs further investigation to be evaluated.

8.1.6 Polysubstance Practices and Impact of Polyuse on the Career of Recreational Users

The empirical data indicated that polysubstance use should not be understood as a single practice. Indeed, the interviews reveal that this practice can take at least four distinct forms (cf. Section 5.4.2):

- *Controlling long-lasting effects*: the most common form of SPU consists of balancing the effects of psychostimulants by using depressant drugs to induce sedation;
- *Changing*: this SPU aims to counteract the effects of one or several drugs by a substance with opposite effects (the case of individuals using cocaine to balance the effects of an excessive consumption of

- alcohol is the most common);
- *Enhancing*: conversely, this form of polysubstance use increases the effects of one substance by adding the effects of a similar drug (the case of alcohol plus cannabis was regularly cited in the interviews);
 - *Pilling up*: this SPU consists of combining different classes of substances to change of physiological and/or psychological states several times in the same session.

Except for "Enhancing", these different forms of SPU could be understood as a combination of two or several instrumental functions: the polyusers varying at will their consumptions to adapt to the context or to their social environment. The analysis of the interviews allows arguing that SPU does not consist of an inconsiderate use of substance randomly chosen by the individual, but is an intentional form of use requiring a mastery and knowledge of psychoactive substances (cf. Section 5.4.1). This knowledge is acquired throughout the career of the recreational polyusers, which could explain why polyuse practices cannot be found in the extract of the "Starting and Learning" stage. It is worth noting that some respondents have experienced "accidental" polyconsumption, mainly induced by an inebriated state. This confirms the *centrality* of alcohol [72] and its *inducing* role in polysubstance use. Nevertheless, most of the respondents differentiate these "accidental" intakes from intentional and preplanned poly-consumptions, these accidents tend to diminish throughout the career of the respondents.

Surprisingly, the respondents (except one) do not labeled polysubstance use as a "dangerous" or "addictive" practice. In the interviews, dangerousness and addiction were always linked to a single substance or to a particular way of administration, but not to a combination of drugs. This could be partially explained by the fact that polysubstance use is not considered as a particular "object" with representations or properties attached to it: respondents did not talk about polysubstances use, except if they were asked about it.

Furthermore, polysubstance practices could be employed by recreational users to facilitate the continuation of their social obligations or keep the control over their consumption. Indeed, several respondents describe how they can use the "Enhancing" SPU to limit their consumption or the "Controlling long lasting effects" to be able to fulfill their social obligations after a long weekend of psychostimulant use. Nevertheless, the "Pilling Up" SPU should be considered as harmful: in that specific case, substances are consumed to facilitate the consumption of more drugs, which could lead to acute drug-related harm. Nevertheless, further evidences are needed to assess the harmfulness of these different polyconsumption practices.

Considering the previous points, assessing the impact of polysubstance use necessitates differentiating the specific forms and frequency of polyuse. This thesis aimed to capture the career of recreational polyusers and not one of the particular forms of SPU. Knowing, henceforth, the rationales and types of substances used for the different forms of SPU, further investigations should focus on the harmfulness of each of the specific forms of SPU. Concerning the harmfulness of SPU, it is worth noting that when describing hazardous situations or acute harm, the respondents generally blame one substance in particular and not a combination of substances. In spite of scientific evidences concerning polysubstance potential harmfulness [307, 330, 331], the large majority of the respondents do not perceive simultaneous polyuse as potentially harmful and their lack of knowledge regarding the combinations related harm may be one of the main risks of such a practice.

Finally, concerning the impact of polysubstance use on the career of recreational users, three points need to be underlined.

First, consistent with the previous point, polysubstance use was rarely cited by the participants as the main cause of long-term adverse events.

The interviewees who expressed regrets concerning their past consumption or considered that they suffered from long-term adverse effects generally incriminated one substance in particular.

Second, as indicated in Section 8.1.2, the respondents cease their consumption and potentially switch to other substances when their use becomes problematic or when the social representations associated with the substance becomes connoted negatively. The "hyper-availability" characterizing the contemporary drug market should have increased the number of potential switches and lengthened their career. The empirical material shows that aging and accumulating further social obligations restrain the frequency of usage and the nature of the consumption. The process of "maturing out" (cf. Section 6.1.1) coupled to the injunction of achieving one's "life project" (cf. Section 6.1.2) prevent the users from engaging in a new drug cycle and limit the intensity of their future usage. The drugs that remain consumed throughout the drug user career are controlled by the means of control techniques and sanctions [152]. In definitive, polysubstance use does not contribute directly increasing the overall duration of drug consumption and seems to be controlled and integrated into the life of these users. This is along the same lines as Ogien, who stipulated:

«Sociology teaches us something rather desperate: to show that the drug does not cause havoc and destructuring that it is supposed to cause is to produce a useless knowledge. Decades of research has indeed shown that regular consumption of drugs is a relatively regulated practice, even if it poses health risks to individuals who engage in it, it does not systematically destroyed them and leads rarely to catastrophic consequences for social order. »²²⁹

Considering the multiplicity of institutional definitions regarding "polysubstance use" (cf. Section 1.4.3) and the fact that the large majority of illicit drug users are polyusers, one could question the relevance of the polyuser category. According to Peretti-Watel [332],

²²⁹ Ogien A. in Fontaine A. (2006) *Double vie. Les drogues et le travail*, Paris, Les Empêcheurs de penser en rond. p. 1.

defining a practice as risky allows labeling the group of individuals as deviant to the norm, even more when these practices induce a social cost. Thus, labeling polysubstance use as risky practice favors the visibility of drug users, but also permit reintroducing the risk inside drug use, while this one appeared to become normalized (cf. Section 1.3.2).

Third, if drug use “does not systematically destroyed” the users, some of them might experience “addictive episode” or acute drug-related harms. Preventing these consequences constitute the main goal of drug-related public policies. However, if we assume (1) that the construction of the recreational status is accomplished by comparison with individuals labeled as "abusers", "compulsive" users or addict, and if we assume (2) that the social representations are modified negatively following experienced/witnessing adverse consequences, we should conclude (3) that drug-related harms, signs of addiction, and/or social failures are necessary to render visible the risks inherent to drug use and are contributing to the construction of rules and sanctions that, in turn, will limit harmful usage and shorten the duration of some substance consumption of most of the recreational users.

8.1.7 Value of the empirical Results: the Strength of the International Dimension

The international nature of this thesis provided the opportunity to compare the data from both French and Australian samples looking for difference and similarities. It appears that the respondents from both samples share more than they differ:

- Initial social representations regarding drugs are identical from one sample to another and their transformations follow the same processes;
- The functions attached to substances and expectations regarding

effects are similar;

- The forms of SPU and their rationales remain identical, but are constrained by the local drug distribution market;
- Respondents from both countries go through the same career stages and gave similar reasons regarding their switches between substances;
- They employ the same type of "risk denial" techniques and tend to develop similar techniques of control for similar reasons;
- They both use the same scapegoating and labeling process toward "compulsive users" and define the status of recreational user with the same characteristics;

The possibility of comparing samples from different countries reinforces the generalization of these sociological findings.

The main difference concerns the use of psycho-stimulants: the Australian sample consumed more of these substances than the French one, which is consistent with both countries national statistics (cf. Table 5.2). Considering that amphetamine-type and MDMA-type are available in Lille, this last point would require further investigations to understand this cultural particularity.

Concerning the data collection, no adverse or unforeseen events occurred during the interview process. Nevertheless, this latter suffers from several limitations:

First, the research findings are based on data collected from self-selected convenience samples: the participants recruited may not be representative of the population of recreational polyusers. However, considering that there are no precise statistics concerning polysubstance use, nor categorized profiles of polyusers, this sample presents a variety of profiles and history of consumption large enough to explore and inform recreational polysubstance use.

Second, the volunteers were reimbursed AU\$50 or 30€ for their participation to this thesis. Considering that the reimbursement was advertised during the recruitment process, this reimbursement could induce some selection bias. Nevertheless, this reimbursement was to cover not only their time, but also their costs of travel to and from the interview location and should be considered as an acknowledgement to their contributions to the success of this research [333]. Furthermore, this reimbursement amount may have not interested economically secured recreational users. However, using a snow-balling technique of recruitment has permitted reaching recreational users who may have not been interested by this reimbursement.

Third, the interviews aimed to re-create the career of respondents across a large retrospective timeframe, which may have induced some recall bias. However, the time length of the interview (average of one hour and forty minutes) and the contextualization of the consumption facilitated experience recalls: most of the respondents added about their past experiences or about the thoughts or conditions of consumption throughout the interview process.

8.2 SimUse Characteristics and Strengths

SimUse is a synergetic model that processes by abduction, drawing its components and methods from a dialog between the model, theoretical framework and the qualitative findings. Based on the generativist approach [251] (cf. Section 2.6.5), it had for purpose to generate by means of a heterogeneous population of agents, acting and interacting through a set of operations, the career of recreational polydrug users.

8.2.1 SimUse construction: an ontological structure informed by qualitative research

To capture the complexity of drug use, SimUse construction was based on the idea that recreational polydrug use is comparable to a Complex Adaptive System (cf. Section 2.6.1). The model needed to integrate five levels of understanding, namely *drug*; *individual*; *network*; *context*; and *society*; as well as their interactions and their inner dynamic (cf. Section 1.5). Using an agent-based model permitted the integration of these levels of influence into a single framework.

SimUse draws from previous models (cf. Section 1.2.2) several of its characteristics:

- In SimUse, users could get through different stages of consumption (such as DrugTalk and SimAmph);
- From SimDrug, SimUse integrates several types of agents, such as dealers, wholesalers, doctors and policemen, normally involved in the daily life of users to reproduce the social context;
- Each *user* belongs to two distinct *networks* of agents. Network members could interact and influence each other. In contrast to SimAmph, where the peers influence agent only to consume, SimUse integrates both peers influence and peers sanctions.
- Experienced peers initiate neophytes willing to try drugs, in the same way as proposed in DrugChat.
- SimUse *users* have a physical and mental health capitals that can vary accordingly to their experiences and consumptions, and can assess these two capitals through self-reevaluation process in the same way that the agents of SimAmph;
- The model allows the *users* to re-evaluate their own practices and judge the behavior of other uses, possibly leading to a modification of their future decision (such as SimAmph).

Compared to the previous simulations concerning drug use, SimUse is the first drug-related model that incorporates several substances and their impact on the physiology of virtual users. This was achieved by adding a neurological engine, called "NeuralBox", to the model (cf. Section 2.2.4). The NeuralBox aimed to mimic the user's tolerance to drugs, but permits capturing the effects produced by polysubstance use by working at the neurotransmitter level (cf. Section 2.2.2). This neurological component allows agents displaying behaviors induced by their consumptions. These behaviors are re-evaluated by the agent and by other surrounding agents and can possibly affect their future decisions.

A second original feature of SimUse is that user's operations and attributes have been justified and designed based on the qualitative material. This 'emic' perspective allowed integrating the reality as perceived by the individuals and not as considered by the modeler [116]. It therefore helps to make the model closer to the reality lived and perceived by the real users. Indeed, the qualitative findings presented in the previous section (8.1) have been transposed into formal attributes and operations (using UML activity diagrams). For example, the decision process executed by SimUse users is based on a modified BDI approach (cf. Section 2.7.4) that integrated the research findings: Beliefs have been replaced by the social representations; Desires by the different instrumental functions depicted by the respondents; and the Intention by a list of drug to purchase and consume in different places. This decision process also integrates the 'Means' that agents have to employ in order to access the drugs, which is closer to the reality described by the respondents.

SimUse also integrates networks as a separate class of agents, but not by using a normal network graph. The main goal of the network class was neither to reproduce the exact number and nature of the connections between recreational users (the exact composition of

recreational user networks and their evolutions would require another research), nor the "strength" of their links. The network class was created to reproduce the way a group of peers can sanction their members, influence their actions, modify the meanings attached to substances, and supply drugs to its members.

One last feature of SimUse concerns the agent initiations. Most of the previous drug-related models (e.g., DrugMart, SimDrug, SimAmph) are launched with "blank" agents (i.e., without any history of consumption), which have a probability of initiating and continuing drug consumption. However, this situation does not reflect the empirical findings: a new user will never start consuming by himself. These initiations always require the presence of other peers or, at least, he needs to have witnessed drug use from other users. Therefore, SimUse integrates "experienced" peers playing an essential role for the initiation of new users, by creating different initial archetype of users.

8.2.2 Limitations of SimUse

Despite some points of agreement and its ability to encompass different influence levels, SimUse remains limited in, at least, four aspects:

1. There are several parameters that require further calibration, especially the initial SocialRepresentations, the exact repartition and nature of Archetype, a precise schedule of user's activities, and the initial repartition and transformation of the InstrumentalUse;
2. The precise geographical and urban contexts are drastically simplified in the actual state of SimUse, which does not allow studying, for example, the influence of venues density on brawl or accident, as well as the impact of negative events on the wealth of specific suburbs or locations as initiated in SimDrug (cf. Section 1.2.2.4);

3. The different operations regarding the drug market structure and the behaviors of the *dealers* are based on logical assumptions and may not reflect the actual reality;
4. Netlogo proved an excellent prototyping environment. Its input flexibility and easily customized output make it an excellent tool for the scale of simulations presented in this thesis. However, future attempts to scale the simulation to real city size, with many thousands of agents, would require recoding in a language more suited to high performance computation.

SimUse is an "exploratory laboratory" aiming to extend the results of the qualitative interviews and identify essential parameters, as well as missing data for subsequent work [124]. Indeed, its interest for social sciences lies in the fact that missing or incomplete data from previous investigations appear during the process of modeling. The abductive process and dialog created between the model and the data help to increase the knowledge concerning complex phenomena such as recreational polydrug use. Indeed, by encapsulating a large number of influential elements and by formalizing them, building an agent-based model forces the researcher to consider all these elements and pushes him to understand the nature of the relationship between these one. It orients further investigation, whose findings and data could be reintegrated later in the model in an iterative process.

Chapter 9. Conclusions and Further Work

This thesis set out to investigate the practice of polysubstance use amongst a population of recreational users and assess the impact of such a practice on their drug “career”. It assumes as its primary hypothesis that drug use, and even more polydrug use, is a complex social phenomenon that requires a multi-disciplinary framework to be grasped and analyzed. It used an agent-based model to capture the different elements influencing recreational polydrug use. As a second main hypothesis, this thesis considered that evaluating the impact of polysubstance use on the life of recreational users requires investigating polysubstance use in a diachronic perspective in order to contextualize user choices and capture the evolution of this practice. Therefore, the empirical arm of this thesis collected information regarding polysubstance use and its evolution in two samples of recreational polyusers situated in Australia and France.

Based on these hypotheses, this research produced the following results:

- An original theoretical approach has been established by considering polysubstance use as a Complex Adaptive System. It incorporates elements from neurology, sociology of action, interactionist theory, and deviant sociology. This theoretical approach was integrated in an agent-based model, named SimUse, which synthesizing the different theoretical components and making them interact and co-evolve.
- A neurological engine, called NeuralBox, was designed to model the behavioral responses inherent in multiple substances use

simultaneously: it models the neuropharmacological impact of the substances on the neurophysiology and behavior of the virtual agent.

- The different attributes and operations shaping SimUse agents were based on the qualitative research consisting of thirty-eight semi-directed interviews conducted with non-dependent, socially-integrated polyusers.
- The interviews were designed to capture the career of recreational polyusers. The main novel finding was that career was found to be a succession of three main steps: Starting and Learning; Instrumenting and Switching, and; Slowing and Selecting. The first step is mainly characterized by a fragmentation of the social representation concerning “Drugs” into substance-specific representations. In the second step, the users consume drugs as neuro-pharmacological means to facilitate the achievement of some aspects of their "reflexive project" and to contemporary social norms. Finally, the last step is characterized by a diminution of substance use, correlative to the increase of social obligations and a desire to become socially well-integrated: the loss of “autonomy” appears as the main risk incurring by the recreational polyusers at that step.
- This thesis demonstrated that to limit drug-related risks, recreational users create throughout their career control techniques and where able to manage the impact of polysubstance use on their daily life and obligations. The control techniques were built by a process of comparison/distinction from the behaviors and characteristics of compulsive users. This induces a labeling of compulsive users by recreational users and participates in the dissocialisation of the former.

- These different forms of polysubstance use require a learning process and appear as mostly intentional, well-structured, and concordant with the neuropharmacological properties of the drugs combined. The findings of this thesis also indicate that four main forms of simultaneous polyuse need to be distinguished: controlling long-lasting effects; enhancing; changing, and; pilling up.
- These forms of polyconsumption are the climax of the substance rationalization effectuated by recreational users: *controlling long-lasting effects* helps them to palliate the comedown effects of substances consumed during the session, to facilitate the return to normal daily life; *enhancing* amplifies the effects and allows users to reach their targeted state more quickly; *changing* permits user to be “in tune” with the moments they are living and make the most of their recreational moments; and *pilling up* consists of multiplying the categories of substances used to experience the maximum of psychological/physical states in a single session.
- By integrating the different sociological findings and combining them with the neurological engine, SimUse acted as a generative model and served as a mediator between empirical and theoretical data. It encompasses polysubstance use in a single framework.

This thesis has studied the micro- and meso-levels of recreational polysubstances use by detailing the career of these users. Nonetheless, a deeper investigation of the social norms influencing the decision of the recreational users is required. Furthermore, this thesis has not directly incorporated these different norms mainly because they are neither characteristic, nor action, but rules of conduct related to social values. Further works can focus on the integration of these values inside an agent-based model.

The dialog established between theories and empirical data via the model, reveals that some additional different types of data are needed. As shown throughout this thesis, modeling is an abductive process by nature: the model limitations bring logically new gaps to be completed. This thesis has indicated that recreational users develop functions regarding their use, but it did not state the distribution of these functions across the population: are these functions individual- or group-specific? If individual, what are the characteristics and rationales that could explain the willingness to achieve particular functions? If group-specific, what are those groups, and how are these functions spread amongst them? in the same vein, some parameters of SimUse would benefit from parameterized (e.g., social representations, number of bad experiences needed to set up rules of control, data regarding the budget, frequencies of use to precise the Stage).

This calls for applying the *epi-ethno* approach as proposed and conceptualized by Moore et al. [334]. This approach consists of using a model as a bridge between ethnographic/subjective information and epidemiologic/objective data, the former generating algorithms (as done in the present research), and the latter calibrating the class attributes and operational parameters and informing their last polysubstance session and their “drug-related schedule”, in order to fill the model with precise information concerning the movements and schedule of the users, collecting information regarding the polyuser population through a quantitative study.

As previously indicated in this research (cf. Section 1.4.3), individuals consuming illicit substances are essentially polysubstance users. Hence, looking to specific characteristics would be equivalent investigating the whole population of drug users and would be fruitless. However, a preliminary screening could be achieved by differentiating the polyusers through the forms of polysubstance use described in this thesis: for example, what are the demographic, social, and economical

characteristics of users pilling up substances? What are their frequencies of use? With who, where and when are they pilling up substances? Have they ever experienced short- or long-term risks or harms related to pilling up session? What are their opinions regarding their combinations of substances? How much money do they spend on substances while polyconsuming? What are their modes of consumptions when not combining substances?

Furthermore, and as indicated by this thesis, polysubstance use should not be considered as a single potentially harmful practice, but as composed of at least four forms of intentional substance combinations oriented toward different ends. Therefore, the dangerousness of polysubstance use needs to be investigated by differentiating the forms of polysubstance usage. This harmfulness should be assessed through a neurophysiological perspective (e.g., is there an impact on the order of intakes? Does some substances are more dangerous to combine together? etc.).

All this data would provide SimUse with a more accurate capacity to test public policies regarding drug use. Indeed, once calibrated and validated against appropriate empirical data, this model could be used to test real world scenarios, such as alcohol taxation effects, increasing law enforcement, developing prevention programs or evaluate the impacts of drug use on the liveability of specific suburbs. SimUse is neither a predictive model, nor a tool for decision makers to assess the relevance of public policies, but a means of getting a better understanding of a “middle-range” complex phenomenon.

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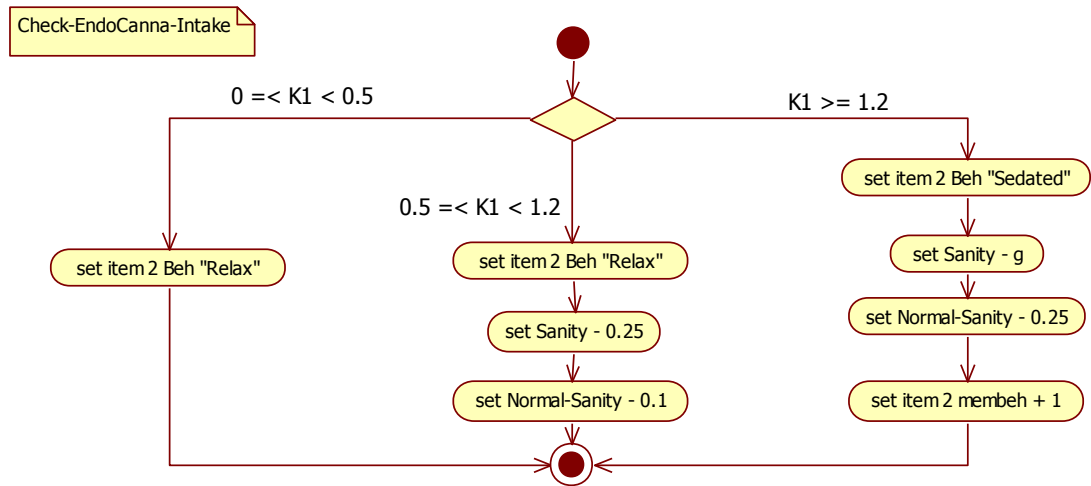
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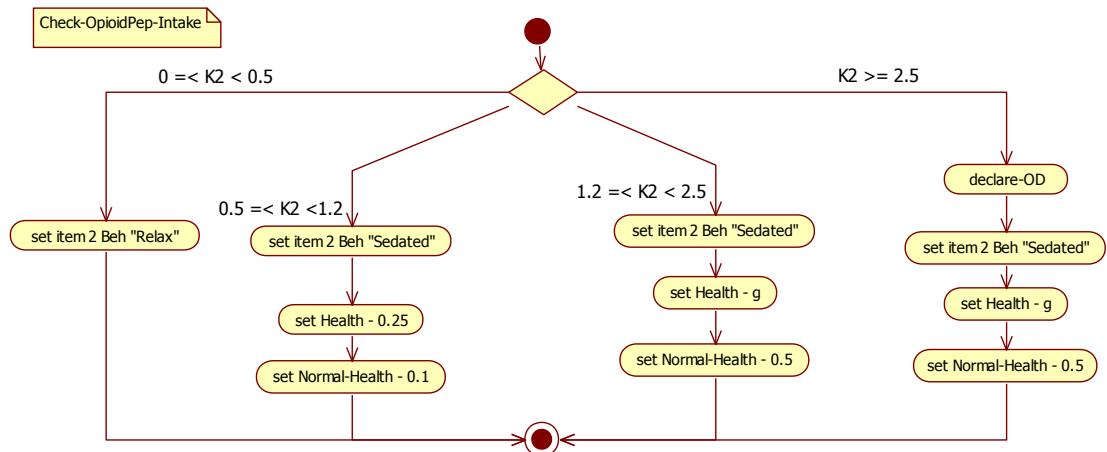
Appendix

Annex 1. **Check-Brain-Intake** Activity Diagrams

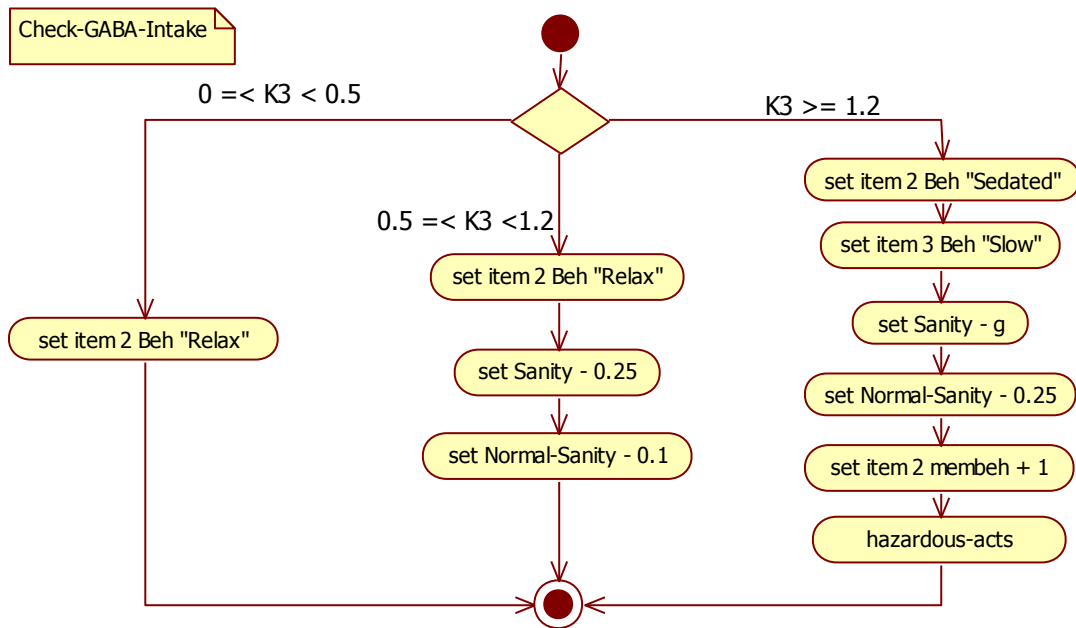
Check-brain-Intake of EndoCannabinoid (item 2 NB)



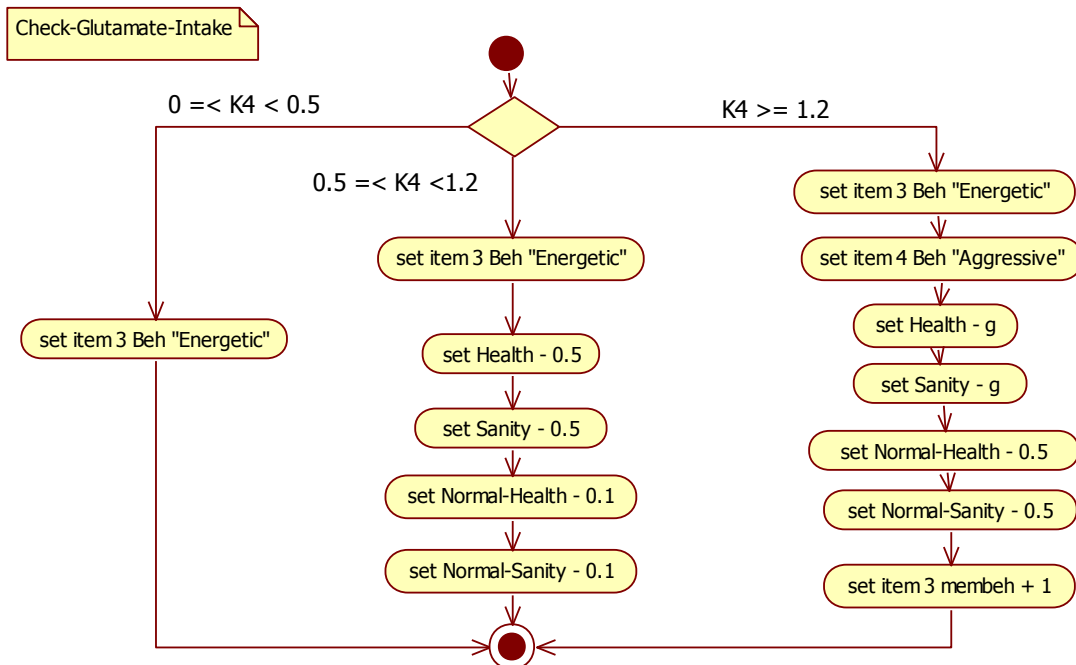
Check-brain-Intake of OpioidPeptids (item 3 NB)



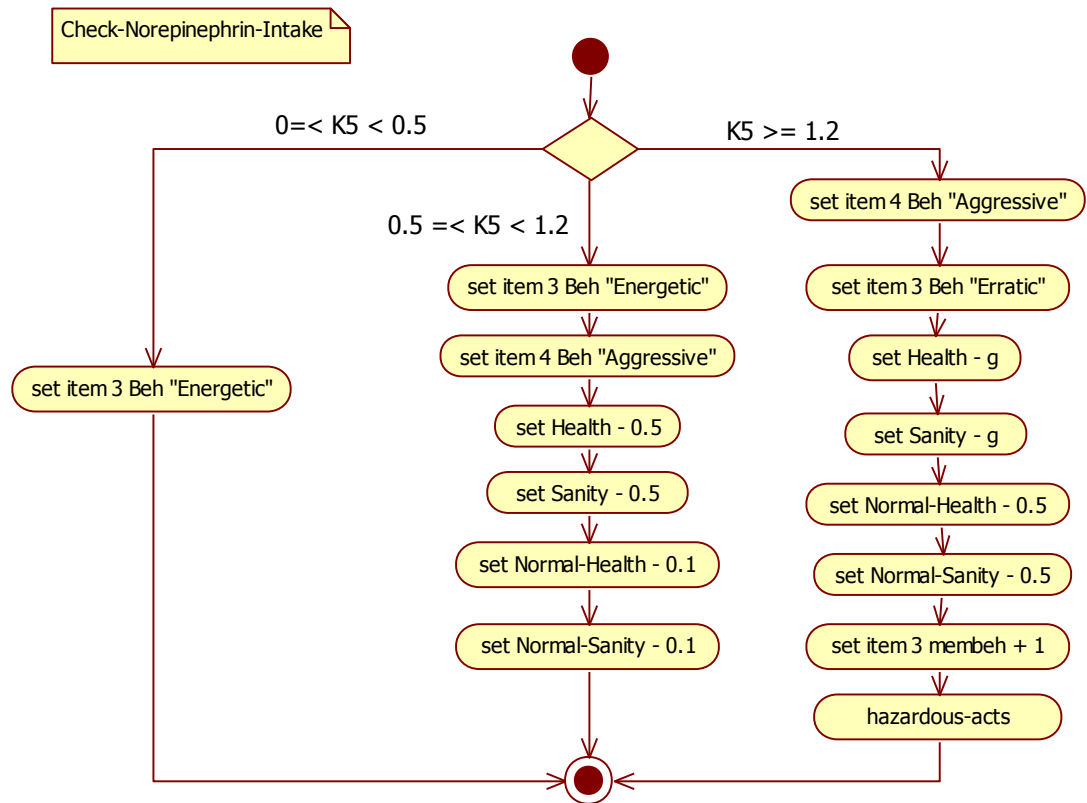
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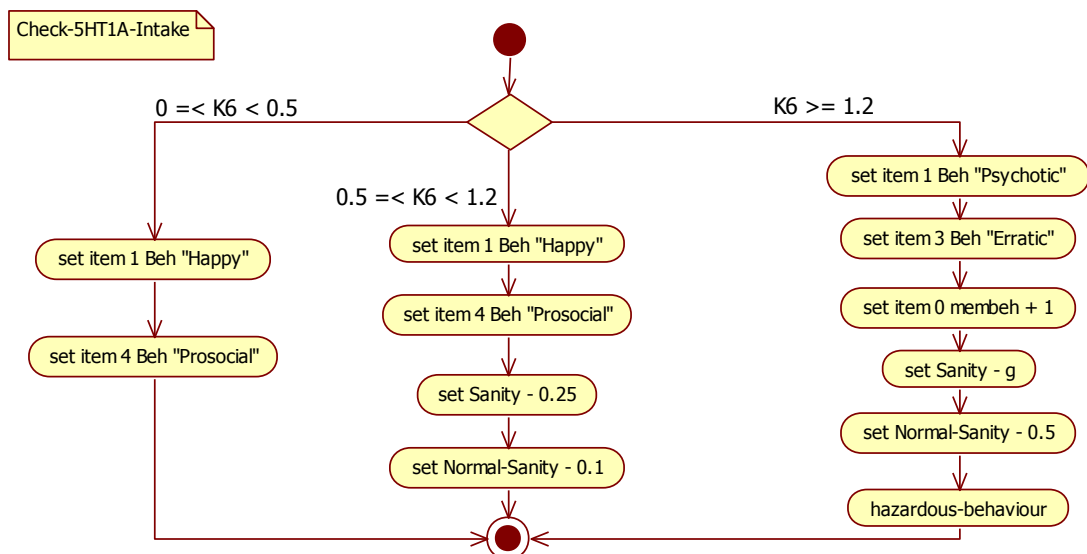
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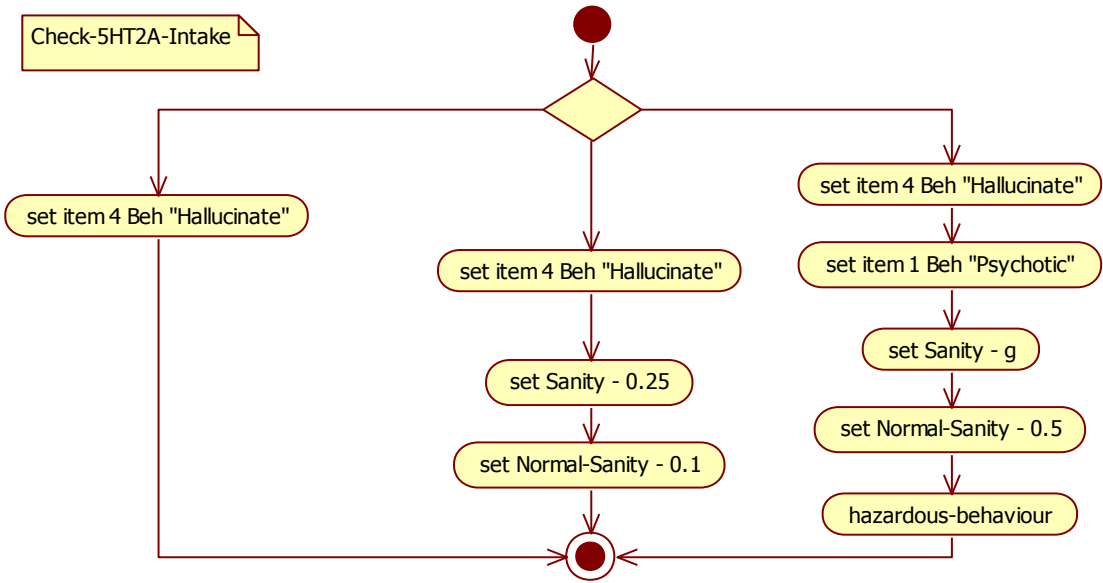
Check-brain-Intake of Norepinephrine (item 6 NB)



Check-brain-Intake of 5-HT_{1A} (item 7 NB)

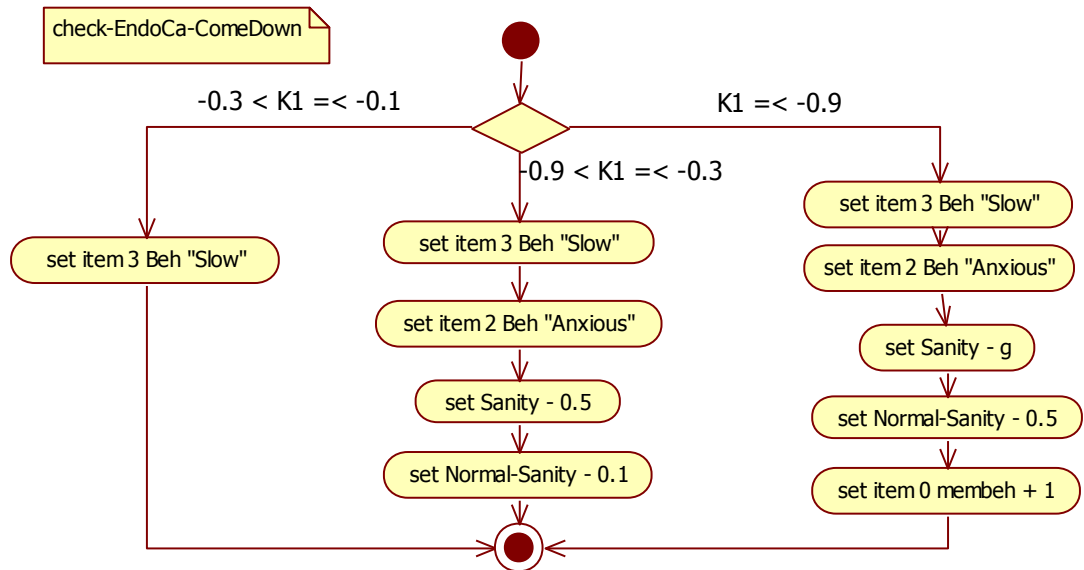


Check-brain-Intake of 5-HT_{2A} (item 8 NB)

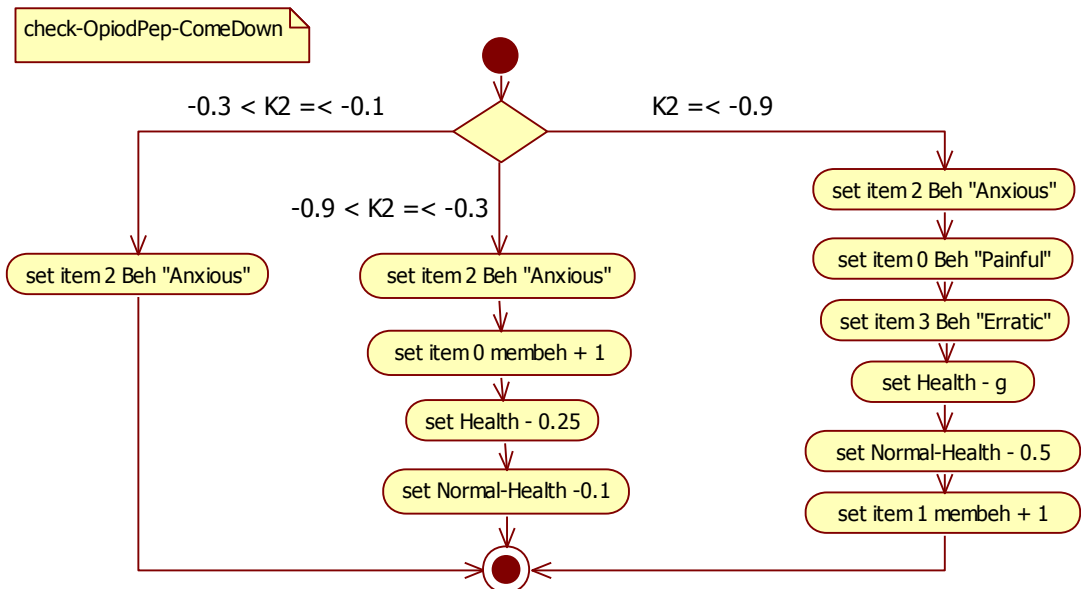


Annex 2. **Check-Brain-ComeDown** Activity Diagrams

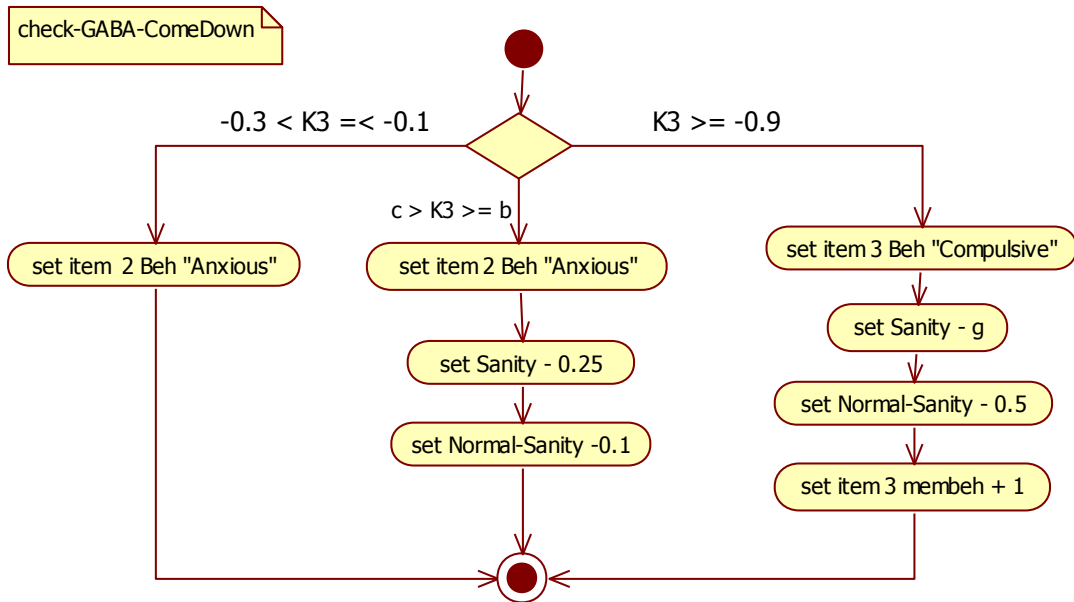
Check-brain-ComeDown of EndoCannabinoid (item 1 NBCD)



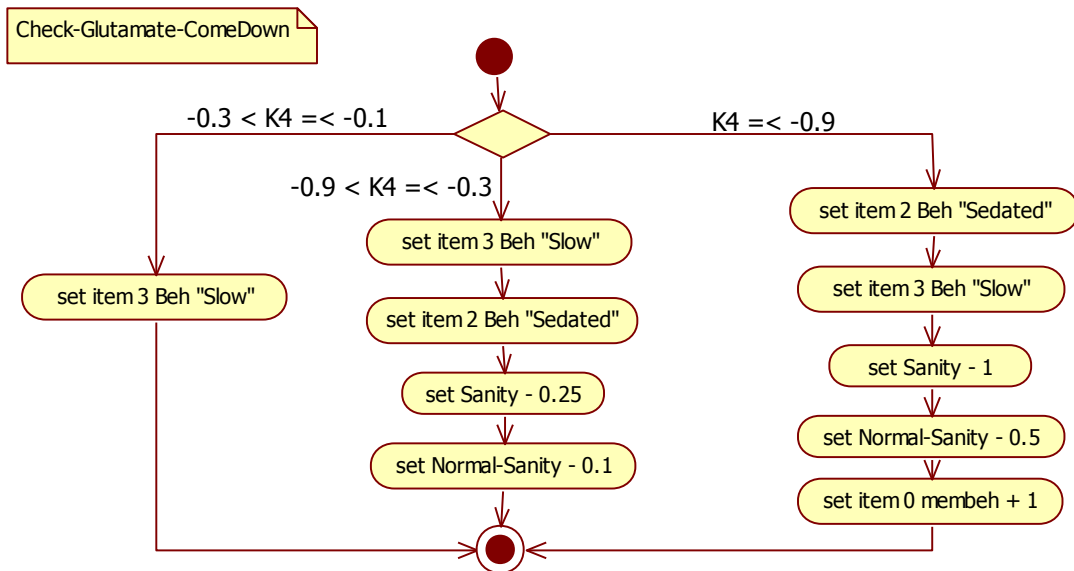
Check-brain-ComeDown of OpioidPeptides (item 2 NBCD)



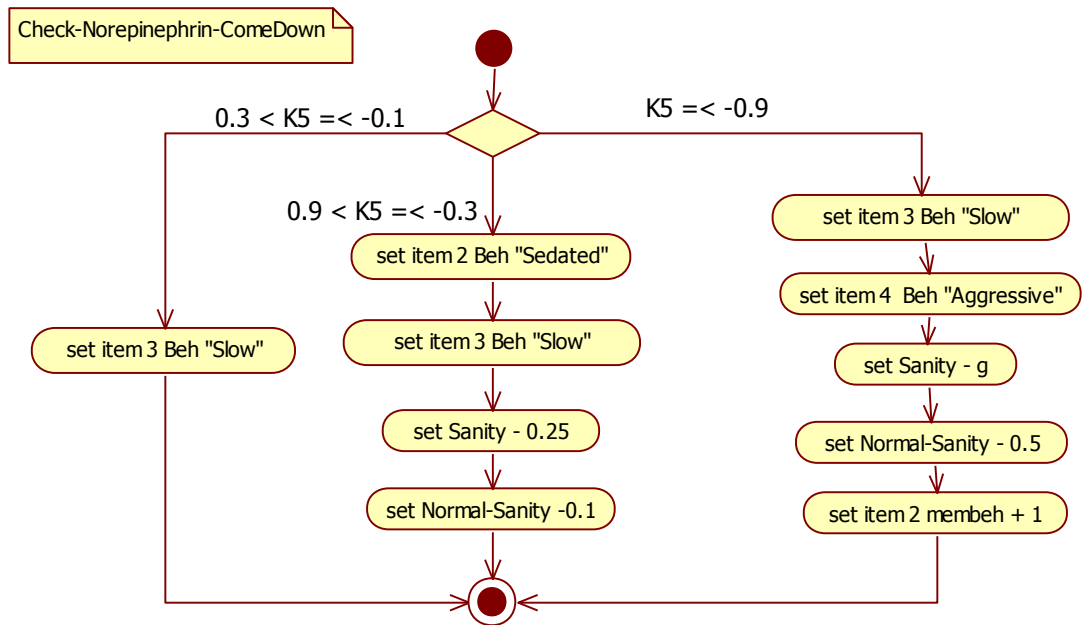
Check-brain-ComeDown of GABA (item 3 NBCD)



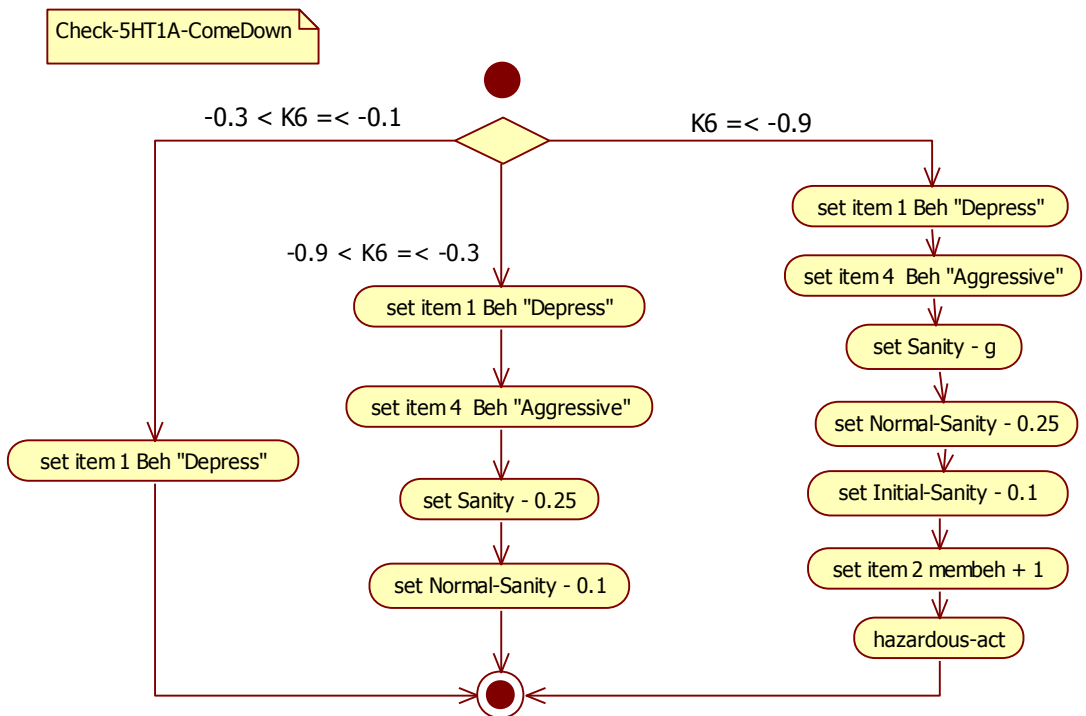
Check-brain-ComeDown of Glutamate (item 4 NBCD)



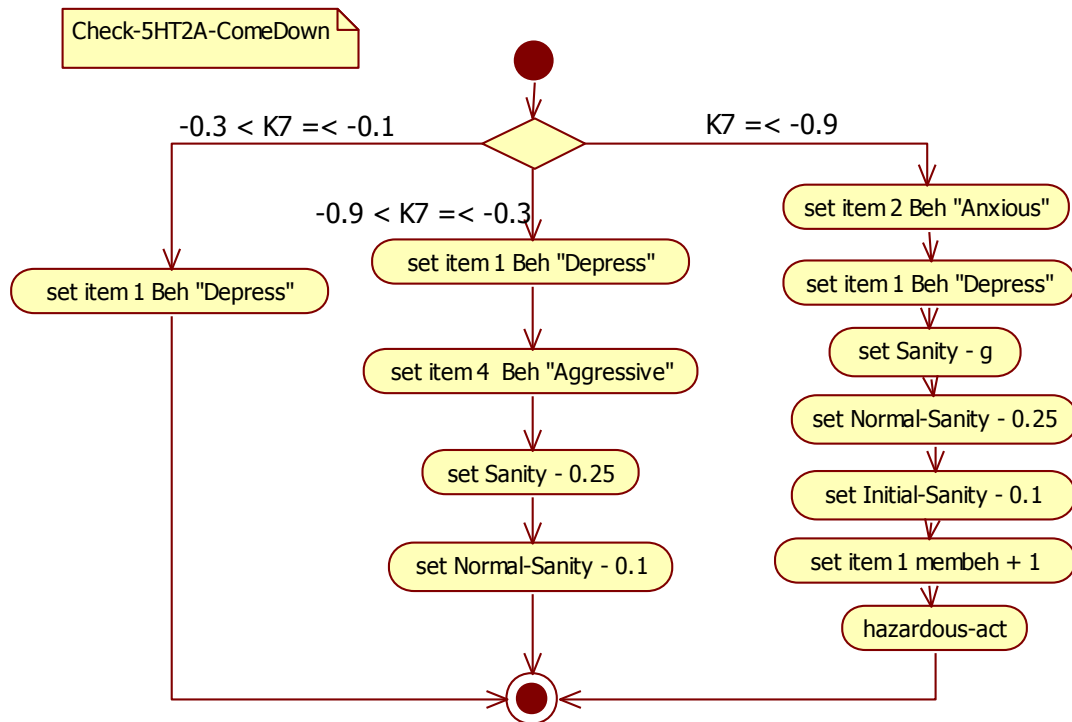
Check-brain-ComeDown of Norepinephrine (item 5 NBCD)



Check-brain-ComeDown of 5-HT_{1A} (item 6 NB CD)



Check-brain-ComeDown of 5-HT_{2A} (item 7 NBCD)



Research Information Sheet

Toward a generic ontology about recreational poly-drug use is a research project investigating recreational drug use through a dynamic perspective. This project aims to highlight the different stages in the life of a recreational drug user: participants are asked to describe some particular elements (consumption, economical position, emotions, opinion etc...) of their life during a specific period. Those questions will be repeated from the beginning of drug use until its end (if ceased). This continuation of data will form a “career” and will be compared to other participant’s “careers”. This project is being carried out by:

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The object of this interview is to describe your drug uses and the evolutions of this use over time. I will ask you different contextual questions for each period of time in order to understand the changes that happened and what could be the causes of such changes.

The information gathered will create your personal drug use history and will be compared to others histories in order to establish a general description.

Process will require one to 4 hours of interviews. Every interview will be audio recorded with MP3 and stored digitally.

Only the supervisor and myself will have access to the information gathered in the interview.

Your participation in this research is voluntary, and you will be free to withdraw from it at any time.

No identifying information (such as name or date of birth) will be recorded during the interview.

Nor will any identifying information appear in any publications regarding the interviews. Your contact details will be stored securely and will only be used to coordinate your participation in the interview.

You must be informed that if you give specific details (names, dates, places) regarding drug use or any related matters, the researcher can be required to disclose the information to the Australian Police (S316 of the Crimes Act). Secondly, if you disclose information that puts yourself or others at risk, the researcher is required to disclose this information to appropriate authorities.

Charles Sturt University Ethics in Human Research Committee has approved this project. If you have any reservations or complaints about the ethical conduct of this project, you may contact the Committee through the Executive Officer:

The Executive Officer	
Ethics in Human Research Committee	
Academic Secretariat	
Charles Sturt University	
Private Mail Bag 29	Phone: (02) 6338 4628
Bathurst NSW 2795	Fax: (02) 6338 4194

Annex 4. Consent Form

Consent Form

Toward a generic ontology about recreational poly-drug use is a research project investigating recreational drug use. It aims to highlight the different stages in the life of a recreational drug user: participants will be asked to describe some particular elements (consumption, economical position, emotions, opinion etc...) of their life during a specific period. Those questions will be repeated from the beginning of drug use until its end (if ceased). This continuation of data will form a drug use history and will be compared to other participant's "careers".

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Before you can participate in this interview, you must give your informed consent.
In signing this consent form, you agree to the following:

1. I understand that I am free to withdraw my participation in the research at any time, and that if I do I will not be subjected to any penalty or discriminatory treatment.
2. The purpose of the research has been explained to me, including any potential risks or discomfort associated with the research.

3. The researcher may decide to cancel the interview if he considers that I am under the influence of any type of drug.
4. I have read and understood the information sheet given to me. I understand with the fact that the interview will be audio recorded.
5. I understand that any information or personal details gathered in the course of this research about me are confidential and that neither my name or any other identifying information will be used or published without my permission.
6. I am over the age of 18.

Charles Sturt University Ethics in Human Research Committee has approved this project. If you have any reservations or complaints about the ethical conduct of this project, you may contact the Committee through the Executive Officer:

The Executive Officer
Ethics in Human Research Committee
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Annex 5. Interviewees Demography

This annex provides a list of the 38 recreational polydrug users interviewed for this research. It details their demographics, as well as the substances they have already used.

Yousseuf, Male, Australian, 29 years old, Postgraduate in Commerce, Financial Planner, interviewed at NDARC Facility.

Yousseuf had just created his own business at the moment of the interview. He considered that he has too much responsibilities to continue his previous rhythm of consumption.

Alcohol, Cannabis, MDMA pill and powder, Cocaine, LSD, Magic Mushrooms.

Picasso, Male, French, 34 years old, no diploma, unemployed, interviewed at his place in the Old Town of Lille.

Picasso considers drugs as his favorite hobbies and was trying to reduce his consumption of crack cocaine when interviewed. He is one of the four respondents having lived an "addictive episode".

Alcohol, Cannabis, Cocaine, MDMA pill and powder, Ketamine, Amphetamine powder, Heroin, Benzodiazepine, LSD, Magic Mushrooms, Solvents.

Maguy, Female, French, 31 years old, Undergraduate in Direction Assistant, worked in a logistic firm, interviewed at her place in Roubaix.

Maguy has a long history of psychostimulant use and described how she became addicted to Opium while she was working in India. She also depicted her addiction to Cocaine and her fear of falling down into it if put it before her eyes. She is one of the four interviewees that have lived an "addictive episode".

Alcohol, Cannabis, Cocaine, MDMA pill, Ketamine, Speed, Opium, Raschacha, LSD, Magic Mushrooms.

Diane, Female, French, 31, Undergraduate in Agriculture, worked and owned her restaurant in Roubaix, interviewed at her restaurant. She has two sons.

Diane favorite activity is going out drinking in pub and bar and considered she needs help to treat her alcoholism. She had a fairly long history of psychostimulant use, but had stopped all her consumptions during her two pregnancies.

Alcohol, Cannabis, Cocaine, MDMA pill, Speed, Mephedrone.

Gourou, Male, French, 19, Baccalaureat, Student, interviewed on Villeneuve d'Ascq campus.

Gourou was on first year of Theater study and plays drums in a band. Despite his young age has experienced a large variety of substances and was not really considering to stop using in a near future.

Alcohol, Cannabis, Cocaine, MDMA pill, Amphetamine powder, Heroin, Benzodiazepine, LSD, Magic Mushrooms, Solvents.

Jessy, Female, Australian, 22, Bachelor in Sciences, Student, interviewed at NDARC Facility.

Jessy seemed eager to discover new substances to analyze their effects on her psyche and had good notions of neurophysiology and neuropharmacology.

Alcohol, Cannabis, MDMA pill, Cocaine, 2CB, 2CI, Ketamine, Speed, Methamphetamine, Dexamphetamine, GHB, DMT, Benzodiazepine, LSD, Mushrooms, San Pedro, Morphine, OxyContin, and Heroin.

HandyCool, Male, Australian, 25, Undergraduate in Biology, Student, interviewed at one of his friend place in Sydney.

HandyCool normally studied in Tasmania and was visiting friends when he saw the advertisement for this research. He has travelled in South America and is politically engaged for the Green. HandyCool consumed when the occasion occurs but

Alcohol, Cannabis, Cocaine, MDMA pill, Amphetamine powder, LSD, Magic Mushrooms.

Toulouse, Male, Australian, 25, no diploma, casual jobs in hospitality, interviewed at his place in Melbourne.

Toulouse is a singer in an underground band of Melbourne that they created with Paco. They live together in the same house. Toulouse used to live in the US for a couple of years where he used cocaine consistently.

Alcohol, Cannabis, Cocaine, MDMA pill, Mephedrone, Ketamine, Speed, Heroin (speedball), LSD, Magic Mushrooms, Benzodiazepine, Solvent.

Jurion, Male, French, 27, Postgraduate in Journalism, Journalist free-lance and Hospitality part-time, interviewed at his flat in France.

Jurion speaks four languages and used to live in Spain, Australia or Poland. He defined himself as a regular bar- and club-goer and his wide social network helped to recruit several other respondents. His initial objective was to try, at least once, all the existing substances.

Alcohol, Cannabis, Cocaine, MDMA pill and powder, Speed, Methamphetamine, Magic Mushrooms.

Little-Devil, Male, French, 29, Undergraduate in Commerce, Barman, interviewed at his place in Lille.

At the moment of the interview, Little-Devil was a barman in Lille and lived principally during the nighttime. Despite his work, one of his main rules remains avoiding any kind of consumptions during his working hours. He consumed socially, but could use cannabis to relax at home or psychostimulants when going on festival or clubs.

Alcohol, Cannabis, Cocaine, MDMA pill, Speed, Magic Mushrooms.

Paco, Male, Mexican/Australian, 27, Postgraduate of Fine Arts,

Student, interviewed at his place in Melbourne.

Paco is the co-singer and guitar player of his band in Melbourne. Paco spent most of his time drawing, painting or playing guitar. Both have a recreational and occasional consumption.

Alcohol, Cannabis, Cocaine, MDMA pill, Heroin, Methamphetamine, LSD, Magic Mushrooms, Solvent.

Neron, Male, French, 28, Undergraduate in Accounting, Accountant, interviewed in Lille at his place.

Neron is voluble and run several activities at the same time. He used to have several night-outs a week, but his partner and his job responsibilities have forced him to reduce the frequency of his night-out.

Alcohol, Cannabis, Cocaine, MDMA pill, Speed, LSD, Magic Mushrooms.

Blondie, Male, Canadian, 22, Postgraduate in Sciences, Student, interviewed at NDARC Facility.

Blondie was in Australia since 6 months when interviewed. He practices soccer and swimming, and regularly posts videos on YouTube. His consumption is mainly social even if he could used psychostimulants during festival or when going to club.

Alcohol, Cannabis, Cocaine, MDMA pill, Speed, LSD, Magic Mushrooms, DMT.

Nancy, Female, Australian, 25, Undergraduate in Health Studies, Medical Receptionist, interviewed at NDARC Facility.

Nancy is talkative and energetic. She left her parents around 14 years old and learnt to live on her own since then. At the time of the interview she was just stopping her consumption of cannabis because her partner wanted to stop definitively. Her uses are oriented toward social dinners, parties and clubbing.

Alcohol, Cannabis, Cocaine, MDMA pill, LSD, Speed.

Jacko, Male, French, 31, Undergraduate in Topology, Geographer, interviewed at his flat in Lille.

At the time of the interview, Jacko just resigned from a job asking him to travel every three months and he was just recontacting his previous drug-related network in Lille. He generally consumed drugs in social setting (bar or parties) and consume psychostimulants in clubs or electronic festivals.

Alcohol, Cocaine, MDMA pill, Heroin, Speed, LSD, Solvent.

Kira, Female, Australian, 24, Postgraduate in Biology, part-time Bartender, interviewed at NDARC Facility.

Kira spent her late teenage years in Middle-East and has not started using illicit drugs until her 19 when she came back to live in Australia. She generally used drugs during social gathering and was trying to avoid illicit drugs at the time of the interview.

Alcohol, Cannabis, Cocaine, MDMA pill, Speed, LSD.

Annie, Female, Australian, 25, Undergraduate in Sociology and Fine Arts, Student, interviewed at NDARC Facility.

Annie plays several instruments (cello, violin and piano). She was interested in the introspective aspect offered by substances and used them to "heal the mind".

Alcohol, Cannabis, MDMA pill, Magic Mushrooms, Morphine, OxyNorm, Solvents.

Batman, Male, French, 20, Undergraduate in Psychology, Student, interviewed on Villeneuve d'Ascq campus.

Batman's uses are mostly related to the exploration of the psyche (he referred several times to his studies at that time) or to social activities between friends.

Alcohol, Cannabis, Magic Mushrooms, Salvia, Kratom.

Bobby, Male, Australian, 24, Postgraduate in Engineering, Engineer, interviewed at NDARC Facility.

Bobby was extremely friendly and gave many details concerning his conception of polysubstance use. His consumption reflects the different panel, users can obtain through psychoactive substances, but the "fun" was always his main motor.

Alcohol, Cannabis, Cocaine, MDMA pill, LSD, Speed, Methamphetamine, Ketamine, Tryptamine, Magic Mushroom.

BuftieBoy, Male, Australian, 40, Certificate in Hospitality, Part-time Hospitality professional, interviewed at his flat.

BuftieBoy was the flatmate of HandyCool for a few weeks; this latter has introduced the research to BuftieBoy. He is the only injector of the sample and has developed enough sanctions to remain a "high-functioning addict" (his own words) despite his practice.

Alcohol, Cannabis, Cocaine, MDMA pill, Heroin, LSD, Speed, Methamphetamine, Benzodiazepine.

Soph, Female, Australian, 23, Undergraduate in Fine Arts, Student and Waiter part-time, interviewed at NDARC Facility.

Soph is one of the rare respondents who had started using Ecstasy before Cannabis. She used drugs during a large variety of situations: parties, relaxing at home, festivals, clubbing, bush walking, and introspection.

Alcohol, Cannabis, Cocaine, MDMA pill, LSD, Ketamine, Speed, Magic Mushrooms, Benzodiazepine, OxyContin, DMT.

Pablo, Male, Australian, 25, Postgraduate in Arts (Media), Student plus part-time waiter, interviewed at NDARC Facility.

Pablo has started his consumption of illicit substance when he was 19. Since then, he tried to manage its consumption by having frequent "breaks". He rarely used by himself and he considered his consumption as recreational and controlled.

Alcohol, Cannabis, Cocaine, MDMA pill, LSD, Magic Mushrooms, Speed.

Robert, Male, Australian, 21, Undergraduate in Commerce, Student and Waiter part-time, interviewed at NDARC Facility.

Robert was laconic and asked if the interview was confidential several times despite the Information Sheet and Consent Forms.

Alcohol, Cannabis, Cocaine, LSD.

Albie, Female, Australian, 19, Undergraduate in Sciences, Student, interviewed at NDARC Facility.

Albie had several bad experiences with alcohol and has almost stopped its consumption. She was increasingly interested in hallucinogens at the time of the interview and was looking for new psychedelic experiences.

Alcohol, Cannabis, MDMA pill, Cocaine, LSD, Magic Mushrooms.

Nick, Male, Australian, 18, Undergraduate of Computer Sciences, Student and Bartender part-time, interviewed at NDARC Facility.

Nick plays a lot of basketball and had a passion for computer programming. He was consuming drugs since two years at the time of the interview and was curious to try new substances. His consumption was purely social and he was never using on his own.

Alcohol, Cannabis, MDMA pill, Speed.

D., Male, Australian, 19, Undergraduate in Law, Student and Pizza Delivery part-time, interviewed at NDARC Facility.

D. practices surf and gym regularly. He reduced his consumption of alcohol and cannabis after he failed his first year of university.

Alcohol, Cannabis, MDMA pill, Cocaine.

Jessy, Female, Australian, 22, Postgraduate of Sciences, Student, interviewed at NDARC Facility.

As Picasso, when asked about her favorite hobby, Jessy answered drugs. She is part of the interviewees that want to experiment all the different substances. Her usage covers the different aspects of her life and she has a good knowledge regarding neurosciences and neuropharmacology.

Alcohol, Cannabis, Cocaine, MDMA pill, Heroin, Methamphetamine, Speed, LSD, Magic Mushrooms, SanPedro, DMT, Benzodiazepine.

Billy, Male, Australian, 22, Postgraduate in Law, Student plus record proceedings in law courts part-time, interviewed at NDARC Facility.

Billy is a poker player and spends time making movies with some of his friend. His use becomes increasingly control after witnessing and living difficult situations.

Alcohol, Cannabis, Cocaine, MDMA pill, LSD.

Marie, Female, French, 21, Undergraduate in Spanish, Student plus Waitress part-time, interviewed on Villeneuve d'Ascq campus.

Marie consumed large quantity of alcohol during high-school before getting into psychostimulant use. At the time of the interview, she had stopped her this consumption and just moved in with her partner who consumes cannabis everyday.

Alcohol, Cannabis, Cocaine, MDMA pill, Speed, Magic Mushrooms.

Cloum, Female, French, 20, Undergraduate in Psychology, Student, interviewed on Villeneuve d'Ascq campus.

Cloum has two older brothers, whom she referred to several time in the interview when talking about the opinions she has on drugs. Her usage is mainly related to social events (parties, clubbing) but she also used cannabis to relax and made her brain stops working.

Alcohol, Cannabis, Cocaine, Speed, LSA.

Raoul, Male, French, 20, Undergraduate in Psychology, Student, interviewed on Villeneuve d'Ascq campus.

Raoul is a rock guitar player interested in psychedelic experiences: his use of several types of hallucinogens reflects this interest. Recently caught by the police at the time of the interview, he has stopped his consumption of cannabis.

Alcohol, Cannabis, Magic Mushrooms, Kratum, Salvia, LSA.

Mike, Male, French, 30, PhD in Philosophy, Student, interviewed on Villeneuve d'Ascq campus.

Mike has a Master in Journalism and was finishing his PhD at the time of the interview. He had a long history of psychostimulant uses and despite more than fifteen years of cannabis use, he is still frequently using this substance.

Alcohol, Cannabis, Cocaine, MDMA pill, Speed, Magic Mushrooms.

Ursula, Female, French, 25, Undergraduate in Theater, Comedian, interviewed at her flat.

Ursula was met through LadyFly. She is a club-goer and uses psychostimulant each time she goes to a club. At the time of the interview, she was trying to stop using cocaine with one of her girlfriend.

Alcohol, Cannabis, Cocaine, MDMA pill, LSD, Ketamine, Speed.

LadyFly, Female, French (Russian born), 24, Postgraduate in Commerce, interviewed at her flat.

LadyFly was met through Picasso. At the time of the interview, she had just finished her Master in Commerce and was looking for a job. She enjoys having alcohol almost every days and goes frequently to parties, festival and clubs. She mainly uses psychostimulant to stay awake and parties for longer.

Alcohol, Cannabis, Cocaine, MDMA pill, Ketamine, Speed.

ElPoyo, Male, French, 32, Diploma in Security, Full-time Security agent and Firefighter, interviewed at his house.

ElPoyo practices several sport (soccer, running, swimming, gym). He lost his parents when he was 23 and lived alone in his house since. He has a long history of psychostimulant use and was slowing down this type of consumption at the time of the interview.

Alcohol, Cannabis, Cocaine, MDMA pill and liquid, Heroin, Ketamine, LSD, Speed, Magic Mushrooms.

Ubik, Male, French, 19, Undergraduate in Communication, Student, interviewed on Villeneuve d'Ascq campus.

Ubik is a fan of science fiction literature and loves underground cinema. He frequently used hallucinogens to "open the doors of consciousness" and was a daily cannabis smoker at the time of the interview.

Alcohol, Cannabis, Cocaine, LSD, Magic Mushrooms, Salvia, Hopeme violacia, Kratum, LSA, Speed, Solvent.

Sony, Male, French, 28, Undergraduate in Communication, Student and part-time DJ, interviewed on Villeneuve d'Ascq campus.

At the time of the interview, Sony was starting his university. He worked as a DJ and as composed several pieces of electronic music, but cannot live based on this activity. His usage was related to the electronic music sphere, but he was slowing down his consumption to focus on his life.

Alcohol, Cannabis, Cocaine, MDMA pill, powder, and liquid, Speed, LSD, Magic Mushrooms, Heroin, Codeine, Ketamine, Benzodiazepine.

Sammy, Male, French, 36, Undergraduate in Biology, works full-time as an IT technician, interviewed at his flat. Father of a daughter.

At the time of his interview, the consumption of Sammy was reduced to alcohol and cannabis that he has integrated in his daily life of a new father. His consumption of alcohol takes only place in parties or dinner, but he continues to smoke cannabis almost every evening.

Alcohol, Cannabis, MDMA pill, Speed, Magic Mushrooms.

Annex 6. French Extracts Chapter 4

[Cloum, F1, female, 20, about alcohol] J'avais l'habitude de voir dans ma famille, mes parents boire aux fêtes et puis j'ai des grands frères donc je les ai vu consommer de l'alcool avant moi. J'avais pas vraiment une opinion négative de ça vu que j'ai jamais vu d'alcooliques dans mon entourage ni rien.

[Marie, F2, female, 21, about alcohol] [*Quelle était ton opinion au sujet de l'alcool avant d'en prendre pour la première fois?*] J'en avais une mauvaise vision: l'alcool j'avais vu des gens que ça rendait vraiment mauvais. Donc je me disais : jamais. [...] Mon père s'est fait enlever le permis à cause de l'alcool. En fait, il s'est fait attrapé deux fois, la deuxième fois, il a pris du sursis. Il a déjà eu des soucis avec l'alcool. Il s'est déjà battu à cause de l'alcool. [*Quelle a été ta réaction après ce qui est arrivé à ton père ?*] J'étais encore petite. Pour moi c'était vraiment, non je voulais pas, pour moi c'était vraiment le diable.

[Neron, F3, male, 28, about alcohol and Drugs] [...] pour la famille c'était une consommation raisonnable [d'alcool] pendant les fêtes, à certains moments précis du calendrier familiale, c'était carrément tolérer sans forcément déraiper; et puis après c'était quand même de la prévention sur la quantité d'alcool à ingérer. J'étais quand même vachement prévenu qu'il fallait pas trop boire sinon coma éthylique, ou bien que le côté alcoolique pouvait se développer chez l'être humain. [...] Pour mes parents ou ma famille, la drogue en général c'est néfaste pour la santé, ils ont quand même un discours assez protecteur vis-à-vis de leurs enfants par rapport à ses produits tout en disant que c'est pile ou face, si tu as un profil toxico, il suffit d'une fois pour tomber dedans. J'ai toujours été averti depuis ma plus jeune enfance qu'on ne naît pas égaux, il n'y a pas d'égalité par rapport à la prise de produits.

[Neron, F4, male, 28, about heroin] Pour moi l'héroïne ça restera la destruction, c'est la drogue pour te détruire. Même en prenant de la drogue, on pense que c'est sûrement pas bien mais c'est peut-être pour pallier un mal-être, mais c'est pas forcément pour se tuer, enfin quand je prenais de la drogue ça n'a jamais été dans le but de me tuer.

[Ubik, F5, male, 19, about heroin] Pour l'héroïne, ça m'intéresse absolument pas. Encore, si on me proposait de fumer de l'opium, je dirais pas non, mais sniffer de l'héroïne, prendre un parachute ou se l'injecter, non. Pas d'héroïne, je veux pas. Je sais que c'est un opiacé et tout ça mais c'est à cause de la connotation culturelle qu'à l'héroïne je pense. Moi si on me dit héroïne, héroïnomane, je pense à "Transpotting", "Requiem for a Dream" direct, tout de suite et tout le côté malsain qui va avec. Voilà, pour moi, l'héroïne, c'est vraiment malsain; c'est connoté dans ma tête «malsain». Donc, j'ai mis une croix rouge dessus. J'y ai accès mais j'en ai jamais pris.

[ElPoyo, F6, male, 32, about drug addiction] La j'avais plus de réflexion dans ma tête : un toxicomane s'était celui qui se piquait, c'était quelqu'un qui se piquait et à l'héroïne. A cette époque-là je me serais jamais piqué et j'aurais jamais pris d'héroïne. Ça, c'est clair et net que c'était impossible pour moi. Après je pouvais prendre n'importe quoi, mais ça j'aurais jamais pu.

[Jurion, F7, male, 27, general] c'est vrai qu'à l'époque, j'aurais pris presque n'importe quoi. Je ne me serais jamais piqué et ça par contre, je connaissais pas beaucoup sur les drogues, autant pour moi le junky, le junky/voleur/criminel/mendiant, c'est celui qui s'injecte. Donc l'image, l'image des médias ou des films, ça m'avait bien marqué. Donc je ne me serais jamais injecté, je ne me serais jamais piqué. Mais sinon tout le reste ouais d'accord.

[Mike, F8, male, 30, about magic mushrooms] [...] ça faisait un peu flipper ces histoires d'hallucinations. Je savais que ça pouvait aller assez loin. Maintenant, je savais que c'était pas si dangereux que ça non plus, que c'était pas une drogue addictive. C'était pas «si dangereux» entre guillemets parce que c'est quand même assez dangereux. Mais ça reste assez propre, ça me semblait assez propre comme façon de faire.

[Jurion, F9, male, 27, general] Jusqu'à mes 16 ans, j'étais un bon garçon, j'étais un bon petit, fume pas, boit pas, donc les drogues je connaissais de noms mais bon... C'était les drogues, les drogues [avec une voix satanique], je sais pas, ça ne faisait pas partie de ma vie tout simplement. C'était pas, c'était pas quelque chose qui m'effrayait, c'était même pas quelque chose qui m'intéressait, c'était juste pas là. Et jusqu'à ce moment-là, je n'avais pas eu d'occasion de m'intéresser ou d'en apprendre plus. Je n'avais pas vu de gens qui en prenaient autour de moi et donc c'est venu comme ça, c'est venu comme ça la première fois. Et du coup j'avais pas d'a priori je te disais, je ne savais même pas ce que ça faisait, quand on nous en a proposé la première fois j'ai dit : « bah ouais ». J'étais là... Mais à l'époque je te disais je ne savais même pas à quoi ça ressemblait une boulette de shit, dont j'étais un peu à la rue.[...] quand j'avais 16 ans, tu m'aurais mis du shit, de l'herbe, une capsule je connaissais rien. Je connaissais même pas à quoi ça ressemblait, j'étais à la rue.

[Batman, F10, male, 19, about cannabis] J'étais opposé au cannabis. Je disais que ça détruisait la vie des gens, etc. En gros, je répétais tout ce qu'on m'avait dit à l'école; d'ailleurs, un joint égal sept clopes; ça rend le cerveau tout petit; ça nous fait mettre en prison; ça nous donne envie de tuer les gens, enfin d'après des études de 1936. [...] Ensuite, quand on a appris que mes parents fumaient aussi, je me suis dit que ça devait pas être si grave; c'était pas non plus des grosses loques et ils sont quand même assez intelligents donc je commençais à douter du fait que ça fasse rapetisser le cerveau.

[LittleDevil, F11, male, 29, about alcohol] Au début, c'était avec mes amis, c'était derrière la baraque de chez mon pote, et on était tout un groupe et pis comme on habitait un petit village, y avait pas grand chose à faire le samedi soir, on avait pas encore la voiture à l'époque donc on allait au petit épicier où on s'achetait quelques bières, on se mettait derrière et on picolait entre amis, [...] c'était récréatif, je buvais pas tous les jours. C'était vraiment le weekend, on buvait quelques bières, on rentrait dans de sacrés états vu qu'on avait pas besoin de beaucoup à cette époque...et voilà c'était pareil, au début c'est vraiment, c'est l'esprit groupe qui prédomine...

[Neron, F12, male, 30, about alcohol] A l'époque, l'alcool nous permettait de provoquer, de faciliter un lien envers le groupe. Il y a celui qui boit et qui tient, il y a celui qui boit et qui est bourré et qui tient pas, il y a celui qui boit et qui vomit, il y a celui qui boit et qui va toujours être méchant, et après ce sont des places que tu crées en fonction du groupe avec qui tu te trouves et avec ton rapport à l'alcool.

[Ursula, F13, female, 25, about alcohol] L'envie de me défoncer, de donner une autre image aux autres, l'envie d'enlever ma petite image de la petite coincée intello première de classe comme ça, envie de faire comme les autres et puis bon, d'essayer comme les autres, voir ce que ça fait de se défoncer à l'alcool.

[Neron, F14, male, 30, about alcohol] au début, c'était sortir de l'enfance: l'alcool c'est réserve aux adultes, ça c'est un premier point, deuxième point, c'est plutôt relié à la fête et à son effet premier qui est de se désinhiber, ça c'est ce que je pensais de l'alcool. Donc quelque chose de social, de festif et réserver quand même à des gens qui ne sont pas des enfants.

[Jurion, F15, male, 27, general] La curiosité, envie de découvrir de nouvelles choses, je me suis toujours dit par rapport aux drogues que j'avais envie de toutes les essayer et que si tu les essayais toutes une fois, je pensais pas que je pouvais devenir accro en une fois et que je pouvais très bien les utiliser une fois et plus jamais en reprendre. [...] et j'ai testé toutes les drogues, par curiosité et pour voir ce que ça faisait.

[Jurion, F16, male, 27, about methamphetamine] La Ice c'était un truc dont j'avais pas entendu parler... J'étais pas sûr de ce que c'était, donc c'est aussi pour ça que je l'ai prise [rires]... Entre guillemets, parce que si j'avais su avant que c'était un truc hardcore, je l'aurais peut-être pas pris. Sur le coup, je me suis dit "Bon Ice, tout le monde en prend", et donc dans mon état d'esprit, ça a été "allez hop on teste....".

[Raoul, F17, male, 19, about magic mushroom] C'était plutôt mitigé, parce qu'il y avait une crainte et aussi un intérêt. Les champignons, c'est une substance qui a un pouvoir psychédélique et pour moi le psychédélisme, ça veut tout dire. C'était la porte de l'esprit pour rentrer

dans une autre monde et aussi la peur de ne jamais revenir; tout le monde expliquait ça sur internet. C'est pour ça que j'en avais pas pris beaucoup. C'était une crainte mêlée d'intérêt. J'étais attiré mais j'avais peur en même temps.

[Jurion, F18, male, 27, about cannabis] Mon meilleur pote le jour où j'ai pris mon premier joint, lui clairement il en avait déjà fumé et il savait ce que c'était. Il a tout de suite dit « oui, oui, on en prend ». Donc, c'est pour ça que j'ai un peu suivi parce que je lui ai fait confiance.

[Jacko, F19, male, 31, about ecstasy/speed] L'ecstasy, c'est beaucoup plus simple quand tu commences à te droguer parce que c'est quelque chose que tu avales et comme t'as déjà avalé des cachets quand t'étais malade, ça diffère pas beaucoup. Quand tu prends du speed, moi je sais que je m'en souviens vraiment parce que c'est quelque chose par le nez et ça, ça fait vraiment bizarre ! Au début, j'avais une vraie réticence avec ça. Mais bon, une fois que tu l'as fait quelque fois et que tu vois tous tes copains qui font pareil, bon bah, c'est tout, ça va. Mais c'est beaucoup plus facile de manger, de prendre un cachet au début que de prendre une latte...

[Neron, F20, male, 28, about ecstasy first uses] [...] je les ai pris je savais pas vraiment ce que c'était donc je me suis retrouvé en voiture à aller dans un café et je m'étais senti bien speed, j'avais pas réellement ressenti des effets énormes à part que j'avais quand même une bonne patate donc j'étais peut-être pas trop attentif à la défonce qui était en train de s'installer, puisque je m'attendais pas vraiment à ça. [...] Après je l'ai rencontré ce produit avec de la musique dans des soirées. Et là, c'était la première fois avec la musique j'ai cru que la soirée avait duré 20 minutes une demi-heure alors que ça faisait 7 heures que j'étais là.

[Jurion, F21, male, 27, about cannabis] Donc, on fume le joint et après, je me souviens bien et on jouait au baby-foot et tu avais les autres qui avaient fumé, ils étaient arrachés, défoncés. Moi ça m'avait rien fait du tout. J'avais rien senti du tout.[...] Ça m'a bien pris deux mois avant de vraiment ressentir les effets du cannabis. A l'époque je fumais, ça ne me faisait rien.

[Neron, F22, male, 28, about LSD] On avait pris chacun un trip entier, on était parti au cinéma et on s'était installé dans une salle quasiment vide. Mon souvenir, c'est une série de fou rires pendant tout le film à se retourner derrière nous, ou de toutes façons on voyait plus rien on savait pas s'il y avait quelqu'un dans la salle ou si il y avait personne, on voyait des gens passés alors qu'il n'y en avait pas. On a passé le film a vraiment faire n'importe quoi, on n'osait plus se regarder, on était assis l'un à côté de l'autre et au bout de 10 minutes on avait 10 sièges entre nous, et on continue à se marrer, on se retournait pour faire des signes, mais on savait pas s'il y avait des gens. Donc c'était du grand n'importe quoi. Le film s'est fini, on n'osait pas sortir de la salle, on pensait qu'il y avait des

gens qui allaient nous attendre dehors, on partait déjà dans un délire parano. On est resté au moins un quart d'heure dans la salle avant de sortir. On était vraiment très attaquée par le produit. [...] après je me suis retrouvé à acheter des frites pour tout le monde, qu'on a pas mangé puisque tu ne peux pas manger sous LSD, tu ne peux même pas ouvrir la mâchoire. Et je me souviens de quelqu'un qui était pas de notre groupe, qui en se prenant un poteau, s'était mordu et il s'était transpercé la lèvre avec sa canine en se tapant la tête. Il avait dû se contracter et il est revenu vers nous au bout d'une heure de ça et on voyait le sang, il était tout bleu, tout violet avec cette pression dans la mâchoire qu'il n'arrivait pas à relâcher et il s'était mordu comme un fou, et il arrivait pas à détendre la bouche. Donc, nous on savait pas ce qui se passait, parce qu'on voyait les visages tout déformés, tu as déjà une vision qui est plus qu'altérée et déformée.

[Sammy, F23, male, 36, general] je suis quelqu'un qui aime savoir ce que c'est avant de consommer, je me suis toujours renseigné: quels sont les effets? Qu'est ce que ça fait? Même si c'est très difficile à décrire avec des mots, je voulais savoir quels sont les dangers que ça pose sur moi, quelles sont les conséquences? Quels sont les risques physiques et mentaux en fait, donc je me renseigne toujours un peu avant. Et quand c'est la première fois, j'y vais pas comme une brute. Je teste juste un peu...

[Sony, F24, male, 28, about first uses] ça peut sembler bizarre mais en fait, je me suis toujours énormément renseigné sur ce que c'était vraiment que ce truc là..et ce que je risquais et si c'est vrai que passée une certaine heure et passée un certain nombre de trucs dans le sang, tu t'en tapes, mais n'empêche que comme j'entendais parler d'un nouveau produit j'essayais de voir quand même ce que c'était et combien de temps ça durait. Enfin, c'est le genre de choses ou tu pars pas non plus à l'aveugle totalement même s'il y a toujours la phase de doute la première fois sur comment ça va se passer, est ce que je vais bien supporter le truc enfin voilà... t'y va pas franco la première fois.

[Diane, F25, female, 31, about cannabis] J'ai vite arrêté parce que c'est une des choses qui ne me convenait pas du tout. [*Tu peux préciser un peu pourquoi?*] Je devenais parano, je me faisais des films c'était pas plaisant pour moi. Je me sentais mal. Je savais pas gérer. Pour moi le cannabis c'est pire que le speed ou autre chose. Je sais pas gérer. Pour conduire, c'était impossible, je fumais un joint et j'étais déconnecté [elle rit] [*Qu'est ce que tu penses du cannabis maintenant?*] Pour moi fumer un joint c'est vraiment négatif, c'est un truc qui me fait peur. Je sais que si je vais tirer une latte, je vais être super mal. Je vais avoir des angoisses, des suées, à me foutre dans un coin par terre et à rester caché, j'étais super mal. [...] Ce n'est pas un produit qui m'intéresse.

[LittleDevil, F26, male, 29, about first use of cocaine] C'est arrivé comme ça, on a fait la fermeture un soir et [mon collègue] m'a fait "Tu veux

essayer?" et comme j'avais déjà essayé le speed et d'autres trucs, je m'étais dit pourquoi pas donc j'ai fait "Allez". Et ça m'a plu, tu sens plus la fatigue, tu as une grande confiance en toi, tu peux boire comme un trou, t'es encore opérationnel; le lendemain tu te réveilles, t'as pas mal au crâne, tu te dis "c'est pas possible". J'ai trouvé l'effet plutôt sympathique, plutôt euphorisant, pas euphorisant, mais la confiance en soi, c'est très agréable.

[Maggy, F27, female, 31, about ketamine] La kétamine j'ai eu une des grandes trouilles de ma vie, je me suis vu mourir, la kétamine, ça m'a... En fait, c'est comme si mon âme s'était dédoublée de mon corps, j'ai voyagé au-dessus de mon corps et je me suis vu crever et j'ai eu une des plus grandes trouilles de ma vie et je suis vraiment pas près de recommencer cette expérience la du tout. Ça c'est une pure merde.

[Sony, F28, male, 28, about cannabis] On a eu l'effet des premiers moments où on se marrait mais un truc de fous! On était vraiment explosé de rire, on crevait la dalle, on faisait n'importe quoi. [...] à cette époque là, t'es quand même jeune, t'as la pêche, t'as pas encore été dégradé par un quelconque autre produit, donc t'es tout frais. T'encaisses vachement. Le lendemain, tu te dis: " Putain, mais en fait, hier, on a fumé, on était éclaté, mais voilà, on se réveille aujourd'hui, on est nickel, on a la pêche, on va en cours, il y a pas de problèmes en fait". [...] Au début, du moins avec mes potes, on voyait juste l'aspect récréatif, point final. Ca nous empêchait pas du tout de continuer à faire nos vies ou quoi que ce soit.

[Mike, F29, male, 30, about ecstasy] je crois que j'avais trop bu et que c'était un remontant. Et puis la fois d'après, je crois que c'est ça qui fait que t'en reprends parce que tu te souviens que t'as eu la montée et t'es remonté quand même. Donc la fois d'après, tu te dis que dès que l'alcool tape un peu trop, tu t'en remets un et ça passe.

[Marie, F30, female, 22, about ecstasy] Et on a pris des ecstas. On a bu de l'alcool avec eux. Puis voilà, c'était une bonne soirée, c'était tranquille mais après je sais pas, j'en ai pas repris. Parce que cette fois là, je crois que j'étais plus bourrée qu'autre chose et je me souviens plus trop de l'effet, du coup ça m'a pas, c'était pas un bon peut être, du coup j'ai pas réitéré de suite.

[Jurion, F31, male, 27, about cocaine] D'un côté je savais pas vraiment non plus, mais je savais certainement plus à quoi m'attendre sans non plus vraiment savoir ce que ça allait me faire. Je savais que la cocaïne c'était un truc qui te boostais, qui te rendait assez bavard, ça allait être un peu comme l'ecstasy, je me suis dit «ça va être tranquille, ça va être pas mal». Je savais que c'était une drogue de riches donc normalement c'est un truc qui était assez sympa... Si tu veux je l'ai vraiment abordé tranquille, sans peur en me disant : « De toute façon ça après l'ecstasy et les champis, ça passera tout seul ».

[Diane, F32, female, 31, about speed] Vu que j'avais déjà goûté les ecsta, je n'avais pas trop peur d'essayer. Je me disais si j'ai essayé les ecstas, le reste je peux essayer. J'ai franchi un certain cap dans les drogues dures.

[Neron, F33, male, 28, about LSD before] Et je suis pas le seul à avoir eu cet a-priori là, à l'époque tout ceux que j'ai connu, on était tous des gros fumeurs de cannabis, on était obligé de fumer je sais pas combien de grammes de cannabis pour être défoncés et là, on nous présente un truc qui fait 1 cm sur 1 cm et on nous dit: "Prends le même pas dans ta bouche, garde le juste entre tes doigts et ça va te monter grave". [...] La première fois, tu te dis: "Ecoute, c'est pas ça qui vas me faire partir au pays des Bisousnours ou des Schtroumpfs".

[Picasso, F34, male, 34, about methamphetamine] Non, ça je me l'interdis. Déjà que le speed, quand j'ai du bon speed, je mets déjà 12h à éliminer ma dernière trace et je peux pas dormir avant 12h, donc un truc que je fume et qui me laisse éveiller pendant trois jours et qui me défonce même pas, a-priori: non [il rit].

[Ubik, F35, male, 19, about stimulant after speed experimentation] quand on m'a proposé du MDMA, je sais que c'est des amphètes en gros aussi, mais en plus fort [...] quand on m'a dit, ça se rapproche, mais t'as l'impression de te jouir dessus t'es avec tout le monde, t'es content tout ça, mais, c'est la catégorie amphétamine. J'ai fait «non merci» parce que le speed, j'ai un coeur qui est pas très costaud à la base et je le sens bien chaque fois que j'en prends [*fait le bruit d'un battement cardiaque effréné*] j'en peux plus, donc je me suis dit jamais plus fort que ça dans cette catégorie de drogues là. C'est pour ça, que la cocaïne, j'ai essayé une fois, pas deux.

[Maggy, F36, female, 31, general] J'avais mon groupe free party et j'avais mon groupe d'amis d'enfance. Ils ne se connaissaient pas entre eux. Donc mon groupe d'amis d'enfance c'était ceux avec qui j'avais des délires plus sain et qui me ramassait à la petite cuillère le dimanche et mon groupe de teuffers, c'est ceux avec qui je consommais de tout. Eux étaient consommateurs de tout. [...] Mes amis d'enfance ils avaient vachement la trouille pour moi, quand ils voyaient comment ils me ramassaient le dimanche ils avaient la trouille pour moi. [*Mais ça t'as pas incité à calmer la chose justement?*] j'avais envie de vivre cette expérience de consommation et je ne pouvais pas avec eux, parce qu'eux ne voulaient pas ce genre d'expérience... [*Qu'est-ce qu'ils prenaient eux par exemple ?*] Alcool et beuh, il y en a qui ne fumait pas et qui mangeait de la beuh pour goûter... Enfin voilà, c'était des trucs beaucoup plus gentille. Moi j'avais envie de connaître un peu plus de trucs et puis des trucs plus forts aussi.

[ElPoyo, F37, male, 32, about speed] Au départ tu prends le produit et tu attends l'effet que ça va faire et au bout d'un certain temps tu ne

regardes plus l'effet tu sais, tu te laisses porter par le produit, et a un moment tu as faire "putain, je suis défoncé", mais tu ne regardes pas les effets que ça fait, tu te laisses porter, tu vas dans la fête, tu ne regardes pas tellement, en fait tu n'es plus attentif aux produits. [...] Tu te laisses porter par le produit, c'est pas comme à tes premiers cachetons ou tu prends, où tu attends de voir « Oh ça monte » » ou, « je sens rien ». Après tu prends ton produit et tu continues ta soirée. Et au bout d'un moment tu vas te faire «oh putain la je suis défoncé», tu te laisses porter par le produit, donc tu n'analyses pas vraiment ce que ça te fait exactement.

Annex 6: French Extracts Chapter 5

[Neron, F38, male, 28, about drugs] C'est ça le principe d'une drogue en général: c'est de la gérer pour essayer d'être dans un état meilleur ou dans un état différent que la sensation d'origine.

[Jurion, F39, male, 27, about cannabis] [...] c'est vrai que c'était ça qui m'a beaucoup marqué par rapport à l'usage du cannabis. Ça me permettait de m'évader vraiment de toute notion de temps et de vivre à l'instant présent comme jamais. [...] Ca c'est un truc que tu peux bosser sobre et sans prendre de drogue, c'est bien de profiter du moment qui passe au moment où il passe. Mais le cannabis, ça se fait comme ça [*claquement de doigts*], tu es là tu n'es plus en train de penser à ce que tu as affaire dans 10 minutes dans une heure, tu n'es plus en train de te souvenir ce que tu as fait il a deux heures... Tu es juste là et ça c'est superbe.

[Picasso, F40, male, 34, general] De toute façon c'est ça les drogues, ça te permet d'atteindre un certain niveau facile [*il insiste sur le facile*] parce que je pense que ce sont des états que tu peux obtenir par d'autres moyens, mais ça va te demander du travail. Et moi je suis très extérieur à tout ça, par la méditation ou par la respiration, par plein de choses, même un hyper angoissé peut arriver à se détendre. Pour moi les drogues et je compte les médicaments dedans les médicaments s'est toujours une question de dosage [...] mais quand tu prends un psychotrope c'est super facile tu vas pouvoir arriver très, très vite dans l'état où tu as envie de te mettre.

[Gourou, F41, male, 19, general] [*Est ce que tu donnes des fonctions aux différentes drogues que tu prends?*] La fonction des hallucinogènes c'est l'ouverture d'esprit, la prise de conscience sur des éléments qui existent mais dont on ne prend pas forcément conscience. Après le but des stimulants, c'est de profiter, de vivre à fond. D'être dedans, de vivre intensément pendant une durée. Pour moi, c'est ça. Et le rôle des opiacés, c'est de descendre, de récupérer ses esprits, c'est ça mine de rien. Et de descendre, de récupérer, de se reposer, de souffler. [...] L'alcool et le joint pour moi, c'est fonction sociable à fond. C'est un stimulant de fête, d'euphorie, de convivialité, voire de créativité aussi.

[Jurion, F42, male, 27, global evolution] Et le plus tu les connais, plus tu as d'expériences, plus tu sais comment toi tu réagis, parce qu'on réagit tous différemment aux drogues, et donc tu sais quand est-ce qu'il faut tu le prennes, et pourquoi. De toute façon, tu prends des drogues pour leurs effets, tu les prends pas pour autre chose, tu les prends parce que ça va te produire quelque chose que tu recherches et qui va aller finalement. Enfin dans ma perspective, c'est très rationnel, si je prends des drogues c'est pour obtenir un effet et parce que les conditions sont réunies pour avoir une expérience intéressante, que ce soit un niveau de détente ou de contemplation ou de réflexion, ou que ce soit à un niveau de pure fête et

de pure énergie. Dans les deux cas, ce sont des trucs que je prends parce que ça va me produire un effet désiré.

[ElPoyo, F43, male, 32, about cocaine] C'est vrai que c'est une drogue qui permet d'aller plus facilement vers les gens, une ouverture pas une ouverture d'esprit mais une ouverture... En fait par rapport à toi, tu vas te sentir mieux et tu vas avoir une meilleure confiance en toi.

[ElPoyo, F44, male, 32, about the deceases of his parents] Quand j'ai connu l'expérience du décès de mes parents, il y a eu une période pas facile, [...] j'ai eu une période où j'ai pas arrêté de fumer, j'ai pas arrêté picoler, je me suis vraiment défoncé la gueule. C'était histoire de me défoncer la gueule. Cette période de défoncé là, j'ai pas passé des soirées, je me souviens pas de ces soirées, c'était histoire de me défoncer la gueule pour arrêter de penser.

[Ubik, F45, male, 19, about hallucinogens in general] Un rôle des hallucinogènes: perdre le contrôle complètement mais complètement; mais c'est le but recherché de chacun. C'est une partie de l'état ouais, c'est perdre partir sur une autre planète.

[Marie, F46, female, 21, about alcohol] Pour la fête, pour être avec des gens, pour délirer, pour faire n'importe quoi. Et puis je suis super timide aussi, quand j'ai bu je ne suis plus du tout la même personne: je suis, je dirais plus extravertie: c'est aussi un moyen de me décoincer.

[Cloum, F47, female, 22, about cannabis] J'ai l'impression d'être détendu, j'ai l'impression que mes soucis sont plus là... enfin, j'essaie de m'échapper un peu. J'essaie vraiment de neutraliser mon cerveau... j'ai un peu l'impression que mon cerveau marche au ralenti donc du coup, j'arrive plus à être calme.

[Neron, F48, male, 28, about cannabis function] on va retomber sur le rôle social du cannabis qui est un faux rôle social: c'est un petit monde de fumeurs qui se recroquevillent sur eux, puisque les fumeurs ne rencontrent que des fumeurs, et il est très rare pour un fumeur de passer des soirées avec des gens qui ne fument pas aussi ou qui vont tolérer que tu puisses fumer à côté.

[LadyFly, F49, female, 25, about cannabis function] tu es dans une bulle, tu restes avec toi même et pour moi, c'est pas une drogue avec laquelle tu peux être sociable. Tu te refermes un peu sur toi et t'as pas envie de parler, t'as pas envie de communiquer avec les gens. Je vais communiquer quand même mais quand ça commence à être un peu trop fort ou quand tu ressens vraiment les effets, là, t'as un peu de mal pour faire le premier pas, pour aller vers les autres.

[Jurion, F50, male, 27, about ecstasy] Pour faire la fête, l'ecstasy c'est magique tu peux être comme tu es complètement crevé, au quatrième

dessous etc., tu prends de l'ecstasy dans 40 minutes, tu es au plus haut de ta forme comme jamais tu as été, c'est un boost impressionnant, donc l'ecstasy c'est vraiment, tu le prends pour aller faire la fête.

[Gourou, F51, male, 19, about stimulants] Le speed c'est plus ou moins stimulant, l'usage est quotidien, il est régulier, très régulier. Un stimulant qui me tient éveiller ou alors pour contrebalancer certains opiacés pour me remonter du trip hallucinogène. La coke un peu dans le même esprit.

[Picasso, F52, male, 34, about heroin] Un bien-être, vraiment un bien-être autant physique... Ce que j'aime bien dans cette drogue par rapport aux autres drogues c'est quelle pouvait atténuer les peines aussi bien physiquement que mentalement. C'est pas une drogue qui va te faire boucler dans ta tête, tu peux être dans n'importe quel état d'esprit elle va à toujours être plus forte que ton état d'esprit, par exemple si tu flippes par rapport à des choses ou autres... Enfin je te dis que c'est une drogue pour oublier, pas pour régler quoi que ce soit, puisqu'aucune drogue ne fait ça, mais ouais je te dis, cette espèce de sensation de bien-être atteint facilement.

[Sony, F53, male, 28, about psychedelic] [...] vraiment de l'introspection mais tout en étant libéré du poids des contraintes externes; ça c'est quelque chose de super intéressant. [...] ça te permet de faire le point sur énormément de choses et moi ça m'a vachement apporté psychologiquement: ta vision du fonctionnement des choses, des gens entre eux, des rapports humains et de la société en général change totalement. Et le truc, c'est que même quand t'es redescendu de ton trip, t'as pas oublié que tu pouvais voir les choses de cette façon là et tu gardes toujours cette sorte de vision. T'es décalé de ces choses. Ça c'est clair et net. Ou alors, il y a énormément de choses que tu vas remettre encore en question et puis tu peux être vraiment agacé par comment ces choses tournent, comment les relations entre les gens fonctionnent, tous les petits jeux de pouvoir..enfin toutes ces conneries, au final t'es là..mais (souffle)...merde, je suis vraiment obligé de vivre là dedans.

[Jurion, F54, male, 27, about alcohol] Je sais que l'alcool comme tout le monde, me désinhibe, il me permet de parler plus facilement. À la base l'alcool c'est pour m'amuser, et c'est vrai que c'est dur, sans alcool la nuit est plus folle... pas vraiment. Je pense que chaque fois que tu veux faire la fête et t'amuser et c'est vrai que l'alcool, c'est toujours un élément moteur, enfin moteur, ça aide la plupart des gens à se sentir plus en confiance et à parler plus facilement. Tu relâches un peu les contrôles mentaux, les différentes inhibitions que tu peux avoir.[...] il peut aussi arriver que je boive parce que je suis triste. J'ai seulement envie d'oublier, c'est aussi ça l'alcool c'est un bon moyen de fuir tes problèmes. De toute façon, la plupart des drogues ça te permet de te sortir de la réalité pendant un moment. Il y a des fois où je vais me mettre une tête parce que j'ai pas envie de penser que ma vie me fait chier ou que si ou

que ça.

[Picasso, F55, male, 38, about drugs in general] Je te dis au début plutôt la curiosité et puis après je pense que super rapidement, je me suis servi des drogues pour me mettre dans certains états. Je pensais qu'avec les drogues, c'était plus facile de faire certaines choses que ce soit sociale, que ce soit dormir, ou ce que tu veux d'autre [...] Le truc avec les drogues c'est que tu prends la petite pilule bleue, tu repars, tu prends la rouge, tu vas dormir. C'est un peu le problème de notre époque, qui va avec ce que la société est maintenant, on te demande toujours d'être frais et dispo, pas forcément dans le cadre du travail, aussi dans le cadre du travail mais même socialement, je pense que quelqu'un qui est un peu déprimé, il va quand même se faire violence et aller à cet apéro ou à cette fête, ou je sais pas quoi... Même de la part de tes amis proches, tu dois avoir la bien séance de haut fait d'être frais et dispo. Tu dois être plutôt rigolard en fait.

[Sony, F56, male, 28, about opiate and heroin] Prendre un peu d'opiacées, ça te pose vraiment et ça te permet de souffler par rapport à des choses [...] c'est ça qui est traître dans l'héro et les opiacées, c'est que tu te suffis à toi-même. C'est à dire qu'en fait, le contexte, ce qui t'entoure n'a plus vraiment d'importance, c'est à dire que même si t'as pas de meuf, même si t'as pas de fric, même si t'es dans une condition sociale et matérielle pas terrible, t'es bien physiquement, t'es bien psychologiquement et le reste, c'est secondaire [...] tu vois généralement, je m'allonge, puis je rêve. Mais bon, le but, c'est pas la réflexion, le but, c'est juste: "Putain j'ai besoin de faire un break là parce qu'il y a beaucoup de responsabilités dans ma vie".

[Jurion, F57, male, 27, about cocaine] la cocaïne c'est pas mal parce que c'est une drogue que tu peux prendre aussi dans beaucoup d'occasions, la cocaïne c'est toi dans ton meilleur jour, la cocaïne c'est sans être aussi violent que l'ecstasy, c'est vraiment sympa comme drogue, parce que ça te rend, plus beau, plus fort, plus confiant, c'est vraiment une drogue qui te booste sous tous les niveaux. Le mec qui prend de la cocaïne, tu le sauras pas forcément, parce que tu ne dis pas de conneries quand tu es sous cocaïne, tu as même tendance à être plutôt intelligent, c'est vraiment une drogue qui te booste tous les aspects: comme le speed et l'ecstasy, tu n'es pas fatigué, tu sens beaucoup moins l'alcool et en plus tu vas être beaucoup plus social, tu vas être beaucoup plus sûr de toi, très en confiance, toi dans tes meilleurs jours.

[Neron, F58, male, 28, about cocaine] Ce petit côté de peps brillant, ce petit côté brillant où tu as la patate, où tu as envie d'aller chez les gens où tu as envie de montrer que tu... C'est aussi ce qu'on m'avait montré sous coke, dont j'étais un peu dans la répétition, dans la reproduction de ce côté où c'est la fête, c'est la nuit, on a le sourire, on vit à 200 à l'heure, on s'éclate. [...] Ça te rassure, tu es bien intérieurement, tu es bien, tu as envie de t'éclater encore plus, tu as envie de tout donner.

[Jacko, F59, male, 31, about alcohol] Tiens, un super bon exemple avec l'alcool: j'ai une copine depuis peu, elle fêtait son anniversaire là, il y a 15 jours avec 35 personnes que je connaissais pas. Et je sais que j'ai bu un verre chez elle avant d'y aller en me disant, on va gagner du temps en gros (il rit). Les liens seront plus facilement déliées. Donc ce sens là, je pense qu'il y a beaucoup de gens comme ça et c'est pas pour oublier: là, fonctionnellement, c'est vraiment intéressant pour être relié aux autres personnes autour de toi qui ont bu aussi.

[Cloum, F60, female, 20, about alcohol] Parce que je pense que la consommation d'alcool, surtout au niveau des soirées, quand on connaît pas les gens, ça aide à aller parler plus facilement, à être plus ouverte. Vraiment, j'arrive peut-être plus à me confier si j'ai bu un petit verre.

[LittleDevil, F61, male, 29, about cannabis and work] quand tu enchaînes 14 heures dans ta journée, voilà, un petit joint, tu souffles. C'est aussi bête que ça. Quand je travaillais sur la Grand Place [de Lille], je fumais énormément, je commençais à 10h du mat, j'avais une demi-heure de pause et j'allais jusqu'à 1h du mat: tu rentres chez toi, tu as 8 heures. Tu rentres, tu te roules un pet, tu te mets devant la télé, tu t'endors avec ton pet. T'arrives chez toi, tu sors du boulot, t'es encore dans le boulot. T'arrives chez toi, tu penses a ton boulot, si tu n'as pas un truc, je sais pas une passion, une activité vraiment à faire qui te schotche, tu y penses tout le temps. T'en es jamais sorti.

[Ursula, F62, female, 25, about speed] quel effet je recherche ? Le fait de pas dormir. C'est vraiment un truc que j'aime dans la drogue, c'est le fait de pas dormir en général.[...] C'est un truc que je trouve génial: ça ouvre à d'autres trucs et surtout, ça fait prendre ton temps avec tes potes, je trouve ça intéressant, avec des gens, avoir autant de temps, c'est un luxe.

[LadyFly, F63, female, 25, about cocaine and private sphere] ça donne de l'énergie. Disons que c'est vendredi soir, t'as bossé toute la semaine et puis t'as quand même envie de sortir mais tu te sens fatiguée et là tu prends quelques traces et puis voilà c'est parti... T'oublies toute ta fatigue, t'es heureux, t'es content d'avoir pris parce que ça te met dans un état où tu te sens bien, où tu te sens à l'aise. C'est plus l'énergie et puis l'adrénaline que ça donne. [...] Je vais pouvoir faire toute la soirée et je vais m'amuser pendant toute la soirée, je vais pas faire la gueule parce que je suis fatiguée.

[Cloum, F64, female, 20, about speed] c'était vraiment pour tenir la soirée parce que je suis vite fatiguée et vu qu'en plus je consomme du cannabis, ça m'aide pas vraiment à tenir. En plus, je sais que je vais rester là jusque 7h du mat donc il faut que je tienne [...] et aussi réussir à être dans l'ambiance de la boîte, être vraiment, genre dedans. Mais je sais que quand j'en prends, je suis pas du tout comme je suis

habituellement, je suis assez calme normalement. Et là, c'est vraiment être énergique et rester sur la piste de danse pendant 4h d'affilée.

[Jurion, F65, male, 27, about drugs and settings] L'alcool, bah un peu partout en fait. Je l'utilise dans tous les lieux classiques de consommation d'alcool, que ce soit bar, pubs ou clubs. J'utilise à la maison quand je reçois des gens, ou dans les maisons de l'occupant, je bois même dans la rue ce que j'aime bien faire pas souvent mais j'aime bien. [...] L'ecstasy, tu peux pas rester en place, tu parles à quelqu'un pendant cinq minutes, tu as envie de parler avec quelqu'un d'autre. Donc l'ecstasy c'est une drogue, c'est une drogue qui marche très bien en club, surtout parce qu'en plus tu as besoin de musique, ça c'est l'autre truc. L'ecstasy, tu te retrouves sans musique dans un lieu où il y a personne, c'est pas tenable, c'est vraiment pas tenable... donc c'est vraiment une drogue pour boîte ou festival. [...] La cocaïne, tu vas pas l'utiliser si tu passes une soirée tout seul, en même temps tu pourrais, ça te ferait pas bad-tripper, mais tu vas quand même avoir envie de socialiser. Tu l'utilises à la maison, en club, en bar. [...] c'est quand tu sors, quand tu es en préparation de sortie...

[LittleDevil, F66, male, 27, about magic mushrooms] faut être serein pour prendre des champis, parce que c'est le genre de drogue où il faut vraiment être bien dans ses baskets, parce que si tu as des trucs qui te turlupinent ou que t'es mal dans ta vie, tu peux vite déraiper et taper des gros bad-trips. J'ai vu des mecs qui se sentaient persécutés, qui se sentaient mal et résultat, leurs hallucinations c'étaient, les murs de l'appart qui se refermaient sur eux, ils ne supportaient plus les endroits clos, ils sentaient qu'on les regardait bizarre, ils se sentaient opprimés...

[LittleDevil, F67, male, 29, about energy selection] Ca dépend, une longue, longue soirée que je sais qu'on va pas rentrer avant 8-9h du mat, ça sera plus coke, parce que j'en aurais envie. Et les trucs plus dansant, genre discothèque, ce sera plus ecstasy, pareil pour les festivals, c'est plus ecsta parce que tu sais que t'as ta tente est pas loin, si t'es vraiment raide défoncé. [*Et pas de speed?*] Non, seulement ecstasy, je prends pas de speed j'aime pas ça, enfin j'en ai pris, mais j'aime pas, ça me réussit pas.

[Jurion, F68, male, 27, about ecstasy] Je l'obtiens parce que je vais dans une soirée ou j'aime bien la musique et parce que je vais voir quelqu'un qui va en prendre à côté de moi et je me dis: "Tiens pourquoi on irait pas se prendre un ecsta", ou parce que je vais rencontrer quelqu'un qui va m'en offrir. [...] De toute façon l'ecstasy, c'est un truc que tu trouves très généralement dans les clubs, si tu vas dans un club qui passe de la musique électro, tu demandes autour de toi, tu as vite fait de trouver quelqu'un qui en vend.

[Sony, F69, male, 28, about heroin first use] L'héroïne c'est un truc, j'avais jamais voulu trop m'aventurer et j'avais jamais trop eu l'occasion.

Mais quand tu connais les bonnes personnes et que tu recherches un produit, tu galèreras peut-être pendant un mois à trouver. Si vraiment il y a quelque chose, tu finiras par le trouver. [...] si tu connais les bonnes personnes, ça peut toujours se débloquer et surtout quand il y a des histoires d'argent en jeu, il y aura toujours un gagnant. S'il y a de la demande, il y aura de l'offre.

[Jacko, F70, male, 31, about ecstasy/speed] est ce que je prenais du speed exprès pour avoir cet effet là ou bien est ce que je prenais de l'ecsta? Moi j'étais pas si "technique". Je prenais ce qu'on pouvait avoir. [...] Il y avait un gars de Seclin qui pouvait en avoir donc on dépendait de lui. Si lui il avait des cachets, s'il avait un stock, il mettait genre deux, trois mois à l'écouler, donc pendant deux, trois mois, on prenait ça quand on sortait. Si c'était du speed, alors on prenait du speed.

[Diane, F71, female, 31, about cocaine] Ca m'a jamais branché, c'est une drogue qui ne dure pas. Autant un ecsta, tu en as pour 3 ou 4 heures; du speed, une dizaine d'heures; la cocaïne, un quart d'heure et ça pour 50 € le gramme, c'est bon quoi...[Elle rit] donc non, ça m'a fait déchanter tout de suite. C'est une drogue qui dure pas, qui est cher: je trouve que ça n'a aucun intérêt à part vider ton portefeuille.

[ElPoyo, F72, male, 32, about cocaine] C'est vrai qu'au fur et à mesure avec l'expérience, tu constates, qu'à sniffer trop régulièrement tu n'as plus les bons effets. Comme là, tu vois de choumer de la coke de temps en temps, tu n'as que les bons effets, tu vas avoir tout de suite le smile et tu vas être tout de suite en forme. Tandis qu'à choumer super régulièrement avec de grosses quantités, tu vas avoir des crises de paranoïa, tu vas être moins à l'aise, tu réagis moins bien avec le produit et ça fait l'effet inverse.

[Mike, F73, male, 31, about speed] Je dirais sur une bonne année, ça a commencé petit, ça a commencé vraiment petit, à une ou deux traces par nuit, quand j'étais à bloc d'alcool, c'était histoire de faire redescendre l'alcool, c'est tout. Et après c'était de plus en plus, parce que tu t'accoutumes vraiment vite. Donc, après, il en faut beaucoup plus, à finir avec deux trois grammes par nuit. [...] Et plus les week-end passaient, plus je réduisais l'espace entre les traces.

[Batman, F74, male, 19, about alcohol] J'aime pas l'agressivité, j'aime pas quand les autres ont trop bu parce que ça me rappelle comment je suis moi quand j'ai trop bu. C'est parce qu'un mec bourré, c'est vachement lourd. Lorsqu'ils s'accrochent à toi, ils disent n'importe quoi, tu peux être en discussion sérieuse avec quelqu'un et puis il débarque en plein milieu et puis il balance n'importe quoi. Ça fait vachement réfléchir sur soi-même, tu vois ce que je veux dire ? c'est un peu un miroir et là je me dis «putain, je suis comme ça parfois ?» (soupir) Ca me donne envie de ralentir encore plus !

[Neron, F75, male, 28, about LSD] J'en ai repris dans les trois mois qui ont suivi. Mais après j'ai levé le pied parce que le je me rendais compte que j'allais droit au mur et j'avais des potes qui étaient devant moi pour me le montrer donc après j'aimais bien me regarder quand j'étais défoncé, quand je voyais la tête de mes amis... Parce que c'est ça qui me faisait très peur c'était voir les têtes des gens avec qui je consommais, je me disais "c'est pas possible je peux pas avoir la même tête qu'eux". Quand j'ai vu leur délire, je me suis dit: "attends, je peux pas il faut que j'arrête: on ressemble à rien".

[Cloum, F76, female, 20, about cannabis after] J'ai vu plusieurs personnes qui consommaient du cannabis et au fil des années je les ai vu vraiment devenir de plus en plus violent quand ils fumaient pas. Du coup, je pense que c'est vraiment une mauvaise drogue parce que je vois vraiment la sensation de manque chez les autres.

[Neron, F77, male, 28, about LSD] C'est super dangereux de prendre du LSD, j'aurais pu perdre la tête entièrement et j'aurais pu y rester et faire la soirée de trop parce que j'en ai connu des gens qui ont fait ça, ça a été leur dernière soirée, après ils ont fini en hôpital de jour. Et tu vois ils sont plus jamais pareils, ils sont COTOREP. Et là, tu te rends compte que c'est quelque chose de très dangereux et non plus, malgré que tu ne sois pas en plus toxicos que t'a pas le profil et que tu essayes ne serais ce qu'une fois, ça va peut-être la fois de trop, et qu'en plus tu es pas forcément sur le bon produit ce qui peut être encore plus mal. J'ai vu des gens s'arracher les cheveux, j'ai vu des gens parler aux buissons, voler des voitures alors qu'ils étaient fils de bonne famille. Ils étaient complètement possédé, aliéné. C'est une drogue qui te fait perdre les pédales. N'importe qui sous LSD peut faire n'importe quoi.

[Diane, F78, female, 31, about mephedrone and future substitutions] La, j'en ai plus, après j'en avais recommandé sur Internet mais le mec a dû fermer son site parce que c'était plus légal ce qui fait que maintenant il n'y en a plus, donc je n'en prends plus. Mais je sais qu'il y a d'autres produits qui vont sortir donc... [*Est-ce que justement tu attends d'autres produits du même type?*] Oui bien sûr.

[Marie, F79, female, 21, about alcohol after] Avant je pouvais pas envisager de sortir sans boire, c'était vraiment impossible. Et maintenant, à force d'en avoir trop abuser, de me dire que ça m'apporte plus d'emmerdes que d'autres choses, je commence à boire moins. Et puis, j'en ai une opinion ou je me dis ce n'est plus essentiel, et que je m'amuse tout aussi bien en étant consciente et en me rappelant les choses.

[Mike, F80, male, 31, about ecstasy after] C'est de la saloperie. Je crois bien que c'est ce qu'il y a de pire. Ça change ta mentalité, ça change pas mal de choses. Et puis, il y a trop d'effets secondaires. Et même quand t'es dedans, t'es trop ravagé.

[Jurion, F81, male, 27, about alcohol and cannabis] je me suis jamais dit que ça se poserait comme un problème par rapport à la notion de dépendance, je me suis dit de toute façon moi l'alcool je peux m'en passer assez facilement, parce que c'était pas quelque chose que j'apprécie plus que ça et surtout parce que je fumais des joints. Donc, j'avais assez rapidement fait la distinction si je fume des joints j'ai pas besoin de boire de l'alcool, surtout que ça marche pas super bien ensemble. Donc comme je fumais pas mal, l'alcool c'était vraiment un truc qui était beaucoup plus occasionnel. Maintenant que je ne fume plus [de cannabis], l'alcool devient quelque chose de beaucoup plus régulier et quelque chose que j'apprécie beaucoup plus, et je me rends compte que désormais, c'est quelque chose qui va falloir que je gère, parce que c'est quelque chose dont je suis, dont je peux être dépendant.

[Ubik, F82, male, 19, about hallucinogens] Je pense pas que ce soit une drogue la salvia. Pour les champignons hallucinogènes et la salvia, j'emploie jamais le mot drogue. J'utilise toujours le mot «plante hallucinogène» parce qu'au final je trouve pas que ce soit une drogue. C'est fort, faut savoir ce qu'on prend et ce qu'on fait, mais c'est pas dangereux. Enfin, ça peut être dangereux si on l'utilise mal, comme beaucoup de choses. Donc pour moi, pas de soucis à se faire.

[Sammy, F83, male, 36, about speed] Dangereux, pas plus que de l'ecsta, pas plus que du LSD. Mais dans tout ce que tu consommes, ça reste dangereux, dans la mesure de la consommation que tu en fais. Mais dangereux pas plus qu'autre chose. T'as pas d'addiction, ton corps ne va pas en réclamer, ton esprit va pas t'en réclamer.

[Diane, F84, female, 31, about speed] J'ai eu des amis qui sont morts à cause du speed. [*Quelle a été ta réaction vis-à-vis de ça?*] Ca m'a jamais vraiment influencé, parce que j'ai toujours pensé que je gérais. Je ne partais pas dans des excès contrairement à certaines personnes qui prenaient plein de trucs et qui ne faisaient pas attention aux doses.

[Mike, F85, male, 30, general] L'alcool, disons que c'est toujours en soirée. J'aime bien alcool / cannabis quand je picole chez moi avec des amis et quand je sais que je vais pas bouger: tu en profites, tu bois un verre et tu fumes un buzz. Et alcool / ecsta, alcool / coke, c'est parce qu'il y a toujours de l'alcool, parce que le soir, je bois. C'est plus après que j'utilise de la drogue pour réguler de l'alcool.

[Sammy, F86, male, 36, about cannabis and alcohol] le danger avec le pétard, c'est que soit il te fait pas du tout monter l'alcool, soit il te le fait trop monter et t'es pas bien. Tout dépend du moment où tu le fumes, si tu fumes en début de soirée, l'alcool il va pas te remonter. Tu picoles d'abord, tu fumes après, tu vas être malade. C'est tout un dosage et il faut connaître son corps et les drogues que tu prends. Donc, [le polyuse] c'est juste à l'envie et à la connaissance du produit. [...] C'est une

machine que tu fais fonctionner avec différents carburants.

[Jacko, F87, male, 31, about cocaine/alcohol] J'ai jamais pris de la coke pour me dire que j'allais être moins bourré [...] mais inversement il y a toujours de l'alcool avec. Faut faire l'association. Je crois que ça enlève du contrôle à la coke justement: l'association des deux, c'est fait pour ça.

[Marie, F88, female, 21, about speed and alcohol] Je buvais bien au début et du coup quand je prenais mon speed j'étais directement comme je voulais être, je sais pas comment dire, je devais pas trop boire et j'étais juste au point où... [*L'état où tu commençais à être bourrée?*] Ouais. Mais où je vais quand même me souvenir de tout. Je prenais mon speed et du coup, j'étais bien. Ca c'était la recette pour passer une bonne soirée et rien oublier. Je prenais de l'alcool pour être bien, c'était début de soirée, durant la route on buvait, on arrivait sur le parking. On prenait notre speed et la, j'étais juste bien bourrée pour rentrer et puis je prenais mon speed, c'était bon pour toute la soirée. Jusque 5:00, j'étais tranquille.

[Neron, F89, male, 28, about polyuse settings and intoxicated uses] Ca te permet aussi d'arriver plus vite dans la défonce. Ça accélère le mélange des deux. Ca multiplie aussi, un joint fumé après trois ou quatre bières, t'es trois fois plus explosé que si tu avais bu que trois quatre bières. Le mec qui boit trois bières et le mec qui boit trois bières et qui a fumé un joint après, il est souvent un peu plus détruit au final.

[Picasso, F90, male, 34, about cocaine/GHB/khétamine] A la fin, mon péché mignon c'était ce que j'appelais les trois A, c'est-à-dire les trois anesthésiants, cocaïne, GHB et khétamine.... Cocktail qui défonce [il rit]. Si tu veux quand tu es dans un mode de défonce où tu te défonces trop à la cocaïne, forcément un moment tu vas le sentir [indicating his heart], tu vas prendre des bonnes claques, mais avec le GHB et avec la khétamine ça te permet de pouvoir prendre plus de cocaïne, de pouvoir aller plus loin dedans.

[Jurion, F91, male, 27, about MDMA/speed/cocaine] [...] après si je suis déjà sous ecstasy, à la limite j'en prendrai du speed, si j'ai l'impression d'être plus ou moins en descente. Mais c'est des drogues qui vont ensemble, c'est clair, et si j'ai vraiment envie de passer la grosse soirée, je prendrai les trois distinctement dans n'importe quel ordre, mais [...] si j'ai pris un ecsta, au moment où ça descend, tu as envie de temporiser la descente, en prenant de coup de speed ou un coup de cocaïne, pour te remonter un peu...

[Gourou, F92, male, 19, about polydrug use] [...] je vois toujours ça comme sauter d'une strate de conscience à une autre. Au début, on est dans strate de conscience collective, on va avoir des délires et on rigole ensemble. Et le fait de passer au speed va tous nous plonger dans un autre système, on sera toujours en connexion, mais on va réagir différemment, penser différemment etc. et les champis, les

hallucinogènes c'est pareil, ça va être encore très différent et très intéressant. On est bien préparé et on est bien en forme, et c'est parti pour un voyage intéressant et spirituel. [*Tu vas pas prendre les ingrédients au hasard?*] Non pas du tout. Je vais bien réfléchir à ce que je veux à temps quel état je suis et à ce que je recherche pour cette soirée, les gens avec qui je suis. [...] C'est toujours calculé les drogues qu'on prend, elles sont toujours, comme on les consomme nous, maintenant comme on les connaît plus ou moins, on sait l'effet que ça va nous faire, on sait quand on va le prendre, on sait voilà quoi. C'est pas du surplus inconsideré.

Annex 6: French Extracts Chapter 6.

[LittleDevil, F93, male, 29, general] Je fais ce qui pour moi reste contrôlable. J'essaie de contrôler mon addiction.

[Neron, F94, male, 30, about his actual consumption] Avant, c'était "no limite", au jour d'aujourd'hui c'est quand même un peu moins no limit. [...] Je n'ai plus cette envie de m'en procurer comme ça, si un jour j'en retrouve peut-être que j'en achèterai, si l'occasion se présente à moi peut-être et encore ça dépend laquelle elle se sera pris intelligemment, dans un endroit très précis, à un moment très précis. Il n'est pas question que j'en prenne au milieu de la semaine, je ne prendrais pas d'ecstasy en milieu de la semaine. Il y a plein de choses que je ne ferai pas, que je ne fais plus. Par rapport au cannabis, c'est pareil j'essaie toujours de retarder le 1er joint de la journée.

[Mike, F95, male, 30, about cannabis] Il y en a qui ont eu des problèmes avec les flics mais à part ça, pas plus de problèmes que ça je pense. [*ça t a rien fait de savoir qu'ils ont eu des problèmes avec les flics?*] Les autres, bon avec les flics, peut-être que ça m'a fait changer. En vieillissant, le fait de voir qu'il y en a d'autres qui se font gauler, t'as peut-être un peu plus peur d'aller avec quelque chose sur toi. Donc, t'évites de te balader avec. Si tu peux éviter, tu laisses tout chez toi. [*Mais est ce que ça a freiné ta consommation ?*] Probablement ouais. Disons genre fumé dans la rue, je le ferai plus, par exemple. Rouler un buzz dans la rue, je l'ai fait à une période, maintenant, je le ferai plus. Ce qui fait que tu fumeras peut-être moins dans la journée aussi. Ça a peut-être une influence aussi. A une période j'en avais toujours sur moi, maintenant, j'en ai plus sur moi.

[Jurion, F96, male, 27, about barriers] le trip de la drogue il est un peu passé, à l'époque comme je disais, j'aurais voulu tester toutes les drogues au moins une fois, maintenant, c'est plus forcément quelque chose que j'ai envie de faire donc... [...] les barrières ont évolué, parce que maintenant je me mets plus de limites, parce que maintenant j'ai testé quasiment toutes les drogues... Ça me fait moins tripper qu'avant, parce qu'en fait j'ai envie de vivre ma vie pleinement, et de pas avoir besoin de prendre des trucs pour y parvenir... Et puis j'ai déjà l'alcool donc c'est bon... [Il rit]

[Sony, F97, male, 28, general] En fait mes 25 ans, ça a été une phase charnière parce que je me suis rendu compte que je m'étais beaucoup amusé mais qu'à côté de ça, j'avais pas construit grand chose de ma vie, enfin tout du moins, j'ai vécu beaucoup de choses me semble-t-il mais pas suivant les normes actuelles. [...] En plus j'étais séparé de cette nana avec qui je suis resté pas mal de temps, la parisienne avec qui je suis resté jusque l'âge de 24. Ça m'a mis un gros coup. Ça m'a mis vraiment un gros coup parce qu'elle m'a quitté parce que je stagnais dans ma vie et que je fumais trop et que j'étais trop à l'ouest. Tout simplement et putain, merde, dans cinq ans, j'ai trente ans mais qu'est ce que j'aurais ?

Quel genre d'avenir je me prépare ? Ouais, je me suis éclaté mais faut que je me bouge sinon, je me prépare vraiment pas une belle vie et ça va être difficile. Surtout que bon, il y a des gens que je connais même à mon âge ou même plus vieux pour qui il n'y a que la défonce qui compte et voilà ça s'arrête là.

[Sony, F98, male, 28, general evolution] Il y a eu une époque, enfin pendant longtemps, jusqu'à mes 24-25, la limite, c'était la limite physique. En gros, je tapais tout ce qui était à ma portée jusqu'au moment où je sentais que j'étais au bout du rouleau et que j'avais eu mon compte. Maintenant, il faut pas que ça m'empêche d'avoir une activité normale lorsque je dois l'avoir. C'est à dire que par exemple, si jamais j'ai des trucs à gérer lundi, je vais pas me mettre de grosses races parce que faut que je sois en forme pour faire les choses. [*Donc t'as plus de temps libre pour prendre autre chose?*] Ouais, j'ai plus de temps libre pour faire autre chose et puis voilà, j'aime bien sortir et me la mettre encore un petit peu de temps en temps mais c'est plus ça qui me fait bander le matin quand je me réveille, à me dire: "Ce week-end, ça va être l'orgie..."

[Sammy, F99, male, 36, about drinking in excess] J'ai pas envie de m'arracher la tête, j'ai envie d'être opérationnel le lendemain, je suis beaucoup plus responsable dans la manière dont je bois. Le problème, c'est que quand je le fais, mon corps il ne suit plus. [...] Je me rends compte que mon corps ne suit plus. C'est le principe chat échaudé craint l'eau froide, tu te dis "oulala, je vais encore me prendre une tôle, je vais encore mettre deux jours à m'en remettre". C'est le genre, quand je fais une soirée je préfère la faire le vendredi soir plutôt que le samedi soir, parce que je sais que j'ai le samedi et le dimanche pour m'en remettre. Je sais que j'aurais mon dimanche. A rester chez moi, comme une larve parce que j'ai trop picolé la vieille.

[Neron, F100, male, 30, about alcohol/cannabis and social commitments] Le boulot c'est un facteur maintenant j'ai un boulot où j'ai des responsabilités, je me lève très tôt donc l'alcool, c'est quelque chose que je bannis. Je peux pas arriver le matin et puis avoir la tête dans le cirage et pas me rappeler ce que j'ai fait la veille ou même au boulot. [...] il y a le fait que je travaille plus de 10 heures par jour avec le temps de déplacement. Donc déjà pendant ces 10-11 heures là, je fume pas. Après il faut que je dorme, à peu près 6 heures et puis que je bouffe aussi quand même [rires]. Ça fait 17 heures plus une heure pour te laver le matin et le soir donc là on est à 18 heures tu vois [...]

[Neron, F101, male, 30, about alcohol] C'est aussi le permis, c'est aussi le fait d'avoir une autre responsabilité avec des lois ou tu n'as pas le droit de boire ou très peu pour prendre le volant donc déjà ces éléments-là font que au jour d'aujourd'hui rien qu'avec le cadre qui est autour de moi, je suis plus limité. Par exemple, quand je vais boire la seule fois dans la semaine essentiellement, j'y vais à pied et je trouve un bar près de chez

moi, je bois un à deux verres de 50 cl pas plus, 1 litre de bière très forte, une fois dans la semaine.

[Marie, F102, female, 21, about the impact of her partner] J'ai un copain depuis bientôt un an, et du coup je suis plus calme c'est ça qui m'a changé. Et ma meilleure copine s'est un peu calmée aussi mais je sais qu'elle reprend des trucs de temps en temps. [*Est-ce que ton mec à calmer le jeu ?*] Ouais carrément. Mais lui il fume des joints. Et c'est peut-être pour ça que je fume un peu plus. Mais sinon au niveau de tout, il m'a calmé, c'est à peu près à cette époque-là que j'ai tout arrêté.

[Jacko, F103, male, 31, about his ex-partner] [*Est ce que tu considères que le temps où tu as été avec ton ex, ça t'avait calmé grandement vis à vis de ta vie d'expatrie actuelle?*] Par rapport à la consommation, ouais. C'est simple à voir que j'étais plus du tout là dedans. J'étais plus du tout dans les sorties. Je voyais moins les copains et puis voilà. C'est sûr. Je sais pas si c'est directement, mais c'est la vie de couple qui a fait que je m'étais éloigné de ça vraiment. [...] Là, c'est quelque chose que je ferais peut-être si je repasse ou si je suis avec quelqu'un qui comprend ça, c'est ça le truc..Si je suis avec quelqu'un qui comprend ça. Alors que si je suis avec quelqu'un qui comprend pas que je prenne des drogues, bon ben, c'est tout ! Ca dépend aussi du boulot, de la vie sociale en général, c'est un tout. En fait, c'est socialement. Si socialement, tu peux te le permettre ou pas en gros, je pense. Moi comme je travaille toujours pas en ce moment, je suis pas trop inséré socialement par ici, j'ai les amis mais j'ai pas de boulot et j'ai pas de vie de couple; enfin j'ai une vie de couple depuis peu mais bon, c'est ma future ex...(rire), c'est pas très... [*C'est déjà ta future ex ?*] Ouais mais tu vois, ça, c'est intéressant parce qu'elle prend et en fait j'aime pas ça. Je peux pas être proche de quelqu'un si elle prend. Voilà c'est ça. C'est assez rigolo. Je pense que ma promise, ce sera quelqu'un qui aura essayé mais qui n'en prend plus.

[Neron, F104, male, 29, about access to drugs] J'ai vieilli, j'ai moins de facilité à m'en procurer, j'ai moins l'environnement et l'entourage pour pouvoir en avoir, il faudrait que j'entame des démarches plus grandes pour essayer de m'en procurer.

[Mike, F105, male, 30, general] [*Est ce que ta poly-consommation a évolué dans le temps?*] Entre mes 20 et mes 30 ans, on voit qu'il y a eu des pics mais...(silence) Tout ce que j'ai essayé, j'ai essayé à fond ! Ca a duré un an, on va dire. Quand je me disais qu'il n'y avait plus rien à en faire: voilà, j'ai fait le tour. [*T'as toujours pas fait le tour du cannabis?*] Non. C'est pas que j'en ai pas fait le tour mais que j'aime bien, que ça m'aide à bien vivre, je dirais, comme boire une bonne bière. Et je le vois pas comme une drogue non plus à partir du moment où j'en consomme pas tous les jours. J'ai fait le tour de me défoncer la gueule à longueur de journées, ça c'est clair. Fumer un petit joint le soir, c'est toujours bien ! [*Et qu'est ce que tu penses du cannabis maintenant?*] Je pense que tu peux te mettre quand même en danger avec ça, dans le sens où tu as vite

fait de te mettre à fumer toute la journée et là tu bousilles toute ta vie. Maintenant, si t'arrives à en faire un usage rationnel qui t'empêche pas de vivre ta vie de tous les jours, je pense pas que ce soit si dangereux que ça.

[Jurion, F106, male, 27, about ecstasy] L'ecsta, le problème, comme c'est une drogue qui est plus lourde, le lendemain t'es quand même pas frais. Généralement, j'en prends pas si le lendemain j'ai un truc à faire, parce que je sais que si je prends l'ecstasy, je vais finir à 6:00 du mat, ça dépend à quelle heure tu la prends, mais généralement j'en prendrai pas s'il est trop tard, je fais attention à pas en prendre trop tard. Si il est 3h ou 4h du mat déjà on oublie. Parce que sinon te voilà parti jusqu'à 9h-10h du matin, même si je bosse que le soir après, parce que tu te dépenses tellement au-delà du normal que ton corps il est ravagé le jour d'après. Donc c'est vraiment une drogue que je peux prendre que si le lendemain j'ai rien à foutre.

[Sony, F107, male, 28, about MDMA/LSD and social commitments] C'est sûr que par exemple, si t'as vraiment un truc super important le lundi, tu vas peut-être y aller plus mollo, tu vas peut-être te tourner vers un ecsta plutôt que vers du LSD parce que tu sais que l'ecsta, il va durer 6h alors que le LSD, même si tu le prends le soir, le lendemain, tu seras encore dedans, tu seras encore dans le pâté et même si avec l'ecsta, le lendemain, tu seras dans le pâté ce sera plus facile à gérer quand même le lendemain.

[Mike, F108, male, 30, about cocaine vs. other stimulants] T'es pas décalqué [avec la cocaïne], t'es pas à l'ouest, tu peux suivre une discussion. Tu peux être propre, enfin, tu peux paraître propre. Tu luttas pas on va dire, tu galères pas. Du reste, c'est assez léger les effets, j'ai envie de dire. C'est pas très fort. Le ressenti ! T'as pas la grosse..enfin tu as une petite montée et comparé aux autres, c'est pas très fort on va dire. C'est peut-être ça aussi qu'on passe à ce truc là en vieillissant sur ces trucs là.

[Jacko, F109, male, 31, about cocaine/ecstasy] Et c'est ce qui me dérangeait quand on parlait des effets du cacheton, de l'ecsta: il y a des moments où j'étais débordé et il y a des moments où s'il se serait passé quelque chose, j'aurais pas pu réagir. Surtout que tu vois pas à plus de deux mètres autour de toi. Donc ça, c'est chiant aussi d'avoir un champ de vision vraiment limité, de pas savoir comment réagir, putain, ça me fait un peu chier dans le sens là, j'aime bien me laisser aller, mais pas jusqu'à.... c'est ça que la coke te permet : c'est que tu te laisses aller, tu peux aller loin mais tu sais contrôler. C'est pour ça, c'est une drogue un peu plus adulte. Les jeunes, ils aiment bien peut-être se laisser plus aller et complètement fuir, ils sont plus dans l'adolescence. La cocaïne, c'est plus une drogue un peu plus âgée.

[Maggy, F110, female, 31, about heroin] J'étais pas bien, je savais que je

renvoyais une image de merde, de pure chiasse qui tient à peine debout et qui ne sait plus articuler. C'était vraiment ça, une meuf qui a mal partout, une merde, une loque humaine. Ca c'était pas ce que je cherchais du tout.

[Jacko, F111, male, 31, about control and responsibility] [*Tu me disais que ce que tu n'aimais pas chez les autres c'était la perte de contrôle?*] Perte de contrôle, et c'est ceux qu'il faut gérer à leur place. Dans le temps, parfois ça me faisait rire. Maintenant, ça me fait plus rire du tout. De devoir gérer quelqu'un... les gens qui s'abandonnent comme ça, je trouve ça vraiment nul [...] Tu risques de rire mais j'aime bien la drogue responsable. Je sais que quand je bois, quand je suis bourré par exemple, il pourrait se passer une couille, je pense que je sais comment réagir, je pense que je sais toujours comment réagir. Surtout avec l'alcool, c'est le genre de truc qui peut donner envie d'en reprendre et surtout que quand t'es bourré, tu peux ne pas te rendre compte de ce que tu prends et puis faire n'importe quoi.

[Neron, F112, male, 28, about alcohol] l'alcool peut te faire perdre une partie du contrôle, de faire sortir de tes gonds. Il y a beaucoup de gens et moi le premier, après une forte prise d'alcool, moi je me réveille avec des trous noirs, je sais pas pendant quelques laps de temps, quelques heures ce que j'ai fait, ou j'étais, ce que j'ai dit, et je trouve que c'est vachement paniquant. C'est subir et puis plus avoir le contrôle sur quelque chose que t'as été, que tu as fait et dont tu ne te rappelles plus. Et la, c'est un danger, si tu as perdu le contrôle à un certain moment dans ta soirée, ça peut être dangereux pour les autres puisque tu ne réponds plus de toi-même au final. Ouais c'est ça, et le danger c'est de moins voir le risque, parce que t'es dans un état plus relâché, plus zen, plus cool encore, donc c'est moins appréhendé ce qui peut se passer et te retrouver du coup par défaut dans des situations encore plus délicates.

[Neron, F113, male, 28, about magic mushrooms] Puis tout dépend des gens avec qui tu es, plus les gens autour de toi seront communicatifs et plus tu les aimes bien, plus ça va bien se passer. Plus ça va être avec des gens qui sont des inconnus, souvent t'es pas rassuré. Et parce que tu contrôles pas trop l'état dans lequel t'es, parce que le mec sous champignons il contrôle pas trop ce qu'il fait, c'est quand même rare. Tu es quand même un peu extraterrestre, si tu n'es pas avec des gens sous champignons dans un endroit... Si tu es avec d'autres, en communauté, qui sont pas sous champignons, ça va pas être forcément génial et même gérable, parce que tu es plus que remarqué.

[Jurion, F114, male, 28, about magic mushrooms] Avec les champignons, tu vas être sérieux cinq minutes et tu vas être mort de rire, tu vas te regarder en train d'essayer d'être sérieux et tu vas péter ton câble tout seul. Ou tu vas parler et d'un coup tu vas faire "OHHH" en regardant une mouche qui vole. Tu es un peu comme un malade mental sous champis. On peut t'enfermer.

[Neron, F115, male, 28, about cannabis] La drogue, il faut se droguer intelligemment, faut savoir quand, faut se connaître, faut connaître le produit sur toi et si tu veux pas que ce soit elle qui gère ta "life"..... après voilà tu choisis bien ce que tu regardes la télé, tu choisis bien ce que tu vas mettre dans ton assiette, tu sais à quelle heure tu manges, c'est un peu pareil pour la drogue. A 28 ans c'est ça, c'est canalisé, c'est géré, c'est budgétisé... Je peux même te dire combien ça me coûte par jour quasiment.

[Picasso, F116, male, 34, about heroin] [*Tu aimais bien l'effet de cette drogue?*] Oui l'effet. C'est pour ça que je me suis toujours interdit d'en reprendre parce que je pourrais retomber, ou je pourrais tomber dedans. [...] [*Qu'est ce que tu en penses maintenant?*] Moi je m'interdis pour les raisons que je t'ai données. Sauf si... Après je te dis que je me l'interdit, tu me sors un keps d'héro en me disant « moi j'en ai », je vais peut-être prendre une latte ça me ferait rire, mais sachant que jamais je ferai la démarche d'en chercher.

[Mike, F117, male, 30, about cocaine] [*Qu'est ce qui te ferait arrêter ou qu'est ce qui t'a fait arrêter la cocaïne ?*] Le fait de me rendre compte à quel point, ça commençait à prendre le dessus assez rapidement. Quand tu commences à penser beaucoup à ça et à y penser de trop, c'est pas bon. [*Comment tu gères ça?*] Je me dis que je dois résister... j'évite du reste d'aller dans des soirées si je sais qu'il va y en avoir de trop.

[Neron, F118, male, 28, about stimulant and surrounding people] Toutes ces drogues de synthèse je les ai toujours prises avec des gens que je connaissais, je n'ai jamais pris seul quand je le prenais seul c'est que je savais que ça allait aller, que je gérais. J'ai jamais vraiment eu de soucis parce que je faisais vraiment attention avant de partir dans ses délires d'être bien accompagné, d'être bien entouré, et puis je ne prenais jamais des quantités vraiment énormes.

[Jurion, F119, male, 27, about ecstasy] Comme c'est une drogue que j'ai toujours voulue occasionnelle, comme la plupart des autres drogues, c'est pas un truc où je vais pas me mettre avec des gens qui vont en prendre régulièrement, parce que je sais que je vais tomber dedans, donc c'est quelque chose que j'ai pris assez régulièrement avec des gens différents.

[Jurion, F120, male, 27, about ecstasy and his consumption in general] Avant c'était une fois tous les six mois, maintenant c'est devenu une fois tous les trois mois, c'est un truc qui est très occasionnel, c'est un truc que j'ai voulu garder comme ça, parce qu'on va dire qu'à partir de mes 20 ans, on va dire que je me suis quand même pas mal renseigné sur les drogues, donc je savais ce que c'était, je savais ce que ça faisait et je ne voulais pas en faire quelque chose de régulier. Enfin toutes les drogues que j'ai pris quelques soit la drogue... bon à part l'alcool et le cannabis,

c'est vraiment des choses que je n'ai pas voulu... Je n'ai pas voulu en faire quelque chose de régulier, j'ai toujours fait très attention à pas en faire quelque chose d'actuel, de quelque chose qui serait comme prendre un café. J'ai toujours fait attention à espacer.

[Neron, F121, male, 28, about cannabis rhythm of use] J'évite de fumer au matin à part pendant le week-end, et j'évite d'en fumer trop à moins que je sois en soirée, j'évite d'en fumer plus de deux à part si je suis en soirée, j'évite d'en fumer plus de deux en soirée normale. C'est ça mes limites, dans la quantité et puis j'essaye de fumer à partir de l'apéro.

[ElPoyo, F122, male, 31, about liquid MDMA] Par exemple la MDMA liquide que le gars qui s'est pointé au dernier festival, il nous a mis la moitié d'une fiole dans nos verres et on a pas demandé ce que c'était. Mais bon tu vois le gars qui s'en sert avant, qui en prend, tu l'analyses, il est pas complètement à l'ouest, il se met à se marrer tout ça. Tu fais gaffe. Même ce coup-là j'ai fait gaffe, j'ai pas vidé mon verre, j'ai pris quelques gorgées, j'ai goutté, j'ai attendu et j'ai vu. J'ai pas fait un cul-sec.

[Gourou, F123, male, 19, about cannabis] [*Est ce que tu as déjà eu des problèmes avec le cannabis ?*] Oui, oui, parfois pendant de trop grande consommation pendant des jours et des jours peut-être le fait d'être stone et de ne plus rien comprendre en cours, être à la masse, de ne plus intégrer, de ne plus savoir synthétiser dans les dissertations, le désordre mental. [*Quand ça arrive, tu fais quoi ?*] Quand ça m'arrive, je fume moins. Je fais un break. [*Tu fais un break de combien généralement ?*] Ça peut aller deux semaines à trois semaines. 15 jours.

[LittleDevil, F124, male, 28, about alcohol] Les lendemains de cuites je me dis que je picole trop et dans l'ensemble je me dis que ça va...parce que je me fais régulièrement quinze jours, un mois sans alcool pour me prouver à moi même que je peux travailler dans un bar et résister justement à ça et j'y arrive.

[ElPoyo, F125, male, 31, about alcohol and cannabis] les soirées avec mes potes ou il y a pas de produits et puis tout ça [sous-entendu psychostimulants], là c'est vrai que j'ai consommé carrément plus d'alcool, et j'ai fait quelques soirées énormes où j'ai fait des trous noirs avec des "one man show". Parce que c'est vrai que le pétard ça te permet de moins boire. Tu fumes ton petit pète et ça te rend stone, et ça te permet de réduire ta consommation d'alcool.

[Mike, F126, male, 30, about stopping drugs] Je savais ce que je faisais même si c'est plus ou moins débile tout ce que j'ai fait, ça, j'en ai bien conscience, mais j'ai jamais eu un usage trop irrationnel. Toujours contrôler le contexte dans lequel j'en prenais. J'en ai jamais pris n'importe où et n'importe comment. Ça m'a jamais empêché de bosser, je dirais. C'était surtout ça le truc important, essayer de conserver un

rythme la semaine. Souvent, il y a peut-être ça aussi, j'arrêtais quand ça commençait à chambouler mon rythme la semaine. Si le lundi ça va pas, tu te dis "allez, on va pas faire ça toute la vie".

[Sony, F127, male, 28, about cannabis vs. stimulants] [*Qu'est ce que tu n'aimes pas avec l'herbe au final?*] C'est le fait de rien foutre et c'est en ça que je dis que la weed, c'est peut-être un des trucs les plus pernicioeux parce que très franchement, ça m'est déjà arrivé de faire des démarches administratives ou de venir en cours ou d'aller à une heure de conduite en ayant tapé une petite trace de speed ou une petite trace de coke avant et personne ne le voit..personne ne le sent. Ça m'empêche pas du tout de faire mes trucs. Bon, c'était plus occasionnel... c'était vraiment plus pour le délire de me dire "allez vas y, après une petite, je vais en cours". Bon voilà, ça mange pas de pain quoi, tu deviens pas la bête. Non c'est tout à fait gérable. [...] franchement, pour moi, c'est plus méchant de fumer un pétard qu'une ligne de coke parce que voilà, tu peux taper ta ligne de coke, comme je disais tu vas pouvoir..tu peux aller acheter ton pain, aller faire tes courses..tu peux aller en cours, tu peux discuter avec ta voisine de pallier qui elle (siffle) est bien droite, elle connaît rien, elle fume pas..enfin voilà, tu peux avoir une activité normale...ça va pas se voir..tu vas avoir la pêche, tu vas sentir que t'as ton palet qui est tout endormi mais ça ne se voit pas. Tu peux gérer une activité normale. Mais la weed, c'est pernicioeux dans le sens où tu fumes, bah non t'as pas envie d'aller en cours, t'as pas envie de faire les choses, t'as pas envie de faire tes démarches, t'as pas envie de chercher un boulot. C'est vraiment la drogue qui te scotche le cul au canapé et tu fous rien. Ça t'empêche d'avancer dans ta vie et c'est en ça que pour moi, c'est un des pires trucs.

[Neron, F128, male, 28, about commitments and risks] [...] je préfère me dire que je suis accroc au cannabis et même si ça me mets déjà dans la merde, ça me met déjà moins dans la merde d'un point de vue social et professionnel que d'être accroc à la cocaïne ou êtes accroc à l'ecstasy. Quand je fume deux pétards le soir et j'ai un peu de mal à me réveiller le matin... mais quand j'arrive au boulot, j'ai quand même un cerveau qui est posé et assez aéré, et je peux réfléchir. En tout cas, j'ai l'impression d'avoir la pleine capacité mentale quand je travaille. Alors que je suis sûr du contraire si j'avais pris un LSD la veille, ou un ecsta la veille, je n'irais même pas au boulot. [...] Avec la fonction que j'ai aujourd'hui, je ne peux pas me permettre ça. Je sais qu'au jour d'aujourd'hui, si tu me présentais de la coke ou du LSD ou quoique ce soit, ça sera pour les vacances, un weekend. Mais ce sera jamais en pleine semaine et même le week-end c'est pas possible, je connais les répercussions du truc et je repartirai pas dans un trip comme avant. Je ne remettrais pas tout en jeu juste pour une soirée et se taper un délire. Ces drogues la, c'est un peu aussi l'effet qu'elles apportent: tu remets toute ta vie en jeu, tout ton équilibre en jeu à chaque prise.

[Sammy, F129, male, 36, about ecstasy] Ce que je n'aime pas c'est les gros lourds qui tapent comme des gorets, qui suent comme des porcs,

qui grincent des dents, qui sont totalement éclatés de chez éclatés, ils arrivent pas à aligner trois mots sans bafouiller ou sans baver. Ils ont arraché la moitié de leurs dents. Ca j'aime pas, mais c'est comme tout, c'est les gens qui font dans l'excès.

[ElPoyo, F130, male, 31, about speed] De toutes façons, tu vois tous les gars qui sont vraiment a fond dans le speed c'est des gars qui sont super crevés, super excités avec les yeux et les joues creusés, tu peux te dire c'est sûr que le gars il carbure au speed. Ça se voit complètement, quelqu'un qui carbure au speed.

[Jacko, F131, male, 31, about MDMA liquid] J'ai senti aucune montée, aucune suée, rien du tout... tandis qu'un petit jeune qui est venu en début de soirée, il a complètement disjoncté ! Vraiment ! Et en prenant presque moins que nous. Donc, je crois qu'avec l'âge et à force d'en prendre, tu développes une sorte d'aptitude, ça c'est sûr. [*Later in the interview*] C'est déjà arrivé des situations où c'était débile de prendre quelque chose parce qu'on avait pris quelque chose pas longtemps avant et c'était pas encore monte. Genre un trentenaire avec qui je suis sorti à Nouvel An, qui m'a fait pitié parce que le mec, il savait même plus ce qu'il avait pris 5-10 mn avant, tellement il était bourré! C'est marrant parce que j'ai fait le test: j'ai demandé c'était quand la dernière fois qu'il avait pris. On sortait de la voiture..donc on était sur le parking, on avait pris, on sort de la voiture, je lui demande, il savait plus. Donc, lui, je lui ai fait la morale en semaine et il se souvenait plus de rien. Des trucs comme ça, c'est sûr, ça fait flipper. Je le vois même plus le mec.

[Jacko, F132, male, 31, general] [*Qu'est ce que tu n'aimes pas dans le comportement des autres en général?*] Les gens qui prennent pas de distance par rapport à ça. Il y a ça et il y a ceux que je croise en boîte qui maîtrisent plus rien et qui sont content de plus rien maîtriser. Je trouve que ça dérange les gens. En gros à partir du moment où t'es présentable et à partir du moment où tu l'as bien intégré, que tu sais gérer, moi j'ai beaucoup plus de tolérance par rapport à ça. Mais ceux qui sont vraiment... ceux sur qui ça se voit trop, ceux sur qui comment dire, qui maîtrisent plus rien et qui sont bien content de plus rien maîtriser mais au détriment des autres qui sont autour, ça, ça me prend la tête.

[LittleDevil, F133, male, 29, about cocaine] [*Qu'est ce que tu n'aimes pas dans cette drogue?*] Sur moi, rien, parce que je me modère, je me contrôle. Par contre chez les autres, la consommation extrême [...] y a des acharnés, comme je te disais tout à l'heure chez certains ça leurs brûlent les pattes, vraiment ils en ont, y tapent. Ici, j'ai fait des soirées, le mec il avait 2 grammes sur lui, sur la soirée les deux grammes ils avaient disparu. Bon d'accord, si on est quatre - cinq, il offre une trace à tout le monde, mais tu le voyais régulièrement en train de.... (il mime le geste de quelqu'un sniffant de la cocaïne).

[LadyFly, F134, female, 24, about cocaine] Ca peut aller loin je pense; ça

peut aller jusqu'à ce que... je connais des gens qui consomment trois, quatre grammes par jour parfois ou bien même en semaine tout le temps, tous les jours, consommation de 10 ou 15 grammes par semaine. [*Qu'est ce que tu en penses?*] Je pense que c'est la drogue qui prend le dessus, que t'es un petit peu accroc et que tu peux pas arrêter, que tu peux pas faire sans.

[LittleDevil, F135, male, 28, about his ecstasy consumption] [*L'ecsta tu me dis entre 2 et 4 par soirée?*] Pas plus, j'aime pas, pour en prendre un à 7h du mat, tu décolles, à 7h30 t'arrives chez toi, t'es encore sous le produit, c'est pas... je suis pas un addict, il faut pas tout terminer quand on est en soirée, non je fais ma consommation, je fais ma soirée et je te dis généralement quand j'en achète, il m'en reste. C'est pour ça quand j'achète un gramme, je préfère le séparer, j'en garde ici pour notre consommation récréative...

[Jurion, F136, male, 27, about methamphetamine smoke on foil] la modalité [fumer sur une feuille d'aluminium] déjà ça fait vraiment toxicos, ça fait vraiment penser au junky, ça fait vraiment penser au crack, ça fait très drogue dure.

[Sony, F137, male, 28, about injection] [...] donc de l'héroïne, j'en ai pas pris beaucoup. J'en ai pris deux fois dans ma vie et pas par injection parce que voilà, les piqûres, c'est un truc, il en est hors de question parce que ça te marque socialement, c'est à dire qu'avoir des traces de piqûres sur ton bras, bah, socialement, t'es mort. Il y a pas photo direct, tu seras fiché.

[Jacko, F138, male, 31, about cocaine] Par exemple, c'est arrivé dernièrement: quelqu'un que je voyais avant, il y a longtemps, qui voulait à tout prix acheter un truc à mon copain A.. Et mon pote lui a pas vendu tellement il faisait pitié, tu vois... En fait, ceux qui transpirent trop le produit, ça me dégoûte vraiment..

[Maggy, F139, female, 31, about heroin addicts] Je les aimais pas du tout en général, y a rien que j'aime bien chez eux, parce qu'en consommateurs d'héroïne c'est une putain, un consommateur d'héroïne est une putain et j'aime pas les consommateurs d'héroïne (relance) je dis que c'est des putains, parce que il n'y a rien qui compte autre que ça et ce sont des gens qui vendraient père et mère, qui tueraient leur mère pour leur consommation. Il n'y a plus de valeur, il n'y a plus de valeurs humaines. Aucune. Il y a qu'un truc qui compte et à mon sens et d'après mon expérience, c'est la seule drogue au niveau de l'accoutumance qui rend les gens comme ça.

[Gourou, F140, male, 19, about heroin addicts] Les toxicos à l'héro ce que j'aime pas, c'est qu'ils sont toujours dans le besoin et dans la dépendance des autres, ils dépendent des autres ils ont du mal à se gérer ils sont trop ailleurs. Souvent ils réclament, ils racolent parfois ils

peuvent être agressifs pour leur drogue aussi quand ils sont en manque de drogue. C'est un peu leur besoin de drogue qui les anime c'est ça qui me gênent.

[Diane, F141, female, 31, about cannabis] Après ça dépends y en a qui gère bien, mais y en a qui sont complètement amorphes et qui foutent rien de leur journée. Enfin moi c'est ce que j'ai remarqué, les gros fumeurs de joints, ils font rien. [...] D'après mon expérience et ceux que je connais, les gens qui fument un gros joint dès le matin, ils font rien de leur journée.

[Sammy, F142, male, 36, about his reasons to continue cannabis] Rien de particulier, le goût, l'effet que ça fait, c'est pas le fait d'être malheureux, d'être dépressif ou en échec, d'avoir un problème familial. C'est vraiment purement volontaire. C'est parce que j'aimais ça voilà point.

[Ursula, F143, female, 24, general] [*Est ce que tu as des règles vis-à-vis de ta consommation?*] je ne consomme pas toute seule, même le joint, même l'alcool. L'alcool, ça m'est déjà arrivé de sortir un jour une bière du frigo et de me dire «Qu'est ce que je fais avec mon verre ?» Et le joint pareil, pas toute seule, rien toute seule. Parce que ça me ferait flipper, parce que pour moi, une drogue ça se partage et parce que pour moi, les gens, ils doivent être là si jamais voilà. Donc ça, c'est vraiment une grosse limite que je trouve quand même que tout le monde n'a pas et même de la coke, on me donne de la coke toute seule, je la prendrais pas, j'appellerai quelqu'un pour en prendre. Même en soirée, je vais pas toute seule aux toilettes pour prendre un rail de coke si j'en ai.

[ElPoyo, F144, male, 31, general] Mais ce qu'il y a aussi, c'est qu'on est dans un groupe, on est dans un groupe de gars pas méchants [...] parce que c'est vrai qu'on n'est pas conventionnel par rapport aux drogues. Par exemple on va arriver à une soirée, le gars il fait tomber le keps de cocaïne dans le chiotte ça va nous faire rire, tu vois ça va nous faire rire ça va pas créer une embrouille ; dans d'autres trucs ça peut créer une embrouille terrible... nous voilà on s'en tape. Voilà où nous je crois qu'on s'en fout de la drogue, je crois qu'on s'en tape mais complètement. On va chouer, on va prendre des trucs et tout ça, mais au fond nous on s'en tape. C'est pas primordial. [...] Mais sinon dans le groupe, il n'y a jamais eu de personnes qui sont tombées dedans. On a tout le temps considéré la drogue pour faire la fête, pour faire la fête et pas pour notre bien-être. C'est pour faire la fête, c'est vrai que ça ne me viendrait pas à l'idée d'acheter 1 g de cocaïne pour moi tout seul, pour : «j'ai rien à faire aujourd'hui, tiens je vais acheter 1 g de coke et je vais chouer».

[Jacko, F145, male, 31, about controlled/compulsive use] Comme je dis souvent il faut faire gaffe à pas provoquer la fête pour pouvoir en prendre. C'est pas l'inverse et donc je me mêle plus trop aux gens comme ça. Justement à mon âge, on voit des gens qui ont vraiment besoin de ça

et qui créent des fêtes justement pour pouvoir [en prendre]. Mais, il y a aucun thème sur leurs fêtes: le thème récurrent c'est en prendre et ce sont des gens qui sont un peu usé et ça, ça m'a un peu calmé. Le noyau dans lequel je suis, c'est vraiment pour la fête. Et surtout, on parle jamais de ça. C'est quelque chose qu'on a intégré mais on en parle jamais, vraiment. En fait, on essaye d'en avoir mais ça dure une phrase sur un coup de fil, là ça dure..bah ça va très très vite et c'est pour ça en fait qu'on continue. Mais la dernière fois, on en a cherché avec un copain, pendant 1/4 d'heures, on a passé des coups de fil et on en a vite eu marre, on a fait «pfff, on arrête parce que ça prend la tête». Le truc, c'est qu'on va pas s'obstiner comme des fous. Si on peut, c'est bien, sinon, c'est tout.

[Sammy, F146, male, 36, general] chacun fait ce qu'il veut, j'ai pas de préjugés par rapport à ça, j'ai pas de préjugés par rapport aux gens qui boivent, j'ai pas de préjugés par rapport aux gens qui fument, j'ai pas de préjugés par rapport aux gens qui se droguent. Après quelles sont les raisons et les motivations j'en sais rien, mais moi, je fais ce que je veux pour moi [...] après chacun fait comme il veut, généralement j'essaie de prévenir ce qui n'en ont jamais pris et qui veulent en prendre. Les gens qui en prennent, de les temporiser, après ils font comme ils veulent, je suis pas leur père, mais c'est vrai que j'ai toujours eu une démarche assez patriarcale, après chacun ses merdes. Et maintenant, j'en suis à un point, j'en ai plus rien à branler, j'ai pas envie qu'on me casse les couilles, les mecs qui tapent et qui me cassent les couilles, c'est barre toi, out, dégage.

[Diane, F147, female, 31, about ecstasy] Bah surconsommation, il ne sont plus pareil. J'ai l'impression que leur cerveau a du tilter, ils ne sont plus les gens que j'ai connus. [elle rit] [*Quelle a été ta réaction vis-à-vis de ces gens qui ont déconnectés ?*] Bah tu essayes de les aider mais bon après... Tu peux pas faire grand-chose... Parce que eux sont persuadés qu'ils vont bien. Enfin moi, j'ai des amis qui sont complètement déconnectés et je sais que c'est à cause de ça. Et tu ne peux plus avoir une conversation normale avec eux. Dès qu'ils boivent un verre d'alcool ou qu'ils prennent un truc, c'est fini. Tu ne peux rien faire, ils ont passé le stade de non retour, c'est fini. [*Tu sors encore avec eux ?*] Non, parce qu'ils sont complètement cons. Ils sont paranos, ils se tapent des films sur n'importe quoi, ils sortent des trucs inconsiderés, que tu ne peux même pas justifier. Tu n'es plus sur la même longueur d'onde.

[Jurion, F148, male, 27, general] [*Est-ce que tu as déjà perdu de vue des gens après ce type de comportement chez eux ?*] Ouais, c'est arrivé. Alors après que ce soit ça c'est pas forcément fait comme ça entre quatre yeux du style tu bois trop je veux plus te voir. C'est généralement des trucs qui se font de manière insidieuse au fil du temps, où tu commences à voir les personnes de moins en moins et comme tu les vois de moins en moins, tu as de moins en moins de choses à leur dire, tu as moins en moins de contacts avec eux et finalement ils disparaissent petit à petit de ta vie.

C'est sûr que j'ai perdu pas mal de gens sur la route parce qu'ils prenaient trop, et que sortir avec eux c'était devenu un problème plutôt qu'un bon moment. Et ça c'est arrivé avec l'alcool, avec le cannabis, et tous les gens qui abusent d'une substance, au bout d'un moment si toi-même tu n'es pas, tu n'abuses pas non plus de cette substance, tu vas commencer à te rendre compte que, de une, ce ne sont pas des gens qui te tirent par le haut et que ce sont des gens qui vont plutôt te pousser à consommer plus; et de deux, ce sont des gens qui ont un problème avec leur consommation, et qui par la même ont un problème dans leur vie sur plusieurs aspects.

[Picasso, F149, male, 34, about crack cocaine] mais je pense que tu as cette espèce d'inconscient collectif chez les gens: quelqu'un qui se drogue mais qui est dans cette espèce de partage de la drogue, et qui va prendre des drogues que quand il est avec des gens ça va passer.... par contre quelqu'un qui a un rapport à la drogue où il va consommer tout seul, ça va toujours être mal vu par le groupe, je pense que d'une façon globale, après ça peut être pas avoué mais c'est vrai. [...] Après je te dis ça dépends des types de drogues, par exemple quand je fume de la C [crack], c'est inconcevable en groupe. Ça c'est vraiment un truc que je vais vraiment faire tout seul, ou avec vraiment pas beaucoup de gens étant donné que je sais que c'est une saloperie. Généralement, je vais le faire avec des gens qui l'ont déjà fait ou qui le font. [...] Le but ça va être ça à l'arrivée, même quitte à esquiver des gens... bah d'ailleurs hier, je te l'ai pas dit, mais dans la soirée d'hier, la copine chez qui je suis passé, je lui disais je vais rentrer « il faut que je mange, j'ai vraiment faim », mais ça me disait surtout d'aller m'enfermer pour faire ça [smoke crack]. Et elle va essayer de me tenir et de me dire « vas y reste la ». Ça c'est mon côté ours et je vais quand même y aller. Et c'est même pas forcément cool dans ton rapport avec tes amis : tout d'un coup.... c'est un truc très personnel, très égoïste le crack, c'est la quintessence de toutes ces conneries là.

[Picasso, F150, male, 35, about crack cocaine] J'ai un très bon exemple, une fois, j'ai des potes qui sont dans les prises de drogue du style du LSD, de l'ecstasy, où ce sont plutôt des clubbers, qui sont vachement dans le partage, c'est-à-dire que voilà ils vont avoir une drogue à un moment, ils vont proposer à tout le monde, enfin vraiment, c'est pas ton p'tit truc pour toi pour ta gueule, pour toi aller le taper aux chiottes. Donc vraiment naturellement quasiment dans toutes les situations, ils sont comme ça. Et donc une fois, on vient ici et forcément j'ai commencé à faire du free base et il y a deux, trois personnes qui ont essayé et ils ont bien aimé parce que c'est un truc qui marche vraiment bien au départ et qui a vraiment un effet de dingue. Et bah ça n'a pas le loupé, au bout de peut-être une heure ou deux, tu voyais tous ces gens qui sont dans le profil que je viens de te citer et qui commençaient à regarder qui mets quoi sur sa petite pipe, où en est la cuillère, si il en a pas trop mis. Ça te change le comportement des gens. [...] Pour te dire simplement que le produit a pris le dessus sur tout le monde. (relance). Voir si celui-là y

s'en mets pas trop, voilà on a acheté ensemble pour l'après-midi, donc voilà tu vois ce qu'il en reste, et si y en a pas un qui a saute son tour où quelqu'un tu en prends trop, des trucs comme ça par exemple... alors qu'avec d'autres trucs ils en auraient rien à foutre.

[Maggy, F151, female, 31, about cocaine and addiction] Pour te remettre dans le contexte, il y ait eu une histoire avec ce mec avec qui j'ai rompu et après j'ai coupé les ponts avec tout le monde. Je me suis retrouvée toute seule, toute seule avec ma cocaïne. Et il y a un jour où tu te regardes et où tu te dis, bah y'a que ça dans ta vie. Et c'est à ce moment-là, où j'ai rencontré et appris à connaître d'autres gens qui sont mes amis de maintenant, les D. et compagnies, les mecs de Nouvelle-Calédonie. Tout ça en fait, c'est un petit peu eux qui m'ont sorti de tout ça (relance) c'est-à-dire que je me suis reposé sur eux, j'ai décidé toute seule d'arrêter mes conneries on va dire, parce que ma vie ne me plaisait plus. A un moment, je me suis dit : "Tu es toute seule avec la cocaïne. Ça vaut rien en fait, je ne vaux rien, tu ne vaux pas un clou, tu n'as pas de potes, ta famille tu l'as laissé de côté pendant trop longtemps, tu n'as pas de pote, t'as rien, tu viens de perdre ton boulot, ton boulot vient de se terminer [end of a temporary contract], what are you doing now?" Donc j'ai renoué des liens avec ma famille, et j'ai cherché à me faire une nouvelle bande de potes, parce que mes vieux potes d'enfance qui me ramassait à la petite cuillère le dimanche au bout d'un moment c'est pareil et je les ai plus ou moins perdus... enfin j'ai encore des contacts avec eux mais je me suis écarté d'eux, tu vois parce que on n'était pas dans le même délire et que moi j'étais toujours dans les extrêmes alors que eux non, donc on s'est un petit peu éloigné... En fait ma vie est devenue vide et je l'ai remplie de cocaïne. Mais il y a un jour où j'ai réalisé, je sais pas pourquoi, j'ai réalisé tout simplement je commençais à faire des nouvelles rencontres, Dany et les autres, j'étais encore a fond dedans et puis j'ai décidé un jour de me concentrer là-dessus. Sur mes nouvelles amitiés, sur ressouder les liens avec la famille, ressouder les liens avec mes anciens potes. Et puis, pour y arriver, je me suis interdit d'avoir accès au marché encore une fois il y a des gens sur qui j'ai fait une croix pour ne plus en avoir, pour ne plus être confronté à ça et pour ne plus être tenté d'acheter. Et c'est comme ça que j'ai arrêté, et ça a été ultra méga dur. Les nouvelles amitiés que j'avais à ce moment-là, ils ne savaient pas et ils m'ont aidé. Ils m'ont aidé à passer le temps, à se découvrir. À passer le temps et à pas trop y penser, à essayer de pas trop y penser. À m'occuper autrement.

Annex 7. Verification of Complex Algorithms

"Brawl" (cf. p.313): this operation requires several changes and leads to other operations.

Verification:

(a) *Do users with "Aggressive" or "Sedated" behaviors could have a fight if there are on the same patch and if the %brawl is equal to 100%? Do these users see their mem-behavior and Health attributes modified? Do they get "bounce" outside the venue they were in? "Aggressive" users isolated on patch should fight and modify their attributes accordingly to the code, before moving to one-of the nearest "Street" patch. The code related to this verification is as follows:*

First, the number of "assault" is verified and two *users* are sent to a 'Bar' patch located on the grid at the coordinates [1 10]:

```
observer> show assault
observer: 0
observer> ask n-of 2 individual with [typ? = "user"] [setxy 1 10]
observer> show [who] of individual with [xcor = 1 and ycor = 10]
observer: [499 400]
```

These two *users* have their ID equal to 499 and 400. Before the test, their Health, membehaviour, and Behaviours attributes are as follows:

```
observer> show [Health] of individuals 499
observer: 78
observer> show [Health] of individuals 400
observer: 68
observer> show [membehaviour] of individuals 499
observer: [0 0 0 0 0 0 0]
observer> show [membehaviour] of individuals 400
observer: [0 0 0 0 0 0 0]
observer> show [behaviour] of individuals 499
observer: ["Normal" "Normal" "Normal" "Normal" "Normal"]
observer> show [behaviour] of individuals 400
observer: ["Normal" "Normal" "Normal" "Normal" "Normal"]
```

Second, these two *users* need to become aggressive:

```
observer> ask individual with [xcor = 1 and ycor = 10] [set behaviour replace-item 4
behaviour "Aggressive"]
observer> show [behaviour] of individuals 499
observer: ["Normal" "Normal" "Normal" "Normal" "Aggressive"]
observer> show [behaviour] of individuals 400
observer: ["Normal" "Normal" "Normal" "Normal" "Aggressive"]
```

Then, the "%Brawl" parameter has to be set to 100:

```
observer> set %brawl 100
```

Finally, the two *users* are asked to tun the **brawl** operation:

```
observer> ask individual with [xcor = 1 and ycor = 10] [brawl]
```

The outputs in terms of *users* Health, membehaviours, and location are as follows:

```
observer> show [Health] of individuals 499
observer: 73
observer> show [Health] of individuals 400
observer: 63
observer> show [membehaviour] of individuals 499
observer: [0 0 0 1 0 0 0]
observer> show [membehaviour] of individuals 400
observer: [0 0 0 1 0 0 0]
observer> show [patch-here] of individuals 499
observer: (patch 0 12)
observer> show [patch-here] of individuals 400
observer: (patch 0 10)
observer> show assault
observer: 1
```

The outputs indicate that these two *users* have lost 5 points of Health, have modified their membehavior attribute, and have been "bounced" out of the 'Bar' location. Finally, the "assaults" outputs is increased by 1 to acknowledge the fight. It has to be noted that *users* have 10% of probability to lose more Health and execute the **treat** operation.

(b) *Do agents with behaviors different from "Aggressive" and "Sedated" can be involved in brawl? Do agents with the "Aggressive" or "Sedated" behaviors can trigger a fight if the %brawl value equal zero? In both cases, these agents should not be fighting and their attributes should remain unchanged.*

The first negative test consists of setting the Behavior of one of the two *users* to "Normal" and the other *user* to "Aggressive":

```
observer> set assault 0
observer> show assault
observer: 0
```

```

observer> set %brawl 100
observer> ask n-of 2 individual with [typ? = "user"] [setxy 1 10]
observer> show [who] of individual with [xcor = 1 and ycor = 10]
observer: [332 352]
observer> ask individuals 332 [set behaviour replace-item 4 behaviour "Aggressive"]
observer> ask individuals 352 [set behaviour replace-item 4 behaviour "Normal"]
observer> show [item 4 behaviour] of individuals 332
observer: "Aggressive"
observer> show [item 4 behaviour] of individuals 352
observer: "Normal"

```

Once the %brawl has been set to 100 and the Behaviour of the two *users* parameterized, they run the **brawl** algorithm:

```

observer> ask individual with [xcor = 1 and ycor = 10] [brawl]
observer> show assault
observer: 0

```

As indicated, the number of assaults remain equal to zero, which indicates that only *users* exhibiting the "Aggressive" or "Sedated" Behavior could fight.

The second negative test consists of setting the "%brawl" parameter to zero and observe the number of assault if all *users* on the grid are located on the same 'Bar' patch with their Behavior attribute set to "Aggressive" or "Sedated":

```

observer> ask individual with [typ? = "user"] [setxy 1 10]
observer> ask individual with [typ? = "user"] [set behaviour replace-item 4 behaviour "Aggressive"]
observer> show modes [item 4 behaviour] of individual with [typ? = "user"]
observer: ["Aggressive"]
observer> set %brawl 0
observer> show assault
observer: 0

```

Then, the test asks all *users* to run the **brawl** algorithms and assesses the number of assaults several times:

```

observer> ask individual with [typ? = "user"] [brawl]
observer> show assault
observer: 0
observer> ask individual with [typ? = "user"] [brawl]
observer> show assault
observer: 0
observer> ask individual with [typ? = "user"] [brawl]
observer> show assault
observer: 0

```

If the %brawl is set to 1, 2 or 5, *users* will start to be involved in fight:

```
observer> set %brawl 1
observer> ask individual with [typ? = "user"] [brawl]
observer> show assault
observer: 6
observer> set %brawl 2
observer> ask individual with [typ? = "user"] [brawl]
observer> show assault
observer: 17
observer> ask individual with [typ? = "user"] [brawl]
observer> show assault
observer: 24
```

"Buy" (cf. p.292): the different **buy** algorithms are essential to the model and they involved both *users* and *dealers*.

Verification:

(a) *Do users obtain the right substance and amount when buying drug from dealer? Does the amounts of money exchanged between the 'user' and the 'dealer' are equal? Does a user searching for a particular substance would be able to find a dealer if it does not know any? Does a user "finding" a dealer change its known-dealers attribute accordingly to the type of dealer met?* These algorithms are tested by isolating one *user* and one *dealer*. The exchange of money and substances should be consistent with the code. *User* trying to buy drugs without a consistent *dealer* address move accordingly to the code (i.e. going nearby a random 'Dealer-Place' or by moving to potential location of sell) and should add the ID of the *dealer* to their known-dealers list.

In the next scenario, a *user* (577) and a cocaine *dealer* (463) are moved to the "Disco" location as defined in the Territory attribute of *user* 577 (here, -10 -9):

```
observer> show hours
observer: "00:00-02:00"
observer> show [Territory] of individuals 577
observer: [-37 21 -10 7 -10 7 -10 -9 11 3 -53 -66 -2 15]
observer> ask one-of individual with [typ? = "user"] [setxy -10 -9]
observer> ask one-of individual with [typ? = "dealer" and drugtype = "Cocaine"] [setxy -10 -9]
observer> show [who] of individual with [xcor = -10 and ycor = -9]
observer: [577 463]
observer> show [who] of individual with [xcor = -10 and ycor = -9 and typ? = "user"]
observer: [577]
```

```

observer> show [who] of individual with [xcor = -10 and ycor = -9 and typ? = "dealer"]
observer: [463]
observer> show [item 2 possession] of individuals 463
observer: 50

```

Then, "Cocaine" is added *user 577* drug-searched attribute to mimic the fact that this agent is looking for cocaine. To insure that this *user* does not already have cocaine and that it does not know a cocaine *dealer*, these two attributes are fixed to zero. The Cash attribute is set to 360 for making sure that this *user* has enough money to buy cocaine:

```

observer> ask individuals 577 [set drug-searched replace-item 2 drug-searched "Cocaine"]
observer> ask individuals 577 [set known-dealers replace-item 1 known-dealers 0]
observer> ask individuals 577 [set possession replace-item 2 possession 0]
observer> ask individuals 577 [set Cash 360]

```

Once all the parameters set, the Cocaine Stage of *user 577* is verified and this agent is asked to run the **buy-cocaine** algorithm:

```

observer> show [item 2 Stage] of individuals 577
observer: 1
observer> ask individuals 577 [buy-cocaine]
observer> show [item 2 possession] of individuals 577
observer: 3
observer> show [item 1 known-dealers] of individuals 577
observer: 463
observer> show [item 2 possession] of individuals 463
observer: 47

```

The *user 577* bought three units of Cocaine to the *dealer 463* and keeps its ID in its known-dealers attribute.

(b) *Can a user buy drugs to a dealer without enough stock?* No drugs, nor cash should be exchanged.

The negative part of this test consists of asking all *users* to search for Cannabis in a context of "full-availability" (all *users* know to whom buy any type of substance). The first round of **buy-cannabis** drains the possession of all the *dealers*.

```

observer> ask individual with [typ? = "user"] [set drug-searched replace-item 1 drug-searched "Cannabis"]
observer> show sum [item 1 possession] of individual with [typ? = "user"]
observer: 0
observer> show sum [item 1 possession] of individual with [typ? = "dealer"]
observer: 250
observer> ask individual with [typ? = "user"] [buy-cannabis]
observer> show sum [item 1 possession] of individual with [typ? = "user"]

```

```
observer: 250
observer> show sum [item 1 possession] of individual with [typ? = "dealer"]
observer: 0
```

If, just after this first round, the **buy-cannabis** is executed again, the Cannabis possession of *users* will not increase, because the *dealers* run out of stock:

```
observer> ask individual with [typ? = "user"] [buy-cannabis]
observer> show sum [item 1 possession] of individual with [typ? = "user"]
observer: 250
observer> show sum [item 1 possession] of individual with [typ? = "dealer"]
observer: 0
```

"Check-others-behavior" (cf. p.208): this operation and the next one (check-self-behavior) are the main sources of changes in the meanings attached by *users* to the substances they are using or could potentially use.

Verification:

- (a) *Do the values of the SocialRepresentations are modified accordingly to the code if an agent is located on the same patch of agents consuming the same substances as it and displaying positive/negative Behaviors values?* Inappropriate behaviors exhibited by other *users* should lead to a decrease in the SocialRepresentations values, and conversely with positive behaviors ("Happy", "Relax", "Energy", etc.). These tests were realized by isolating several *users* on the same patch and by modifying one or several values of their Behavior and memuse attributes.
- (b) *Do the values of the SocialRepresentations change if the agent is alone or if other agents behave normally?* No changes should be observed.

Several respondents considered the aggressiveness coming from individuals inebriated, as modifying their own perceptions regarding alcohol (for an example please cf. Batman statement 5.3.1). The **check-others-behavior** aims to reproduce the "mirror" effect described by respondents when observing other users with inappropriate behaviors.

To achieve these tests, five *users* are randomly picked up and sent to the same 'Disco' location. The scenario consists here to force one of

these *users* (*individual* 537) to exhibit the "Aggressive" Behavior and to display a recent consumption of alcohol (item 0 last-use):

```
observer> ask n-of 5 individual with [typ? = "user"] [setxy 4 -3]
observer> show [who] of individual with [xcor = 4 and ycor = -3]
observer: [537 535 622 633 550]
observer> ask individuals 537 [set last-use replace-item 0 last-use 2 set behaviour replace-item 4 behaviour "Aggressive"]
```

The **check-others-behaviours** algorithm functions on *users* that have consumed similar drugs in the same time step as the *user* having an inappropriate Behavior. Therefore, the other *users* present in the 'Disco' location need to have also consume alcohol:

```
observer> ask individual with [xcor = 4 and ycor = -3] [set memuse-tick replace-item 0 memuse-tick 1]
```

To assess the impact of the "aggressive" behavior displayed by *user* 537 on surrounding *users*, their initial SocialRepresentation concerning alcohol are presented before executing the **check-others-behaviour** operation:

```
observer> show [item 1 belief-alcohol] of individual with [xcor = 4 and ycor = -3]
observer: [1.937 0.611 1.742 0.990 1.596]
observer> show [item 1 belief-alcohol] of individuals 537
observer: 1.742
observer> ask individual with [xcor = 4 and ycor = -3] [check-others-behaviour]
observer> show [item 1 belief-alcohol] of individual with [xcor = 4 and ycor = -3]
observer: [1.664 0.142 1.742 0.990 1.265]
```

As it could be noted, the SocialRepresentation value of only three *users* have changed. It has to be reminded that the functioning of the **check-others-behaviour** operation involved an element of randomness to mimic the fact that one or several *users* may or may not considered this particular Behavior as inappropriate or may not see the incriminate *user* behave badly. Furthermore, the SocialRepresentation of the *user* 537 does not change because he is the *user* displaying the inappropriate Behavior.

Conversely, several respondents explain that, during their initiation phase, the fact of witnessing "positive" behaviors of peers using alcohol as inferred a positive image

The verification can continue with the same *users*. This time the Behavior of *user 537* is set to "Normal" to evaluate if the SocialRepresentation of surrounding *users* will be modified if they are asked to run the **check-others-behaviour**:

```
observer> ask individuals 537 [set last-use replace-item 0 last-use 2 set behaviour replace-  
item 4 behaviour "Normal"]  
observer> ask individual with [xcor = 4 and ycor = -3] [check-others-behaviour]  
observer> show [item 1 belief-alcohol] of individual with [xcor = 4 and ycor = -3]  
observer: [1.664 0.142 1.742 0.990 1.265]
```

As expected, the SocialRepresentation attribute of other *users* does not change. Finally, the reaction of other *users* could be assessed if the *user 537* displays a positive attitude after consuming alcohol. In that case, the Behavior of this *user* is set to "Prosocial" and the reaction of surrounding *users* test:

```
observer> ask individuals 537 [set last-use replace-item 0 last-use 2 set behaviour replace-  
item 4 behaviour "Prosocial"]  
observer> ask individual with [xcor = 4 and ycor = -3] [check-others-behaviour]  
observer> show [item 1 belief-alcohol] of individual with [xcor = 4 and ycor = -3]  
observer: [1.664 0.142 1.742 1.416 1.265]
```

Only one *user* seemed to be affected by the "Prosocial" Behavior displayed by *user 537*, but again, this test integrates a degree of randomness explaining this result.

The last part of this verification test verifies that if only one *user* is present on a location, running the **check-others-behaviour** will not affect its SocialRepresentation. Therefore, one *user* is asked to move to a 'Bar' location. Its memuse-tick, Behavior, and last-use attributes are set to represent a state, where this *user* has consumed all the different substances available recently and is exhibiting all the possible inappropriate Behavior:

```
observer> ask one-of individual with [typ? = "user"] [setxy -1 10]  
observer> show [who] of individual with [xcor = -1 and ycor = 10]  
observer: [613]  
observer> ask individuals 613 [set memuse-tick [1 1 1 1 1 1 1 1 1] set last-use ["Alcohol"  
"Cannabis" "Cocaine" "Ecstasy" "Heroin" "Meth" "Speed" "LSD" "MagMush"]]  
observer> ask individuals 613 [set behaviour ["Normal" "Psychotic" "Sedated" "Erratic"  
"Aggressive"]]
```

Then, the different values of *user 613*'s SocialRepresentation attribute

are displayed for comparison:

```
observer> show [item 1 belief-alcohol] of individuals 613
observer: 1.464
observer> show [item 1 belief-cannabis] of individuals 613
observer: -0.197
observer> show [item 1 belief-cocaine] of individuals 613
observer: -1.181
observer> show [item 1 belief-ecstasy] of individuals 613
observer: -0.305
observer> show [item 1 belief-heroin] of individuals 613
observer: -3.922
observer> show [item 1 belief-meth] of individuals 613
observer: -1.933
observer> show [item 1 belief-speed] of individuals 613
observer: -0.512
observer> show [item 1 belief-LSD] of individuals 613
observer: -2.242
observer> show [item 1 belief-MagMush] of individuals 613
observer: 0.065
```

Finally, the *user 613* is asked to run the **check-others-behaviour**:

```
observer> ask individuals 613 [check-others-behaviour]
observer> show [item 1 belief-alcohol] of individuals 613
observer: 1.464
observer> show [item 1 belief-cannabis] of individuals 613
observer: -0.197
observer> show [item 1 belief-cocaine] of individuals 613
observer: -1.181
observer> show [item 1 belief-ecstasy] of individuals 613
observer: -0.305
observer> show [item 1 belief-heroin] of individuals 613
observer: -3.922
observer> show [item 1 belief-meth] of individuals 613
observer: -1.933
observer> show [item 1 belief-speed] of individuals 613
observer: -0.512
observer> show [item 1 belief-LSD] of individuals 613
observer: -2.242
observer> show [item 1 belief-MagMush] of individuals 613
observer: 0.065
```

As it could be expected, the *user 613* does not modify any element of its SocialRepresentation attribute, because he was the only *user* on the location. Conversely, this *user* would have seen large changes in its SocialRepresentation, if it has run the following algorithm.

"Check-Self-behavior" (p. 238).

Verification:

(a) *Does the agent modify its SocialRepresentations attributes if it exhibits positive/negative behaviors and in which sense/proportions? Users should increase the values of their SocialRepresentations if their behaviors are concordant with their expectations and decrease the same values if they exhibit inappropriate behaviors (i.e displaying "Relax" will increase the value of the SocialRepresentations, while displaying the "Aggressive" behavior while using speed should decrease its Social-Representation value).* (b) *Do the SocialRepresentations of the agent changed if all the elements of its Behavior attributes are equal to "Normal"? No changes should be observed.*

To verify this algorithm, one *user* will be asked to reconsider its past Behavior.

To mimic the consequences of such inappropriate conduct, the first thing is to ask one *user* to set his Behavior to "Aggressive", to fix his current-InstrumentalUse to "Energy" and to make him think that he has consumed speed in the last few ticks (last-use attribute):

```
observer> show [who] of one-of individual with [typ? = "user"]
observer: 642
observer> ask individuals 642 [set behaviour replace-item 4 behaviour "Aggressive"]
observer> ask individuals 642 [set current-InstrumentalUse replace-item 0 current-InstrumentalUse "Energy"]
observer> ask individuals 642 [set last-use replace-item 6 last-use 1]
observer> show [item 1 belief-speed] of individuals 642
observer: 1.901
```

Before running the algorithm, the SocialRepresentation associated by this agent to "Speed" was equal to 1.901. After the execution of the **check-self-behavior** method the SocialRepresentation attached by *user* 642 to Speed is decreased by 0.221:

```
observer> ask individuals 642 [check-self-behaviour]
observer> show [item 1 belief-speed] of individuals 642
observer: 1.622
```

Continuing with this *user*, the inverse phenomenon could be verified. To test the positive outcomes of drugs, the *user 642* will exhibit the expected effect considering its current-InstrumentalUse (here, "Energy"). Therefore, the *user 642* is asked to replace his "Aggressive" Behavior by the "Energetic" one, before running again the **check-self-behaviour**:

```
observer> ask individuals 642 [set behaviour replace-item 4 behaviour "Normal"]
observer> ask individuals 642 [set behaviour replace-item 3 behaviour "Energetic"]
observer> ask individuals 642 [check-self-behaviour]
observer> show [item 1 belief-speed] of individuals 642
observer: 1.949
```

As expected, the value of the Speed SocialRepresentation increases because the agent exhibits the Behavior targeted through his current-InstrumentalUse (here, "Energetic").

Finally, if his Behavior is set to "Normal" and if the *user 642* executes again the **check-self-behaviour**, its SocialRepresentation of does not vary:

```
observer> ask individuals 642 [set behaviour replace-item 4 behaviour "Normal"]
observer> ask individuals 642 [check-self-behaviour]
observer> show [item 1 belief-speed] of individuals 642
observer: 1.949
```

"Deliberate-drug-searched" (cf. p.288): this process and the subsequent related operations are essential in the decision process of all *users*.

Verification:

(a) *Do the substances appearing in the drug-searched list are concordant with the functions targeted (exception of the **use-depressant** algorithm)? Does the totality of the combinations permitted by the two elements of the current-InstrumentalUse generated correct drug-searched list?* This test asks one *user* to run the **deliberate-drug-searched** with several combinations of current-InstrumentalUse and compares the drug-searched-list of the *user* with the expected outputs. To obtain only the outputs of the **deliberated-drug-searched** algorithm, it has been

modified to prevent the *user from* running the **check-SocialRepresentations** which can alter the drug-searched-list.

```
observer> ask individuals 597 [set consuming? true set current-InstrumentalUse ["None"
"Sociable"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set current-InstrumentalUse ["None"
"None"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set current-InstrumentalUse ["None"
"Relax"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set current-InstrumentalUse ["None"
"Energy"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set current-InstrumentalUse ["None"
"Intoxicated"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set current-InstrumentalUse ["None"
"Hallucinate"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Sociable" "Hallucinate"] deliberate-drug-searched show drug-
searched]
(individuals 597): [0 0 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Sociable" "None"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Sociable" "Sociable"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Sociable" "Relax"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" 0 0 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Sociable" "Energy"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" 0 "Cocaine" "Ecstasy" 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Sociable" "Intoxicated"] deliberate-drug-searched show drug-
searched]
(individuals 597): ["Alcohol" 0 "Cocaine" "Ecstasy" 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Relax" "Intoxicated"] deliberate-drug-searched show drug-searched]
```

(individuals 597): ["Alcohol" "Cannabis" 0 0 "Heroin" 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Relax" "None"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" 0 0 0 0 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Relax" "Sociable"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" 0 0 0 0 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Relax" "Energy"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" 0 0 0 0 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Energy" "None"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" 0 "Cocaine" "Ecstasy" 0 0 "Speed" 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Energy" "Sociable"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" 0 "Cocaine" "Ecstasy" 0 0 "Speed" 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Energy" "Relax"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" 0 "Cocaine" "Ecstasy" 0 0 "Speed" 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Energy" "Intoxicated"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" 0 "Cocaine" "Ecstasy" 0 "Meth" "Speed" 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Energy" "Energy"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" 0 "Cocaine" "Ecstasy" 0 "Meth" "Speed" 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Relax" "Relax"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" 0 0 "Heroin" 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Intoxicated" "Relax"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" "Cocaine" 0 "Heroin" 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Intoxicated" "None"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" "Cocaine" 0 "Heroin" 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Intoxicated" "Sociable"] deliberate-drug-searched show drug-
searched]
(individuals 597): ["Alcohol" "Cannabis" "Cocaine" 0 "Heroin" 0 0 0 0]

observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Intoxicated" "Energy"] deliberate-drug-searched show drug-searched]
(individuals 597): ["Alcohol" "Cannabis" "Cocaine" 0 "Heroin" "Meth" "Speed" 0 0]

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Intoxicated" "Intoxicated"] deliberate-drug-searched show drug-
searched]
(individuals 597): ["Alcohol" "Cannabis" "Cocaine" 0 "Heroin" 0 0 0 0]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Hallucinate" "Intoxicated"] deliberate-drug-searched show drug-
searched]
(individuals 597): [0 0 0 0 0 0 0 "LSD" "MagMush"]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Hallucinate" "Energy"] deliberate-drug-searched show drug-
searched]
(individuals 597): [0 0 0 0 0 0 0 "LSD" "MagMush"]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Hallucinate" "None"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 "LSD" "MagMush"]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Hallucinate" "Sociable"] deliberate-drug-searched show drug-
searched]
(individuals 597): [0 0 0 0 0 0 0 "LSD" "MagMush"]
```

```
observer> ask individuals 597 [set consuming? true set drug-searched [0 0 0 0 0 0 0 0] set
current-InstrumentalUse ["Hallucinate" "relax"] deliberate-drug-searched show drug-searched]
(individuals 597): [0 0 0 0 0 0 0 "LSD" "MagMush"]
```

As illustrated by the previous Command Center lines, this algorithm behaves accordingly to the Deliberate-Drug-Searches activity diagram.

"Check-SocialRepresentations" (cf. p.289): this algorithm is essential in the deliberation process by insuring that *users* are not able to consume drugs associated with a negative social representation.

Verification:

(b) *Do substances with a negative SocialRepresentations attribute will be consumed?* Substances with a negative value (or inferior to 0.5 for substance new users) should be removed from the drug-searched-list, and consequently, should not be consumed.

This verification test is straightforward: first, the drug-searched list of the *user* is completed with all the substances that can be possibly consumed in SimUse:

```
observer> ask individuals 274 [set drug-searched ["Alcohol" "Cannabis" "Cocaine" "Ecstasy"
"Heroin" "Meth" "Speed" "LSD" "MagMush"]]
```

```

observer> show [drug-searched] of individuals 274
observer: ["Alcohol" "Cannabis" "Cocaine" "Ecstasy" "Heroin" "Meth" "Speed" "LSD"
"MagMush"]

```

Second, the different SocialRepresentations are alternatively set with a negative or a positive values as follows:

```

observer> show [item 1 belief-alcohol] of individuals 274
observer: -1.768648947665758
observer> show [item 1 belief-cannabis] of individuals 274
observer: 1.7687780963127884
observer> show [item 1 belief-cocaine] of individuals 274
observer: -2.0864502917749017
observer> show [item 1 belief-ecstasy] of individuals 274
observer: 1.882357875982583
observer> show [item 1 belief-heroin] of individuals 274
observer: -2.154923642111573
observer> show [item 1 belief-meth] of individuals 274
observer: 1.624359545719195
observer> show [item 1 belief-speed] of individuals 274
observer: -1.998431750391108
observer> show [item 1 belief-LSD] of individuals 274
observer: 2.0024917064663685
observer> show [item 1 belief-MagMush] of individuals 274
observer: -2.093150468006522

```

Finally, the *user 274* runs the **check-socialrepresentations** algorithm:

```

observer> ask individuals 274 [check-socialrepresentations]
observer> show [drug-searched] of individuals 274
observer: [0 "Cannabis" 0 "Ecstasy" 0 "Meth" 0 "LSD" 0]

```

As expected, the substances with a negative SocialRepresentations attributes are removed from the drug-searched list.

"More?" (cf. p.310): this algorithm is frequently called during the consumption phase and is a main component of the polysubstance use.

Verification:

(b) *Does a user displaying one of the expected behaviors accordingly to its current-InstrumentalUse attribute run the **more?** operation nevertheless? Does a user without the right drugs in its possession can consume more substances? Users in those conditions should not, in the first case, execute this operation, and in the second case, should not be able to consume more drugs.*

In the next example, the current-InstrumentalUse of a *user* is set to

"Energy" and "Sociable" and this *user* obtain two doses of all substances in its possession attribute. Considering that the **more?** Operation is based on the difference between the NeuralBox neurotransmitter level and the Tolerance-Threshold level, these two attributes are displayed:

```
observer> inspect one-of individual
observer> show [NB] of individuals 340
observer: [2.153 1.639 1.887 1.798 1.842 1.644 1.667 1.873]
observer> show [TT] of individuals 340
observer: [2.164 1.645 1.896 1.807 1.851 1.65 1.675 1.892]
observer> ask individuals 340 [set possession [2 2 2 2 2 2 2 2]]
observer> show [possession] of individuals 340
observer: [2 2 2 2 2 2 2 2]
observer> ask individuals 340 [set consuming? True]
observer> ask individuals 340 [set current-InstrumentalUse ["Energy" "Sociable"]]
observer> show [current-InstrumentalUse] of individuals 340
observer: ["Energy" "Sociable"]
observer> show [Behaviour] of individuals 340
observer: ["Normal" "Normal" "Normal" "Normal" "Normal"]
```

As indicated, the levels of the NeuralBox (NB) are inferior to the levels of Tolerance-Threshold (TT). The different elements of the Behavior attribute are "Normal". At that point, the *user 340* is asked to deliberate the type of drugs it is willing to consume (**deliberate-drug-searched**) and its order of preferences (preferred-drug-list):

```
observer> ask individuals 340 [deliberate-drug-searched]
observer> show [preferred-drug-list] of individuals 340
observer: ["Alcohol" "Cocaine" "Ecstasy" 0 0 0 0 0 0]
observer> ask individuals 340 [more?]
observer> show [possession] of individuals 340
observer: [2 2 1 2 2 2 2 2]
```

Considering that its first current-InstrumentalUse is equal to "Energy" and that the first stimulant of its drug-preferred-list is Cocaine, the *user* has consumed one unit of Cocaine as indicated by the state of its possession attribute. Verifying its different neurotransmitter levels, it appears that the levels of glutamate (item 4 = 1.7483) and norepinephrin (item 5 = 1.5783) are superior to their related levels of Tolerance-Threshold (respectively, 1.587 and 1.414). Therefore, the *user 340* exhibits the Behavior "Energetic", which is the effect searched through the "Energy" current-InstrumentalUse:

```
observer> show [NB] of individuals 340
```

```

observer: [2.0773 1.405 1.618 1.542 1.7483 1.5783 1.5983 1.606]
observer> show [TT] of individuals 340
observer: [1.855 1.411 1.625 1.549 1.587 1.414 1.435 1.622]
observer> show [behaviour] of individuals 340
observer: ["Normal" "Happy" "Normal" "Energetic" "Normal"]
observer> ask individuals 340 [more?]
observer> show [possession] of individuals 340
observer: [2 2 1 2 2 2 2 2]

```

If this *user* is asked to run again the **more?** algorithm, its possession attribute does not change, which indicates that it has not consumed a new dose, although it has enough drugs to continue its consumption of stimulants.

The first negative test aims to verify if a *user* could consume more drugs if its possession is equal to zero. Again, a *user* with the "Curious" archetype is randomly selected and its different attributes display:

```

observer> show [who] of one-of individual with [typ? = "user" and item 0 archetype = "Curious"]
observer: 320
observer> show [NB] of individuals 320
observer: [1.569 1.591 1.638 1.607 1.652 1.735 1.69 1.961]
observer> show [TT] of individuals 320
observer: [1.578 1.6 1.647 1.616 1.66 1.743 1.7 1.981]

```

The process is run in the same way than previously, but this time the different possession of the *user* are set to zero:

```

observer> ask individuals 320 [set consuming? true]
observer> ask individuals 320 [set current-instrumentalUse ["Energy" "Sociable"]]
observer> ask individuals 320 [deliberate-drug-searched]
observer> show [preferred-drug-list] of individuals 320
observer: ["Alcohol" "Cocaine" "Ecstasy" 0 0 0 0 0]
observer> ask individuals 320 [set possession [0 0 0 0 0 0 0 0]]
observer> show [possession] of individuals 320
observer: [0 0 0 0 0 0 0 0]
observer> ask individuals 320 [more?]
observer> show [NB] of individuals 320
observer: [1.569 1.591 1.638 1.607 1.652 1.735 1.69 1.961]
observer> show [Behaviour] of individuals 320
observer: ["Normal" "Normal" "Normal" "Normal" "Normal"]

```

As expected, the *user* 320 is unable to consume more substances. It has to be noted that there were no *dealers* on the location, which also prevented the *user* 320 to buy substances. This case will be presented with the verification of the **Buy** operation.

The last verification consists of testing if a *user* with a level of neurotransmitters (NeuralBox) superior to its Tolerance-Threshold and with enough drugs, will wether or not, consume more doses. The test starts with the same commands than before, pick up randomly a "Curious" *user* and ask this agent to deliberate its drug-searched list:

```
observer> show [who] of one-of individual with [typ? = "user" and item 0 archetype = "Curious"]
observer: 258
observer> show [NB] of individuals 258
observer: [1.67 1.749 1.663 1.708 1.747 1.952 2.194 1.751]
observer> show [TT] of individuals 258
observer: [1.679 1.757 1.672 1.718 1.756 1.964 2.208 1.769]
```

Again, this *user* is asked to run the deliberate process and select one or several drugs considering its current-InstrumentalUse:

```
observer> ask individuals 320 [set consuming? true]
observer> show [Behaviour] of individuals 258
observer: ["Normal" "Normal" "Normal" "Normal" "Normal"]
observer> ask individuals 258 [set current-instrumentalUse ["Energy" "Sociable"]]
observer> ask individuals 258 [deliberate-drug-searched]
observer> show [preferred-drug-list] of individuals 258
observer: ["Alcohol" "Cocaine" "Ecstasy" 0 0 0 0 0]
```

Then, the observer

```
observer> ask individuals 258 [set possession [2 2 2 2 2 2 2 2]]
observer> ask individuals 258 [set NB [1.69 1.749 1.663 1.708 1.757 1.965 2.194 1.751]]
observer> ask individuals 258 [more?]
observer> show [possession] of individuals 258
observer: [2 2 2 2 2 2 2 2]
observer> ask individuals 258 [check-brain-intake]
observer> show [behaviour] of individuals 258
observer: ["Normal" "Happy" "Normal" "Energetic" "Normal"]
```

"Sell" (cf. p.294): this algorithm guarantees that the *users* would be able to find drugs if they do not have *dealers* in their peer *networks*.

Verification:

(a) *Do dealers sell their substances in the "dedicated" locations?*
Following the routine of the different type of *dealer* allow to verify that they are selling in the right settings. The next tests verify the movements of *dealers* accordingly to their drugtype and the "Hours" for a normal week.

```
observer> repeat 84 [go show Days show hours ask individual with [typ? = "dealer"] [show
```

drugtype show [type?] of patch-here]]
observer: "Monday"
observer: "10:00-12:00"
(individuals 103): "Cannabis" "dealer-places"
(individuals 136): "Cocaine" "dealer-places"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 258): "PolystimSocial" "dealer-places"
(individuals 80): "Meth" "dealer-places"
(individuals 155): "Heroin" "dealer-places"
(individuals 143): "Speed" "dealer-places"
(individuals 127): "Ecstasy" "dealer-places"

observer: "Monday"
observer: "12:00-14:00"
(individuals 103): "Cannabis" "dealer-places"
(individuals 155): "Heroin" "dealer-places"
(individuals 143): "Speed" "dealer-places"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 80): "Meth" "dealer-places"
(individuals 258): "PolystimSocial" "dealer-places"
(individuals 127): "Ecstasy" "dealer-places"
(individuals 136): "Cocaine" "dealer-places"

observer: "Monday"
observer: "14:00-16:00"
(individuals 136): "Cocaine" "dealer-places"
(individuals 103): "Cannabis" "dealer-places"
(individuals 127): "Ecstasy" "dealer-places"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 155): "Heroin" "dealer-places"
(individuals 143): "Speed" "dealer-places"
(individuals 258): "PolystimSocial" "dealer-places"
(individuals 80): "Meth" "dealer-places"

observer: "Monday"
observer: "16:00-18:00"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 80): "Meth" "dealer-places"
(individuals 258): "PolystimSocial" "dealer-places"
(individuals 136): "Cocaine" "dealer-places"
(individuals 143): "Speed" "dealer-places"
(individuals 103): "Cannabis" "dealer-places"
(individuals 155): "Heroin" "Street"
(individuals 127): "Ecstasy" "dealer-places"

observer: "Monday"
observer: "18:00-20:00"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 136): "Cocaine" "dealer-places"
(individuals 103): "Cannabis" "dealer-places"
(individuals 143): "Speed" "dealer-places"
(individuals 155): "Heroin" "Street"
(individuals 258): "PolystimSocial" "dealer-places"
(individuals 80): "Meth" "dealer-places"
(individuals 127): "Ecstasy" "dealer-places"

observer: "Monday"
observer: "20:00-22:00"
(individuals 80): "Meth" "Disco"
(individuals 103): "Cannabis" "dealer-places"
(individuals 136): "Cocaine" "Disco"
(individuals 258): "PolystimSocial" "Disco"
(individuals 127): "Ecstasy" "Disco"
(individuals 143): "Speed" "Disco"
(individuals 91): "Cannabis+MagMush" "Bar"
(individuals 155): "Heroin" "dealer-places"

observer: "Monday"
observer: "22:00-24:00"
(individuals 258): "PolystimSocial" "Disco"
(individuals 80): "Meth" "Disco"
(individuals 103): "Cannabis" "dealer-places"
(individuals 143): "Speed" "Disco"
(individuals 136): "Cocaine" "Disco"
(individuals 127): "Ecstasy" "Disco"
(individuals 155): "Heroin" "Street"
(individuals 91): "Cannabis+MagMush" "dealer-places"

observer: "Tuesday"
observer: "00:00-02:00"
(individuals 136): "Cocaine" "Disco"
(individuals 103): "Cannabis" "Bar"
(individuals 258): "PolystimSocial" "Disco"
(individuals 127): "Ecstasy" "Disco"
(individuals 80): "Meth" "Disco"
(individuals 155): "Heroin" "dealer-places"
(individuals 143): "Speed" "Disco"
(individuals 91): "Cannabis+MagMush" "dealer-places"

observer: "Tuesday"
observer: "02:00-04:00"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 258): "PolystimSocial" "Disco"
(individuals 155): "Heroin" "Street"
(individuals 143): "Speed" "Disco"
(individuals 80): "Meth" "Disco"
(individuals 127): "Ecstasy" "Disco"
(individuals 103): "Cannabis" "Bar"
(individuals 136): "Cocaine" "Disco"

observer: "Tuesday"
observer: "04:00-06:00"
(individuals 103): "Cannabis" "dealer-places"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 143): "Speed" "Disco"
(individuals 136): "Cocaine" "Disco"
(individuals 80): "Meth" "Disco"
(individuals 155): "Heroin" "Street"
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observer: "Tuesday"
observer: "06:00-08:00"
(individuals 91): "Cannabis+MagMush" "dealer-places"
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(individuals 155): "Heroin" "dealer-places"
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(individuals 103): "Cannabis" "dealer-places"

observer: "Tuesday"
observer: "08:00-10:00"
(individuals 258): "PolystimSocial" "dealer-places"
(individuals 136): "Cocaine" "dealer-places"
(individuals 143): "Speed" "dealer-places"
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(individuals 155): "Heroin" "dealer-places"
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observer: "Tuesday"
observer: "10:00-12:00"
(individuals 80): "Meth" "dealer-places"
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(individuals 143): "Speed" "dealer-places"

observer: "Tuesday"
observer: "12:00-14:00"
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observer: "Tuesday"
observer: "14:00-16:00"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 155): "Heroin" "Street"
(individual: 143): "Speed" "dealer-places"
(individuals 80): "Meth" "dealer-places"
(individuals 127): "Ecstasy" "dealer-places"
(individuals 136): "Cocaine" "dealer-places"
(individuals 103): "Cannabis" "dealer-places"
(individuals 258): "PolystimSocial" "dealer-places"

observer: "Tuesday"
observer: "16:00-18:00"
(individuals 103): "Cannabis" "Bar"
(individuals 155): "Heroin" "Street"
(individuals 136): "Cocaine" "dealer-places"
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(individuals 143): "Speed" "dealer-places"

observer: "Tuesday"
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(individuals 103): "Cannabis" "dealer-places"

observer: "Tuesday"
observer: "20:00-22:00"
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observer: "Tuesday"
observer: "22:00-24:00"
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(individuals 127): "Ecstasy" "Disco"

observer: "Wednesday"
observer: "00:00-02:00"
(individuals 127): "Ecstasy" "Disco"
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observer: "Wednesday"
observer: "02:00-04:00"
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(individuals 136): "Cocaine" "Disco"

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observer: "04:00-06:00"
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observer: "Wednesday"
observer: "06:00-08:00"
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observer: "Wednesday"
observer: "08:00-10:00"
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(individuals 143): "Speed" "dealer-places"

observer: "Wednesday"
observer: "10:00-12:00"
(individuals 80): "Meth" "dealer-places"
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(individuals 103): "Cannabis" "dealer-places"
(individuals 127): "Ecstasy" "dealer-places"
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(individuals 91): "Cannabis+MagMush" "dealer-places"

observer: "Wednesday"
observer: "12:00-14:00"
(individuals 155): "Heroin" "Street"
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observer: "Wednesday"
observer: "14:00-16:00"
(individuals 136): "Cocaine" "dealer-places"
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(individuals 143): "Speed" "dealer-places"
(individuals 80): "Meth" "dealer-places"

observer: "Wednesday"
observer: "16:00-18:00"
(individuals 103): "Cannabis" "dealer-places"
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(individuals 155): "Heroin" "dealer-places"

observer: "Wednesday"
observer: "18:00-20:00"
(individuals 136): "Cocaine" "dealer-places"
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(individuals 80): "Meth" "dealer-places"
(individuals 91): "Cannabis+MagMush" "Bar"
(individuals 127): "Ecstasy" "dealer-places"

observer: "Wednesday"
observer: "20:00-22:00"
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(individuals 155): "Heroin" "dealer-places"
(individuals 258): "PolystimSocial" "Disco"
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(individuals 143): "Speed" "Disco"
(individuals 91): "Cannabis+MagMush" "dealer-places"
(individuals 127): "Ecstasy" "Disco"

(individuals 136): "Cocaine" "Disco"

observer: "Wednesday"

observer: "22:00-24:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 127): "Ecstasy" "Disco"

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(individuals 155): "Heroin" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 103): "Cannabis" "Bar"

(individuals 143): "Speed" "Disco"

observer: "Thursday"

observer: "00:00-02:00"

(individuals 80): "Meth" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 103): "Cannabis" "Bar"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

observer: "Thursday"

observer: "02:00-04:00"

(individuals 155): "Heroin" "Street"

(individuals 91): "Cannabis+MagMush" "dealer-places"

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(individuals 127): "Ecstasy" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 80): "Meth" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 143): "Speed" "Disco"

observer: "Thursday"

observer: "04:00-06:00"

(individuals 127): "Ecstasy" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 155): "Heroin" "Street"

(individuals 80): "Meth" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 103): "Cannabis" "dealer-places"

observer: "Thursday"

observer: "06:00-08:00"

(individuals 80): "Meth" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 143): "Speed" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 103): "Cannabis" "dealer-places"

observer: "Thursday"

observer: "08:00-10:00"

(individuals 80): "Meth" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

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(individuals 127): "Ecstasy" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

observer: "Thursday"

observer: "10:00-12:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

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(individuals 80): "Meth" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

observer: "Thursday"

observer: "12:00-14:00"

(individuals 136): "Cocaine" "dealer-places"

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(individuals 258): "PolystimSocial" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

observer: "Thursday"

observer: "14:00-16:00"

(individuals 155): "Heroin" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

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(individuals 103): "Cannabis" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

observer: "Thursday"

observer: "16:00-18:00"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

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(individuals 155): "Heroin" "dealer-places"

(individuals 143): "Speed" "dealer-places"

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(individuals 136): "Cocaine" "dealer-places"

(individuals 80): "Meth" "dealer-places"

observer: "Thursday"

observer: "18:00-20:00"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 103): "Cannabis" "Bar"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 80): "Meth" "dealer-places"

observer: "Thursday"

observer: "20:00-22:00"

(individuals 155): "Heroin" "dealer-places"

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(individuals 103): "Cannabis" "dealer-places"

(individuals 143): "Speed" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 91): "Cannabis+MagMush" "Bar"

(individuals 136): "Cocaine" "Disco"

(individuals 127): "Ecstasy" "Disco"

observer: "Thursday"

observer: "22:00-24:00"

(individuals 143): "Speed" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 103): "Cannabis" "dealer-places"

observer: "Friday"

observer: "00:00-02:00"

(individuals 103): "Cannabis" "Bar"

(individuals 136): "Cocaine" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 143): "Speed" "Disco"

observer: "Friday"

observer: "02:00-04:00"

(individuals 80): "Meth" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 155): "Heroin" "Street"

(individuals 143): "Speed" "Disco"

observer: "Friday"

observer: "04:00-06:00"

(individuals 80): "Meth" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

observer: "Friday"

observer: "06:00-08:00"

(individuals 80): "Meth" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 136): "Cocaine" "Disco"

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(individuals 127): "Ecstasy" "Disco"

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(individuals 143): "Speed" "Disco"

observer: "Friday"

observer: "08:00-10:00"

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observer: "Friday"

observer: "10:00-12:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

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observer: "Friday"

observer: "12:00-14:00"

(individuals 103): "Cannabis" "dealer-places"

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observer: "Friday"

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observer: "Friday"

observer: "20:00-22:00"

(individuals 136): "Cocaine" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 80): "Meth" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 103): "Cannabis" "dealer-places"

observer: "Friday"

observer: "22:00-24:00"

(individuals 80): "Meth" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 91): "Cannabis+MagMush" "Bar"

(individuals 143): "Speed" "Disco"

observer: "Saturday"

observer: "00:00-02:00"

(individuals 127): "Ecstasy" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 155): "Heroin" "Street"

(individuals 103): "Cannabis" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 80): "Meth" "Disco"

observer: "Saturday"

observer: "02:00-04:00"

(individuals 143): "Speed" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 91): "Cannabis+MagMush" "Bar"

(individuals 258): "PolystimSocial" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 80): "Meth" "Disco"

observer: "Saturday"

observer: "04:00-06:00"

(individuals 258): "PolystimSocial" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 80): "Meth" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 103): "Cannabis" "Bar"

(individuals 136): "Cocaine" "Disco"

(individuals 127): "Ecstasy" "Disco"

observer: "Saturday"

observer: "06:00-08:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

observer: "Saturday"

observer: "08:00-10:00"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 143): "Speed" "dealer-places"

observer: "Saturday"

observer: "10:00-12:00"

(individuals 155): "Heroin" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 143): "Speed" "dealer-places"

observer: "Saturday"

observer: "12:00-14:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

observer: "Saturday"

observer: "14:00-16:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

observer: "Saturday"

observer: "16:00-18:00"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 155): "Heroin" "Street"

(individuals 143): "Speed" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

observer: "Saturday"

observer: "18:00-20:00"

(individuals 80): "Meth" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

observer: "Saturday"

observer: "20:00-22:00"

(individuals 136): "Cocaine" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 143): "Speed" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 155): "Heroin" "Street"

observer: "Saturday"

observer: "22:00-24:00"

(individuals 155): "Heroin" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 143): "Speed" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 80): "Meth" "Disco"

observer: "Sunday"

observer: "00:00-02:00"

(individuals 103): "Cannabis" "Bar"

(individuals 136): "Cocaine" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

observer: "Sunday"

observer: "02:00-04:00"

(individuals 127): "Ecstasy" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 155): "Heroin" "Street"

(individuals 103): "Cannabis" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 91): "Cannabis+MagMush" "Bar"

(individuals 258): "PolystimSocial" "Disco"

observer: "Sunday"

observer: "04:00-06:00"

(individuals 127): "Ecstasy" "Disco"

(individuals 103): "Cannabis" "Bar"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "Disco"

observer: "Sunday"

observer: "06:00-08:00"

(individuals 136): "Cocaine" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 258): "PolystimSocial" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 91): "Cannabis+MagMush" "Bar"

(individuals 80): "Meth" "Disco"

(individuals 143): "Speed" "Disco"

observer: "Sunday"

observer: "08:00-10:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 143): "Speed" "dealer-places"

observer: "Sunday"

observer: "10:00-12:00"

(individuals 136): "Cocaine" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

observer: "Sunday"

observer: "12:00-14:00"

(individuals 143): "Speed" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "dealer-places"

observer: "Sunday"

observer: "14:00-16:00"

(individuals 143): "Speed" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

observer: "Sunday"

observer: "16:00-18:00"

(individuals 91): "Cannabis+MagMush" "Bar"

(individuals 80): "Meth" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 155): "Heroin" "dealer-places"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 143): "Speed" "dealer-places"

observer: "Sunday"

observer: "18:00-20:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 155): "Heroin" "Street"

(individuals 258): "PolystimSocial" "dealer-places"

(individuals 80): "Meth" "dealer-places"

(individuals 127): "Ecstasy" "dealer-places"

(individuals 103): "Cannabis" "dealer-places"

(individuals 143): "Speed" "dealer-places"

(individuals 136): "Cocaine" "dealer-places"

observer: "Sunday"

observer: "20:00-22:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 103): "Cannabis" "dealer-places"

(individuals 136): "Cocaine" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "Disco"

(individuals 258): "PolystimSocial" "Disco"

observer: "Sunday"

observer: "22:00-24:00"

(individuals 80): "Meth" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 127): "Ecstasy" "Disco"

(individuals 103): "Cannabis" "Bar"

(individuals 258): "PolystimSocial" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 143): "Speed" "Disco"

observer: "Monday"

observer: "00:00-02:00"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 143): "Speed" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 136): "Cocaine" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

(individuals 103): "Cannabis" "dealer-places"

observer: "Monday"

observer: "02:00-04:00"

(individuals 258): "PolystimSocial" "Disco"

(individuals 143): "Speed" "Disco"

(individuals 80): "Meth" "Disco"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 103): "Cannabis" "Bar"

(individuals 136): "Cocaine" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

observer: "Monday"

observer: "04:00-06:00"

(individuals 91): "Cannabis+MagMush" "Bar"

(individuals 136): "Cocaine" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 103): "Cannabis" "Bar"

(individuals 127): "Ecstasy" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 80): "Meth" "Disco"

(individuals 143): "Speed" "Disco"

observer: "Monday"

observer: "06:00-08:00"

(individuals 143): "Speed" "Disco"

(individuals 103): "Cannabis" "Bar"

(individuals 91): "Cannabis+MagMush" "dealer-places"

(individuals 80): "Meth" "Disco"

(individuals 258): "PolystimSocial" "Disco"

(individuals 155): "Heroin" "dealer-places"

(individuals 127): "Ecstasy" "Disco"

(individuals 136): "Cocaine" "Disco"

These results demonstrate that the *dealers* are moving accordingly to the **sell** method (described p.294).

"Use-depressant" (cf. p.343): this operation is a component of the simultaneous polysubstance use and could lead to new consumption.

Verification:

(a) *Does an agent using enough depressant can run the **rest** algorithm normally?* After consumptions of depressant drugs, the *users* exhibiting the "Sedated" or "Relax" Behaviors should be able to run the **rest** algorithm.

To conduct this test, one of the *user* is asked to increase its level of glutamate (item 4 NeuralBox) 0.6 point above its related Tolerance-

Threshold which leads it to exhibit the "Energetic" Behaviour. This *user* is also asked to consider that it has consumed Ecstasy a few ticks before and that it already knows to "UseDepressant" before trying to **rest**.

```
observer> show [Health] of individuals 516
observer: 81
observer> show [Initial-Health] of individuals 516
observer: 81
observer> show [NB] of individuals 516
observer: [0.984 0.79 1.19 0.838 0.672 1.17 0.814 1.218]
observer> show [TT] of individuals 516
observer: [0.994 0.798 1.202 0.846 0.679 1.182 0.822 1.23]
observer> show [memuse] of individuals 516
observer: [0 0 0 0 0 0 0 0]
observer> show [membehaviour] of individuals 516
observer: [0 0 0 0 0 0]
observer> show [behaviour] of individuals 516
observer: ["Normal" "Normal" "Normal" "Normal" "Normal"]
observer> ask individuals 516 [set last-use replace-item 3 last-use 10]
observer> show [last-use] of individuals 516
observer: [0 0 0 10 0 0]
observer> show [possession] of individuals 516
observer: [0 0 0 0 0 0 0]
observer> ask individuals 516 [set NB replace-item 4 NB (item 4 TT + 0.6)]
observer> ask individuals 516 [check-brain-intake]
observer> show [behaviour] of individuals 516
observer: ["Normal" "Normal" "Normal" "Energetic" "Normal"]
observer> ask individuals 516 [set controlrules replace-item 0 controlrules "UseDepressant"]
observer> show [cash] of individuals 516
observer: 100
observer> show [current-instrumentaluse] of individuals 516
observer: ["None" "None"]
```

The last lines of the 'Command Center' shows that the *user 516* does not have any drugs and that its current-InstrumentalUse are both 'None'. Once all the conditions set, the observer asks the *user 516* to run the **rest** algorithm. Considering the level of glutamate, this user has to consume depressant drugs before resting:

```
observer> ask individuals 516 [rest]
observer> show [current-instrumentaluse] of individuals 516
observer: ["Relax" "None"]
observer> show [NB] of individuals 516
observer: [1.008 0.79 1.19 0.862 0.672 1.17 0.814 1.218]
observer> show [TT] of individuals 516
observer: [1.018 0.798 1.202 0.871 0.679 1.182 0.822 1.23]
observer> show [current-instrumentaluse] of individuals 516
observer: ["Relax" "None"]
observer> show [behaviour] of individuals 516
observer: ["Normal" "Happy" "Relax" "Energetic" "Prosocial"]
```

```

observer> show [membehaviour] of individuals 516
observer: [0 0 0 0 0 0 0]
observer> show [last-use] of individuals 516
observer: [13 0 0 10 0 0 0 0]
observer> show [memuse] of individuals 516
observer: [1 0 0 0 0 0 0 0]
observer> show [Health] of individuals 516
observer: 80.9
observer> show [Initial-Health] of individuals 516
observer: 80.9
observer> show [membehaviour] of individuals 516
observer: [0 0 0 0 0 0 0]

```

The *user 516* has changed its current-InstrumentalUse to "Relax" and has consumed Alcohol (the first elements of its memuse and last-use attribute show that it has consumed one unit of Alcohol on the thirteenth time step). This has for effect of reducing sufficiently its level of GABA to induce a relaxed state (as shown by its Behaviour). This state allowed *user 516* to rest: as indicated by the last lines, it has not lost any point of Health or Initial-Health and it will not remember negatively its last intake of Ecstasy (its membehavior remains has not change).

(b) *If the user can obtain depressant drugs will it be able to **rest**?*

The negative test consists of asking a *user* to exhibit the 'Energy' Behavior (with a level of glutamate and/or norepinephrine superior by 0.5 to their Tolerance-Threshold) inherent to the intake of Ecstasy and asking it to run the **rest** algorithm with no cash to purchase depressant drugs (Alcohol, Cannabis or Heroin):

```

observer> show [who] of one-of individual
observer: 158
observer> show [Health] of individuals 158
observer: 70
observer> show [Initial-Health] of individuals 158
observer: 70
observer> show [NB] of individuals 158
observer: [1.023 0.787 0.982 0.926 1.274 0.491 1.178 0.559]
observer> show [TT] of individuals 158
observer: [1.033 0.795 0.992 0.935 1.287 0.496 1.19 0.565]
observer> show [memuse] of individuals 158
observer: [0 0 0 0 0 0 0 0]
observer> show [membehaviour] of individuals 158
observer: [0 0 0 0 0 0 0]
observer> show [behaviour] of individuals 158

```

```

observer: ["Normal" "Normal" "Normal" "Normal" "Normal"]

observer> ask individuals 158 [set last-use replace-item 3 last-use 10]
observer> ask individuals 158 [set controlrules replace-item 0 controlrules "UseDepressant"]
observer> ask individuals 158 [set NB replace-item 5 NB 1]
observer> ask individuals 158 [check-brain-intake]
observer> show [behaviour] of individuals 158
observer: ["Normal" "Normal" "Normal" "Energetic" "Aggressive"]
observer> ask individuals 158 [set cash 0]
observer> ask individuals 158 [rest]
observer> show [behaviour] of individuals 158
observer: ["Normal" "Normal" "Normal" "Energetic" "Aggressive"]
observer> show [Health] of individuals 158
observer: 64.75
observer> show [Initial-Health] of individuals 158
observer: 68.9
observer> show [membehaviour] of individuals 158
observer: [0 0 0 0 0 0 1]

```

As indicated the *user 158* was unable to sleep normally and suffer the consequences of its incapacity to **rest**: it loses 5 points of Health (the lost of another 0.25 it is due to the **check-brain-intake** algorithm) and 1 point in Initial-Health. Moreover, this *user* will also remember that it was unable to sleep after an intake of Ecstasy.

Annex 8. Results from the "dummy" tests

“NoMoney” Scenario results

run	step	Alcohol	Canna bis	Cocaine	Ecstasy	Heroin	Meth	Speed	LSD	Mag Mush	assault	death	insan	treat	arrest	hazar dous- acts
1	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

“NoDealer” Scenario Results

run	step	Alcohol	Cannabis	Cocaine	Ecstasy	Heroin	Meth	Speed	LSD	Mag Mush	assault	death	insane	treat	arrest	hazardous-acts
2	200	798	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	200	839	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	200	836	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	200	803	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	200	1007	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	200	837	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	200	820	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	200	890	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	200	858	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	200	819	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	200	947	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	200	873	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	200	846	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	200	829	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	200	987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	200	922	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	200	757	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	200	1018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	200	878	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	200	962	0	0	0	0	0	0	0	0	0	0	0	0	0	0

“NoEffects” Scenario Results

run	step	Alcohol	Cannabis	Cocaine	Ecstasy	Heroin	Meth	Speed	LSD	Mag Mush	assault	death	insane	treat	arrest	hazardous-acts
1	200	773	55	34	79	15	15	9	0	0	0	0	0	0	0	0
2	200	761	95	12	53	3	15	6	3	6	0	0	0	0	0	0
3	200	740	46	33	46	12	15	6	0	6	0	0	0	0	0	0
4	200	797	64	28	89	5	15	9	0	6	0	0	0	0	0	0
5	200	753	49	18	65	12	23	9	7	0	0	0	0	0	0	0
6	200	716	33	23	78	18	21	12	0	12	0	0	0	0	0	0
7	200	721	35	23	68	3	15	9	0	0	0	0	0	0	0	0
8	200	705	32	18	67	2	12	9	3	0	0	0	0	0	0	0
9	200	955	87	43	69	6	19	9	6	0	0	0	0	0	0	0
10	200	784	74	33	80	6	6	9	0	0	0	0	0	0	0	0
11	200	858	59	33	67	21	15	12	0	0	0	0	0	0	0	0
12	200	754	51	15	59	14	3	3	3	0	0	0	0	0	0	0
13	200	914	90	17	60	3	12	6	6	0	0	0	0	0	0	0
14	200	850	53	9	48	9	19	16	0	0	0	0	0	0	0	0
15	200	804	75	31	58	24	21	18	0	0	0	0	0	0	0	0
16	200	690	38	6	94	6	16	12	0	0	0	0	0	0	0	0
17	200	765	44	22	56	0	9	6	3	0	0	0	0	0	0	0
18	200	883	41	12	81	6	15	18	7	0	0	0	0	0	0	0
19	200	852	55	26	73	15	24	18	3	6	0	0	0	0	0	0
20	200	950	88	39	80	12	18	0	0	6	0	0	0	0	0	0

“NoAlcohol” Scenario Results

run	step	alcohol	cannabis	cocaine	ecstasy	heroin	meth	speed	LSD	Mag Mush	assault	death	insane	treat	arrest	hazardous-acts
2	200	0	100	10	19	6	0	0	0	0	0	0	0	0	0	0
1	200	0	63	17	13	1	0	0	0	6	0	0	0	0	0	0
3	200	0	49	19	26	2	0	1	0	0	0	0	0	0	0	0
4	200	0	66	15	22	1	1	1	4	0	0	0	0	0	0	0
5	200	0	40	15	21	0	0	0	0	0	0	0	0	0	0	0
6	200	0	48	10	17	9	0	0	0	3	0	0	0	0	0	0
7	200	0	59	17	30	2	0	1	4	0	0	0	0	0	0	0
8	200	0	45	17	22	1	0	0	2	0	0	0	0	0	0	0
9	200	0	64	16	23	2	0	0	4	0	0	0	0	0	0	0
10	200	0	74	1	6	9	0	0	2	0	0	0	0	0	0	0
11	200	0	89	16	22	4	0	0	0	0	1	0	0	0	0	0
12	200	0	54	10	35	4	0	1	0	0	1	0	0	0	0	0
13	200	0	53	8	40	6	0	1	4	0	0	0	0	0	0	0
14	200	0	66	22	15	8	0	1	0	6	0	0	0	0	0	0
15	200	0	66	8	20	11	1	0	0	0	0	0	0	0	0	0
16	200	0	19	7	33	0	0	1	0	0	1	0	0	0	0	0
17	200	0	58	16	20	2	0	0	0	0	0	0	0	0	0	0
18	200	0	73	20	22	2	0	0	4	0	0	0	0	1	0	1
19	200	0	46	13	21	4	0	0	2	3	0	0	0	0	0	0
20	200	0	51	13	20	4	1	0	2	6	0	0	0	0	0	0

Annex 9. Results from SimUse Verification

Test/Outputs	Alcohol	Cannabis	Cocaine	Ecstasy	Heroin	Meth	Speed	LSD	MagMush
Standard	26654.3	2145.9	479.2	646	78.8	72.7	36.3	59.8	4.6
Standard SD	1070.4	300.8	101.8	128.4	22.2	32	15.8	25.6	4.2
P1	26616.1	2179.3	575.9	669.9	82.9	66.8	31.1	71.9	4.9
P1 SD	1191.8	351.9	110.9	100.2	21.7	26.9	16.3	25	4
P10	26654.3	2145.9	479.2	646	78.8	72.7	36.3	59.8	4.6
P10 SD	1070.4	300.8	101.8	128.4	22.2	32	15.8	25.6	4.2
P30	26719	2112.4	416.4	480.7	74.7	69.3	35.1	59.6	5.8
P30 SD	1047.4	246.8	88.7	92.9	17.6	27.1	13.7	25.9	4.4
P60	26867	2055.5	391.4	293.4	76.5	103	39	51.1	4.9
P60 SD	1020.2	262.7	83.3	55.5	24.7	30.4	16.1	25.4	4.2
P100	27150.2	2088	412.9	160.2	74.9	132	45.4	56.8	6.2
P100 SD	1021.6	337.8	89.7	28.1	22.8	34.8	21.4	25.5	5.1
CannaDepletion	27454.9	1185.34	466.18	627.52	121.7	74.92	40.18	61.82	5.14
CannaDepletion SD	1098.3	160.7	108.3	129.6	48.7	30.4	18.4	30.6	3.8
CocainePurity	26229.8	2051.5	367.1	605.8	74.5	67.6	30.8	59.9	4.8
CocainePurity SD	830.2	319.7	73.2	111	26	25.7	16.3	21.8	4
NoInteractions	25009.6	2002.6	557.9	589.3	108.6	94	26.8	42.7	2.5
NoInteractions SD	978	232.3	122.6	93.6	26.9	38.1	19.9	17.1	3.4
NoRules	27277	2276.1	481.8	692.6	77.1	93	65.8	74.4	6.1
NoRules SD	942.3	334.8	114.8	129.8	24	36.3	25.5	30.4	4.5
NoSelf	37522.7	1874.8	372.1	617.7	61.2	53.6	26.9	51.7	5.1
NoSelf SD	1513.1	215.4	99.8	145.7	15.2	28.8	19	27.8	4
NoControl	40561.7	2248.6	435	763.9	103.8	58.2	49.1	38.9	4.8
NoControl SD	1475.2	395.9	104	153.7	23.7	38.6	16.4	16.8	4.7
Final	78181.2	3056.9	1854.5	1792.5	112.3	304.9	331.3	3.2	5
Final SD	3812.4	645.4	340.4	300.7	57	95.3	116.5	7.9	4.2

Test/Outputs	assault	deaths	insanes	treatnum	arrestnum	hazardous-acts	overdose
Standard	59.8	0.4	5.4	51	1.9	25.8	0.1
Standard SD	13.3	0.6	2.3	9.4	1.7	7.1	0.3
P1	61	0.6	5.5	53.7	1.6	27.9	0.3
P1 SD	11.3	0.8	2.3	9.1	1.9	9.7	0.6
P10	59.8	0.4	5.4	51	1.9	25.8	0.1
P10 SD	13.3	0.6	2.3	9.4	1.7	7.1	0.3
P30	52.5	0.4	6.1	43.8	1.9	23.4	0.2
P30 SD	10	0.6	1.8	9	1.6	8.6	0.5
P60	49.2	0.3	5.6	42.7	1.4	21.4	0.1
P60 SD	12.5	0.5	2.7	8.3	2	9.3	0.3
P100	45.2	0.6	5.7	41.5	1.4	20.6	0.1
P100 SD	11.1	0.8	2.6	8.4	1.5	9.1	0.3
CannaDepletion	60.54	0.82	3.86	46.38	2.16	24.74	0.06
CannaDepletion SD	13	0.8	2	8.9	2.6	9.1	0.3
CocainePurity	63.2	2.7	14.2	57.4	1.9	44.4	3.7
CocainePurity SD	9.9	1.6	3.8	8.5	1.9	11.3	2.5
NoInteractions	54.2	0.6	6	52.2	1.9	26.1	0
NoInteractions SD	11.7	0.7	2.1	7.4	2.2	7.6	0
NoRules	70.2	0.7	6.1	58.5	2.6	35.1	0.1
NoRules SD	10.9	0.8	2.7	13.8	2.7	15.5	0.2
NoSelf	233.2	0.7	10.5	125.2	4.1	65.4	0
NoSelf SD	32.7	0.8	3.2	16.5	3.9	17	0.1
NoControl	287.5	1.4	16.3	182.9	4.5	112	0
NoControl SD	34.2	1.1	3.9	21.9	3.2	26.5	0
Final	150.6	2.2	8.3	106.9	5	71	1.1
Final SD	23.3	1.4	2.5	19.3	3.3	15.1	1.7

Test/Outputs	Regular User Alcohol	Regular User Cannabis	Regular User Cocaine	Regular User Ecstasy	Regular User Heroin	Regular User Meth	Regular User Speed	Regular User LSD	Regular User MagMush
Standard	46.10%	12.30%	3.70%	5.10%	0.70%	0.60%	0.40%	1.30%	0.00%
Standard SD	10.5	8.4	5.1	6.5	2.1	2	1.4	3.3	0.4
P1	46.30%	12.60%	4.20%	5.10%	0.70%	0.60%	0.30%	1.40%	0.00%
P1 SD	13.5	10.7	5.1	5.4	1.8	1.7	1.3	2.7	0.4
P10	46.10%	12.30%	3.70%	5.10%	0.70%	0.60%	0.40%	1.30%	0.00%
P10 SD	10.5	8.4	5.1	6.5	2.1	2	1.4	3.3	0.4
P30	46.80%	11.90%	3.30%	4.80%	0.60%	0.50%	0.30%	1.30%	0.00%
P30 SD	12.4	6.8	5	5.7	1.5	1.5	1.2	3.4	0.4
P60	46.80%	12.00%	3.00%	3.50%	0.60%	0.60%	0.30%	1.20%	0.10%
P60 SD	11.4	9.1	4	4.7	1.8	1.8	1.2	3.4	0.5
P100	47.30%	12.00%	3.20%	2.30%	0.60%	0.70%	0.30%	1.10%	0.00%
P100 SD	14.1	10.1	5.6	3	1.9	1.7	1.2	2.9	0.4
CannaDepletion	47.70%	1.50%	3.80%	5.50%	1.30%	0.70%	0.40%	1.30%	0.10%
CannaDepletion SD	14	2.8	5.4	5.8	2.9	2	1.6	3.1	0.5
CocainePurity	43.84%	10.40%	1.82%	4.52%	0.54%	0.56%	0.34%	1.08%	0.02%
CocainePurity SD	10.9	9.1	3.5	5.5	1.9	1.8	1.4	2.5	0.4
NoInteractions	41.30%	10.00%	4.20%	4.10%	1.20%	1.10%	0.20%	0.80%	0.00%
NoInteractions SD	12.5	5	5.9	4.8	2.2	2.4	1.2	2.4	0.3
NoRules	45.80%	12.30%	3.80%	4.80%	0.60%	0.80%	0.70%	1.60%	0.00%
NoRules SD	14.2	8.1	5.3	7.2	1.9	2	2.2	3.9	0.5
NoSelf	64.10%	9.30%	2.20%	5.10%	0.30%	0.20%	0.20%	0.90%	0.00%
NoSelf SD	12.6	5.9	4.7	7.2	1.2	1.1	1.1	3.3	0.3
NoControl	67.10%	9.20%	3.00%	5.00%	0.80%	0.30%	0.40%	0.70%	0.00%
NoControl SD	12.9	5	4.4	6.3	2	2	1.3	2.3	0.4
Final	35.00%	4.90%	2.90%	3.50%	0.20%	0.50%	0.70%	0.00%	0.00%
Final SD	13.2	6.5	4.3	5.6	1.1	1.8	1.9	0.3	0.2

Test/Outputs	Experiment Alcohol	Experiment Cannabis	Experiment Cocaine	Experiment Ecstasy	Experiment Heroin	Experiment Meth	Experiment Speed	Experiment LSD	Experiment MagMush
Standard	95.90%	19.40%	8.20%	10.50%	3.20%	3.10%	2.50%	2.80%	1.90%
Standard SD	4.9	10.2	6.9	9.1	3.8	3.9	3.7	4.2	2.7
P1	95.90%	19.50%	8.90%	10.30%	3.10%	2.80%	2.40%	3.20%	2.20%
P1 SD	4.6	12.1	6.8	6	3.8	3.6	2.6	3.6	3.3
P10	95.90%	19.40%	8.20%	10.50%	3.20%	3.10%	2.50%	2.80%	1.90%
P10 SD	4.9	10.2	6.9	9.1	3.8	3.9	3.7	4.2	2.7
P30	96.00%	18.90%	7.30%	9.00%	3.00%	3.10%	2.40%	3.00%	2.10%
P30 SD	3.6	7.9	5.6	8	3.1	3.6	3.5	4.7	3.3
P60	96.20%	18.70%	7.30%	6.90%	3.20%	3.60%	2.60%	2.90%	1.90%
P60 SD	4.5	9.2	6.1	5.5	3.3	3.7	3	4.1	2.4
P100	96.10%	18.80%	7.70%	4.90%	3.00%	3.90%	2.70%	2.90%	2.00%
P100 SD	4.7	12.4	6.4	5.2	3.6	3.9	3.4	3.9	3.4
CannaDepletion	95.90%	15.20%	8.30%	10.60%	3.60%	3.20%	2.70%	2.90%	2.10%
CannaDepletion SD	5.9	7.9	7.6	8.5	4.3	3.7	3.3	4.1	2.8
CocainePurity	93.54%	17.08%	6.46%	9.14%	2.72%	2.76%	2.34%	2.56%	1.84%
CocainePurity SD	5.6	11.4	6	7.7	3.6	3.5	2.8	3.5	2.5
NoInteractions	94.50%	14.10%	8.40%	9.00%	3.60%	3.50%	2.30%	2.60%	2.00%
NoInteractions SD	5.3	4.3	7.5	5.9	3.8	4.4	3.1	3.7	3.4
NoRules	95.70%	19.30%	7.90%	10.60%	3.00%	3.40%	3.00%	3.30%	2.20%
NoRules SD	5.5	9.2	6.8	8	4.1	4	4.2	4.6	3.3
NoSelf	95.60%	14.10%	6.90%	8.40%	2.90%	2.70%	2.30%	2.60%	2.00%
NoSelf SD	4.7	5.1	6.8	7.7	4.2	3.5	3.5	3.8	2.9
NoControl	94.00%	13.80%	7.20%	8.40%	3.60%	2.70%	2.70%	2.50%	1.90%
NoControl SD	5.4	5.2	6.3	5.8	4	3.8	3.4	4.1	2.7
Final	97.30%	20.20%	10.60%	14.70%	0.90%	2.50%	3.30%	0.00%	0.10%
Final SD	3.5	13.5	7.4	9.3	3.2	4.8	5.4	0.3	0.5

Test/Outputs	SocRep Alcohol Non-Users	SocRep Cannabis Non-Users	SocRep Cocaine Non-Users	SocRep Ecstasy Non-Users	SocRep Heroin Non-Users	SocRep Meth Non- Users	SocRep Speed Non-Users	SocRep LSD Non- Users	SocRep MagMush Non-Users
Standard	1.4	0.5	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
Standard SD	0.2	0.1	0	0	0	0	0	0	0
P1	1.4	0.5	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
P1 SD	0.3	0.1	0	0.1	0	0	0	0	0
P10	1.4	0.5	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
P10 SD	0.2	0.1	0	0	0	0	0	0	0
P30	1.4	0.4	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
P30 SD	0.3	0.1	0	0	0	0	0	0	0
P60	1.3	0.5	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
P60 SD	0.7	0.1	0	0	0	0	0	0	0
P100	1.3	0.4	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
P100 SD	0.3	0.1	0	0	0	0	0	0	0
CannaDepletion	1.4	0.5	-2	-0.2	-4	-1.9	-1.2	-1.9	-0.2
CannaDepletion SD	0.2	0.1	0	0	0	0	0	0	0
CocainePurity	1.3	0.3	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
CocainePurity SD	0.4	0.1	0	0.1	0	0	0	0	0
NoInteractions	1.3	0.3	-2.1	-0.4	-4.1	-2	-1.4	-2	-0.4
NoInteractions SD	0.2	0	0	0	0	0	0	0	0
NoRules	1.4	0.5	-2	-0.2	-4	-1.9	-1.2	-1.8	-0.2
NoRules SD	0.3	0.1	0	0.1	0	0	0	0	0
NoSelf	1.1	0.3	-2	-0.3	-4	-1.9	-1.2	-1.9	-0.2
NoSelf SD	0.4	0	0	0	0	0	0	0	0
NoControl	1.3	0.3	-2.1	-0.4	-4.1	-2	-1.4	-2	-0.4
NoControl SD	0.1	0	0	0	0	0	0	0	0
Final	1.3	0.7	-1.9	-0.1	-4	-1.8	-1	-1.7	-0.2
Final SD	0.7	0.1	0.1	0	0	0	0.1	0.1	0

Test/Outputs	SocRep Alcohol Users	SocRep Cannabis Users	SocRep Cocaine Users	SocRep Ecstasy Users	SocRep Heroin Users	SocRep Meth Users	SocRep Speed Users	SocRep LSD Users	SocRep MagMush Users
Standard	1.9	4	2.9	2.3	2.6	3.4	1	4.7	1.26
Standard SD	0.2	0.2	0.4	0.4	1.4	1.3	1.7	1.4	5.1
P1	2	4	2.7	2.2	2.7	3.2	1.6	4.5	1.42
P1 SD	0.2	0.2	0.3	0.4	1.2	1.1	3.2	0.8	6.6
P10	1.9	4	2.9	2.3	2.6	3.4	1	4.7	1.26
P10 SD	0.2	0.2	0.4	0.4	1.4	1.3	1.7	1.4	5.1
P30	2	4	2.9	2.8	2.6	3.8	2	4.6	1.34
P30 SD	0.2	0.2	0.4	0.4	1.3	1.7	2.6	2.3	6
P60	2	4	2.9	3.4	2.4	3.7	1.6	4.9	1.24
P60 SD	0.1	0.3	0.4	0.5	1.5	0.7	1.7	1.1	4.4
P100	2	4	3	3.8	2.5	3.8	1.5	5	1.21
P100 SD	0.2	0.2	0.4	0.7	1.3	0.8	2.2	2.3	5.6
CannaDepletion	2	3.4	2.2	2	1.5	1.5	1.6	1.9	1.6
CannaDepletion SD	0.2	0.2	0.3	0.3	0.6	0.5	0.4	0.6	0.2
CocainePurity	1.9	3.6	3.3	2.3	2	3.7	5	4.4	1.2
CocainePurity SD	0.2	0.4	0.5	0.4	1.8	1.3	2.2	1.4	3.1
NoInteractions	1.7	4.1	3.1	2	3.3	5	2.5	5	1.78
NoInteractions SD	0.2	0.2	0.5	0.4	1.4	1	4.4	2.2	6.9
NoRules	1.9	4	3	2.1	2.4	3.5	1.3	0.7	1.19
NoRules SD	0.2	0.2	0.4	0.5	1.3	1	2.3	1	4.3
NoSelf	1.9	1.8	0.7	1.8	-0.9	0.5	0.9	0.6	1.4
NoSelf SD	0.1	0.1	0.3	0.2	0.3	0.4	0.3	0.3	0.2
NoControl	1.5	2.1	2.4	2.3	3.9	5	5	2.3	1.57
NoControl SD	0	0.1	0.2	0.2	1	3.8	2.3	3.7	1.2
Final	1.9	4.1	1.9	2	2	2.3	3.3	0.2	0.9
Final SD	0.2	0.2	0.4	0.3	1.3	0.7	0.5	0.6	0.3

Test/Outputs	Rejectors Experiment Alcohol	Rejectors Experiment Cannabis	Rejectors Experiment Cocaine	Rejectors Experiment Ecstasy	Rejectors Experiment Heroin	Rejectors Experiment Meth	Rejectors Experiment Speed	Rejectors Experiment LSD	Rejectors Experiment MagMush
Standard	96.70%	6.60%	0.20%	1.60%	0.00%	0.00%	0.00%	0.00%	0.00%
Standard SD	2.4	3.5	0.5	1.7	0	0	0.2	0	0.1
P1	96.50%	6.90%	0.10%	1.10%	0.00%	0.00%	0.10%	0.00%	0.00%
P1 SD	2.6	3.9	0.3	1.3	0	0.2	0.4	0.1	0.2
P10	96.70%	6.60%	0.20%	1.60%	0.00%	0.00%	0.00%	0.00%	0.00%
P10 SD	2.4	3.5	0.5	1.7	0	0	0.2	0	0.1
P30	96.60%	5.90%	0.20%	1.20%	0.00%	0.00%	0.10%	0.00%	0.10%
P30 SD	2.1	2.8	0.6	1.6	0	0	0.3	0.2	0.3
P60	96.50%	6.10%	0.10%	0.90%	0.00%	0.00%	0.10%	0.00%	0.00%
P60 SD	2.2	3.4	0.3	1.3	0	0	0.3	0.1	0.2
P100	96.30%	6.20%	0.00%	0.30%	0.00%	0.00%	0.00%	0.00%	0.10%
P100 SD	2.6	4.5	0.1	0.7	0	0.1	0.1	0.1	0.3
CannaDepletion	96.10%	3.40%	0.20%	1.60%	0.00%	0.00%	0.10%	0.00%	0.00%
CannaDepletion SD	2.9	2.1	0.5	1.9	0	0	0.4	0	0.1
CocainePurity	96.25%	6.13%	0.19%	1.38%	0%	0%	0%	0%	0.06%
CocainePurity SD	2.3	4.4	0.5	1.6	0	0	0.2	0	0.3
NoInteractions	96.30%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NoInteractions SD	2.8	0	0	0.1	0	0	0	0	0
NoRules	96.20%	6.80%	0.10%	1.40%	0.00%	0.00%	0.10%	0.00%	0.00%
NoRules SD	2.5	3.4	0.4	1.8	0	0.1	0.3	0	0.3
NoSelf	95.30%	0.20%	0.00%	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%
NoSelf SD	2.5	0.6	0	0.6	0	0	0.1	0	0.2
NoControl	93.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NoControl SD	3.2	0	0	0	0	0	0	0	0
Final	97.90%	8.30%	1.30%	4.80%	0.00%	0.20%	0.80%	0.00%	0.00%
Final SD	1.5	4.5	1.5	2.5	0	0.7	1.3	0	0

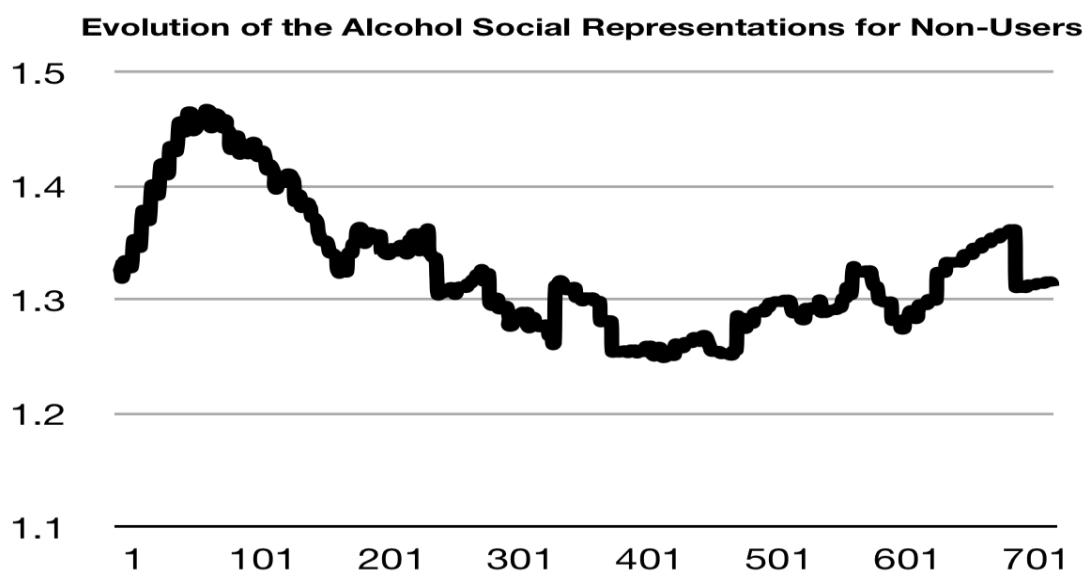
Test/Outputs	Neutral Experiment Alcohol	Neutral Experiment Cannabis	Neutral Experiment Cocaine	Neutral Experiment Ecstasy	Neutral Experiment Heroin	Neutral Experiment Meth	Neutral Experiment Speed	Neutral Experiment LSD	Neutral Experiment MagMush
Standard	96.00%	7.60%	0.40%	1.70%	0.00%	0.00%	0.10%	0.00%	0.00%
Standard SD	2.6	5.3	1.2	2.9	0	0.2	0.6	0	0.3
P1	96.30%	7.40%	0.50%	1.60%	0.00%	0.00%	0.10%	0.00%	0.00%
P1 SD	3	6.1	1.1	2	0	0.2	0.6	0.4	0.4
P10	96.00%	7.60%	0.40%	1.70%	0.00%	0.00%	0.10%	0.00%	0.00%
P10 SD	2.6	5.3	1.2	2.9	0	0.2	0.6	0	0.3
P30	96.10%	6.80%	0.40%	1.40%	0.00%	0.00%	0.10%	0.00%	0.00%
P30 SD	2.6	4.7	1.3	2.5	0	0.1	0.4	0.3	0.3
P60	96.30%	6.60%	0.30%	1.10%	0.00%	0.00%	0.20%	0.00%	0.10%
P60 SD	3.4	4.5	0.8	1.9	0	0.2	0.7	0.2	0.4
P100	95.90%	7.10%	0.40%	0.40%	0.00%	0.00%	0.10%	0.00%	0.00%
P100 SD	2.8	5.6	1.2	1.2	0	0.1	0.4	0	0.3
CannaDepletion	95.90%	4.40%	0.50%	1.90%	0.00%	0.00%	0.20%	0.00%	0.00%
CannaDepletion SD	2.9	3.9	1.2	2.4	0	0.2	0.6	0.2	0.2
CocainePurity	96.04%	6.84%	0.56%	1.80%	0%	0%	0.16%	0%	0%
CocainePurity SD	3.1	5.4	1.5	2.7	0	0.2	0.5	0	0
NoInteractions	96.30%	0.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NoInteractions SD	2.5	1.5	0.1	0.1	0	0	0	0	0
NoRules	95.80%	7.30%	0.50%	2.00%	0.00%	0.00%	0.20%	0.00%	0.10%
NoRules SD	2.9	5	1.1	3.2	0	0.2	0.7	0.2	0.6
NoSelf	95.10%	1.00%	0.00%	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%
NoSelf SD	3.1	1.6	0.2	0.8	0	0	0.2	0	0.1
NoControl	93.60%	0.70%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NoControl SD	3.7	1.3	0	0.1	0	0	0	0	0
Final	96.20%	8.80%	2.80%	5.30%	0.00%	0.40%	1.00%	0.00%	0.00%
Final SD	2.5	7.7	2.8	3.6	0	1.6	1.6	0	0.2

Test/Outputs	% individual with [controlrules != [0 0 0]]	% individual with [alcohol- rules != [0 0 0 0 0 0]]	% individual with [cannabis- rules != [0 0 0 0 0 0]]	% individual with [cocaine- rules != [0 0 0 0 0 0]]	% individual with [ecstasy- rules != [0 0 0 0 0 0]]	% individual with [heroin- rules != [0 0 0 0 0 0]]	% individual with [meth- rules != [0 0 0 0 0 0]]
Standard	1.00%	4.00%	3.10%	1.10%	1.00%	0.70%	0.40%
Standard SD	2.4	4.2	4.1	2.1	2.4	1.9	1.3
P1	0.90%	3.90%	3.10%	1.00%	1.10%	0.80%	0.50%
P1 SD	2	4.5	3.6	2.1	1.9	1.9	1.3
P10	1.00%	4.00%	3.10%	1.10%	1.00%	0.70%	0.40%
P10 SD	2.4	4.2	4.1	2.1	2.4	1.9	1.3
P30	1.50%	3.80%	2.90%	0.80%	0.40%	0.70%	0.40%
P30 SD	2.6	5.2	4.3	2.1	1.1	1.7	1.4
P60	2.50%	3.80%	2.90%	0.80%	0.10%	0.70%	0.40%
P60 SD	3	4.3	3.5	2.3	0.7	1.9	1.5
P100	3.00%	3.70%	2.80%	0.80%	0.00%	0.70%	0.40%
P100 SD	4	5	3.8	2.2	0.4	1.8	1.2
CannaDepletion	1.00%	2.80%	1.40%	0.60%	0.90%	0.50%	0.50%
CannaDepletion SD	2.6	3.4	2.5	1.7	2.7	2.1	1.5
CocainePurity	0.86%	4.74%	3.76%	2.12%	0.94%	0.64%	0.40%
CocainePurity SD	1.8	4.4	4.2	3.4	2.2	1.8	1.6
NoInteractions	1.00%	3.70%	3.00%	1.20%	1.00%	1.20%	0.30%
NoInteractions SD	2	4.3	3.9	2.6	2.3	2.6	1.2
NoRules	0	0	0	0	0	0	0
NoRules SD	0	0	0	0	0	0	0
NoSelf	1.30%	9.10%	2.80%	1.00%	1.20%	0.60%	0.50%
NoSelf SD	2.1	5.9	3.5	2.7	2.8	1.7	1.6
NoControl	0	0	0	0	0	0	0
NoControl SD	0	0	0	0	0	0	0
Final	2.50%	5.50%	2.90%	1.20%	2.40%	0.20%	1.30%
Final SD	2.9	3.8	4.3	2.6	4.8	0.9	2.5

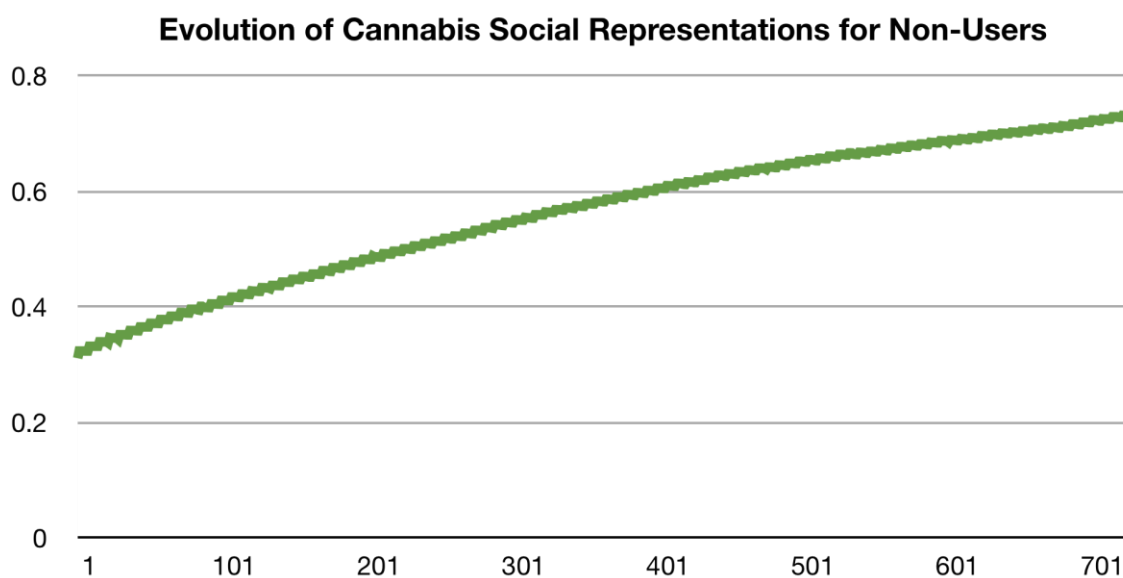
Test/Outputs	% individual with [speed- rules != [0 0 0 0 0 0]]	% individual with [LSD- rules != [0 0 0 0 0 0]]	% individual with [MagMush- rules != [0 0 0 0 0 0]]	%individual wih rules created
Standard	0.30%	0.20%	0.00%	6.00%
Standard SD	1.3	1	0	5
P1	0.20%	0.20%	0.00%	5.90%
P1 SD	0.9	0.9	0	4.9
P10	0.30%	0.20%	0.00%	6.00%
P10 SD	1.3	1	0	5
P30	0.20%	0.20%	0.00%	5.50%
P30 SD	1.2	0.7	0	5.9
P60	0.20%	0.10%	0.00%	6.40%
P60 SD	1.2	0.6	0	5.2
P100	0.20%	0.10%	0.00%	6.60%
P100 SD	1.1	1	0	5.8
CannaDepletion	0.40%	0.20%	0.00%	4.70%
CannaDepletion SD	1.2	1	0	4.6
CocainePurity	0.20%	0.22%	0%	6.64%
CocainePurity SD	1.1	1.2	0.1	5.6
NoInteractions	0.20%	0.10%	0.00%	5.90%
NoInteractions SD	0.8	0.7	0	4.6
NoRules	0	0	0	0
NoRules SD	0	0	0	0
NoSelf	0.30%	0.20%	0.00%	10.20%
NoSelf SD	1.1	1	0	6.4
NoControl	0	0	0	0
NoControl SD	0	0	0	0
Final	1.20%	0.00%	0.00%	13.20%
Final SD	2.6	0.3	0	7

Annex 10. Evolutions of the substances Consumption Trends and SocialRepresentations for Users and NonUsers.

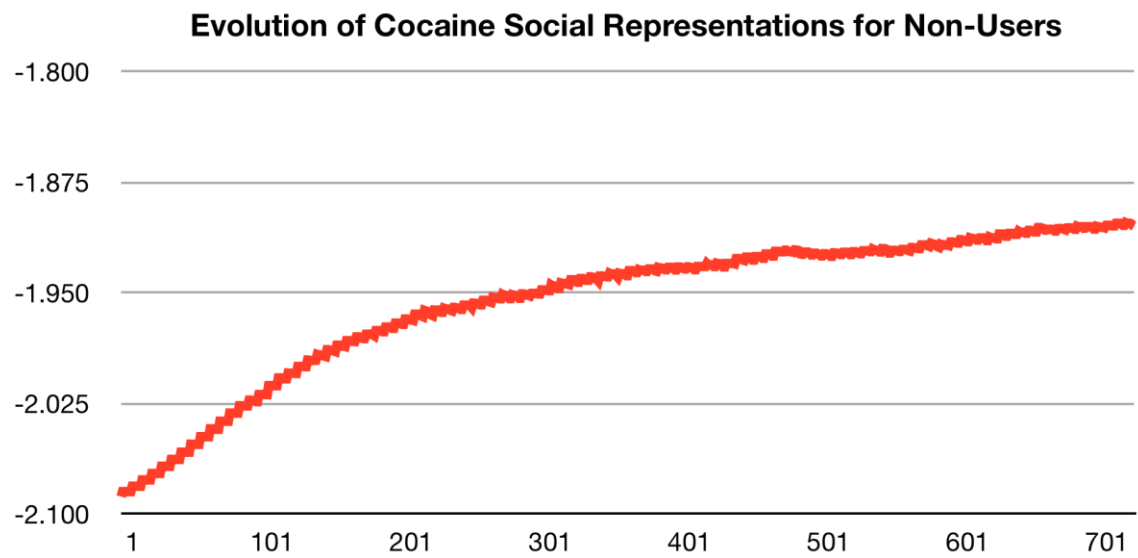
Evolution of the Alcohol SocialRepresentation attribute amongst non-users.



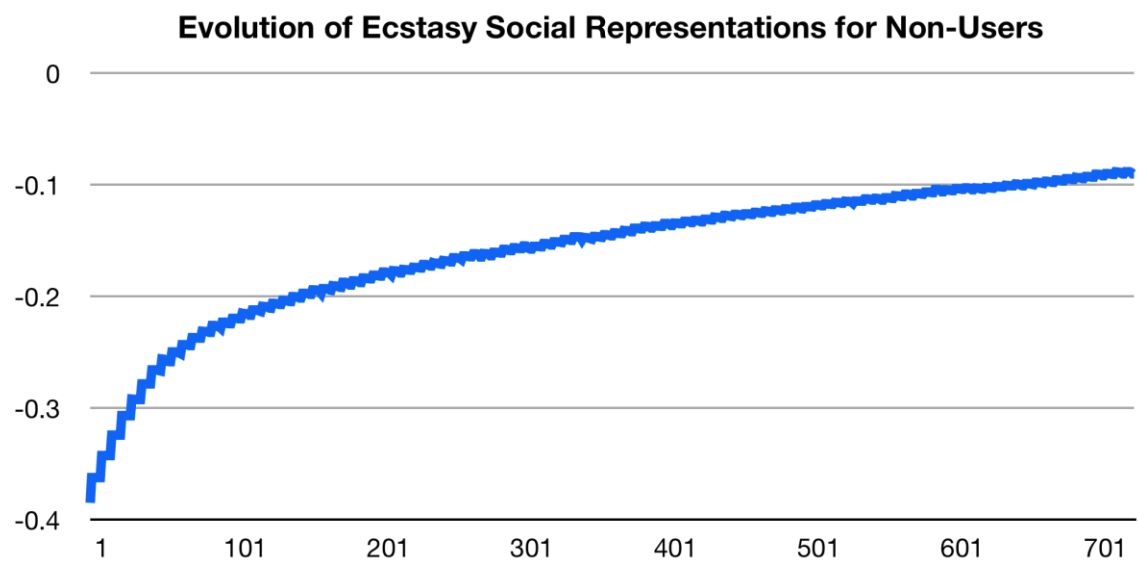
Evolution of the Cannabis SocialRepresentation attribute amongst non-users.



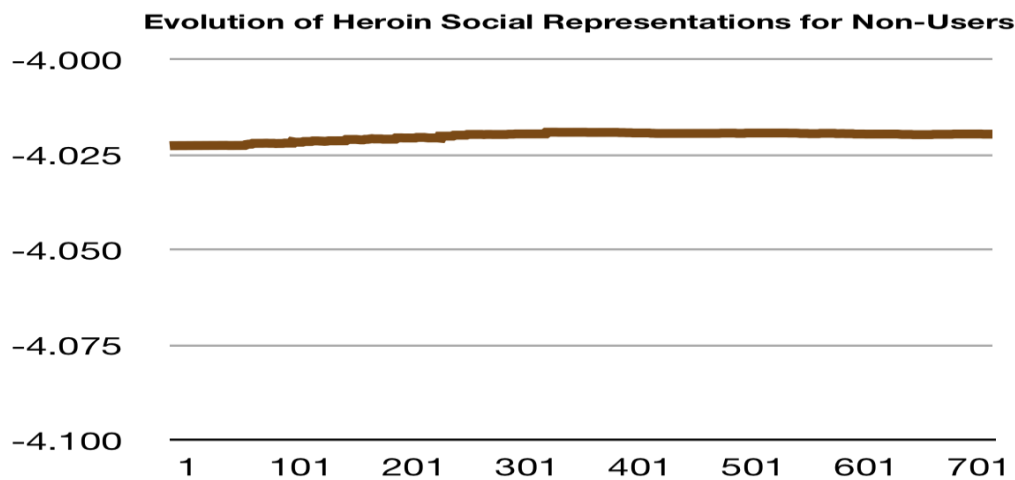
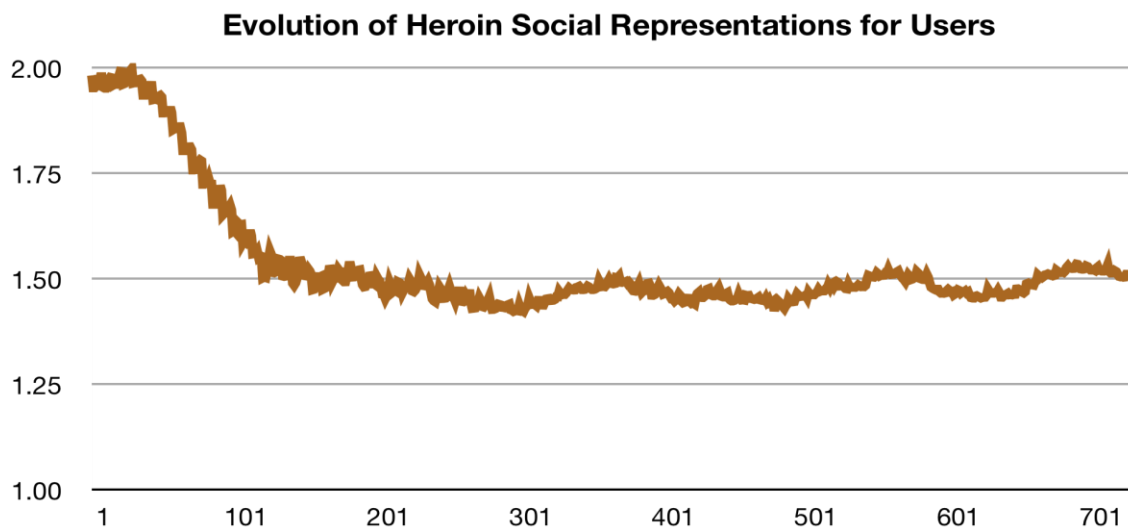
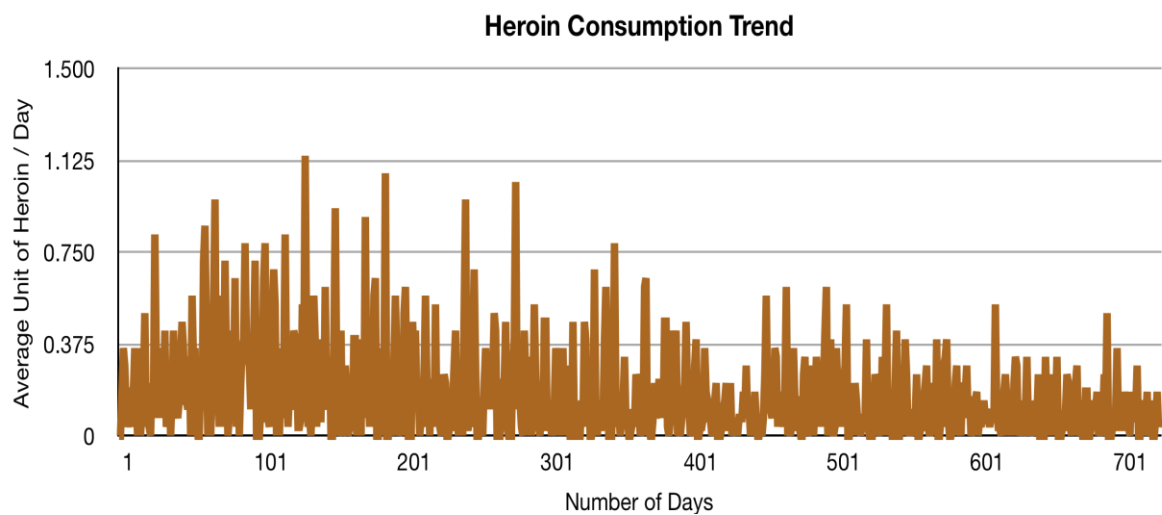
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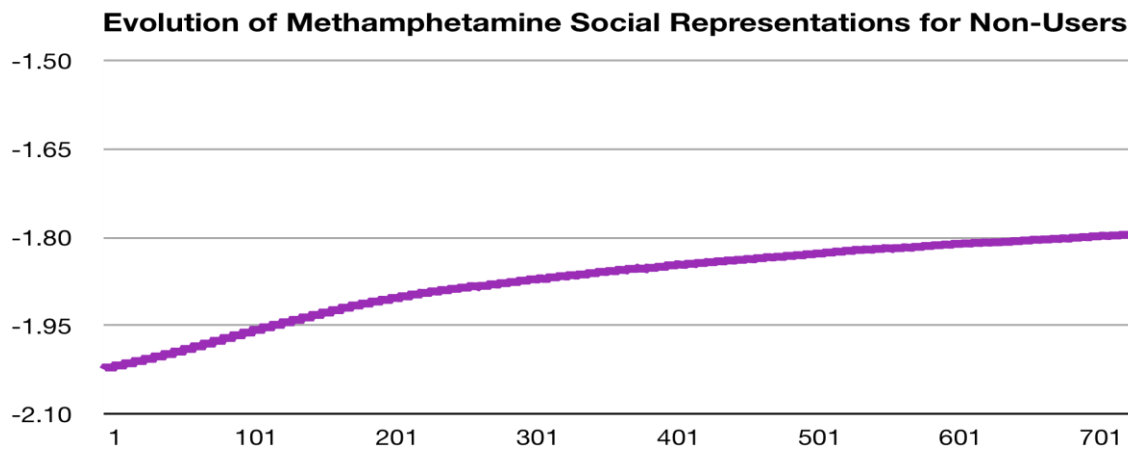
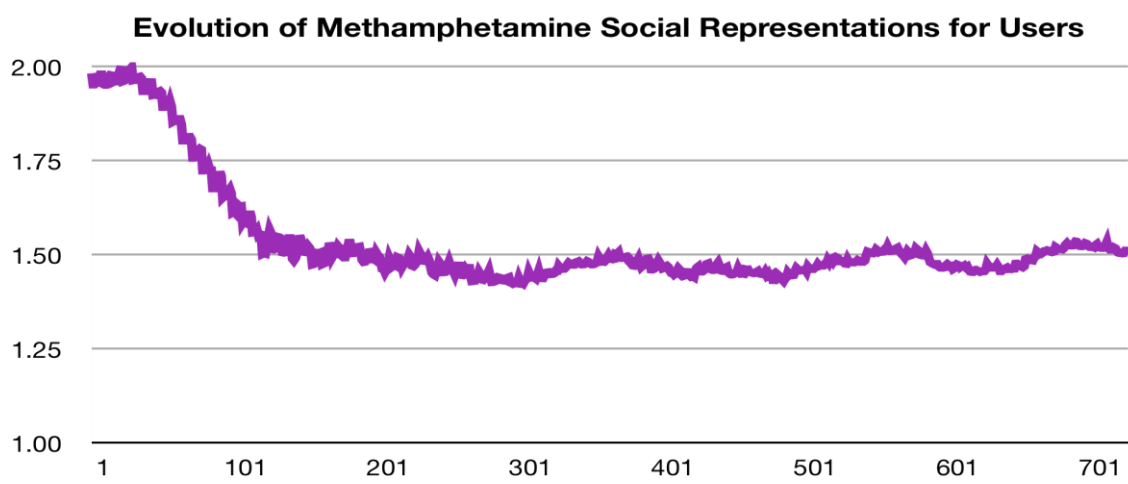
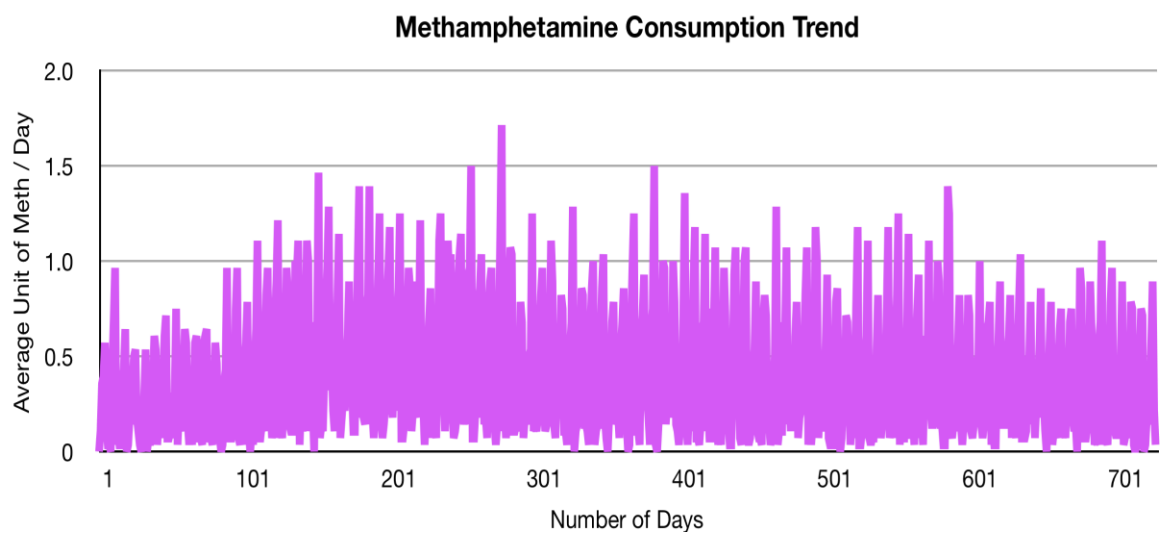
Evolution of the Ecstasy SocialRepresentations attribute amongst non-users.



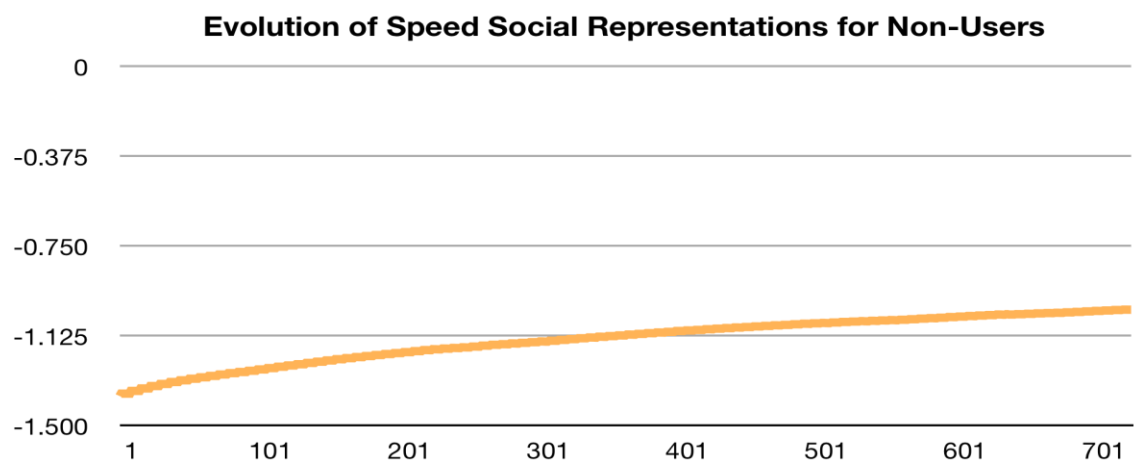
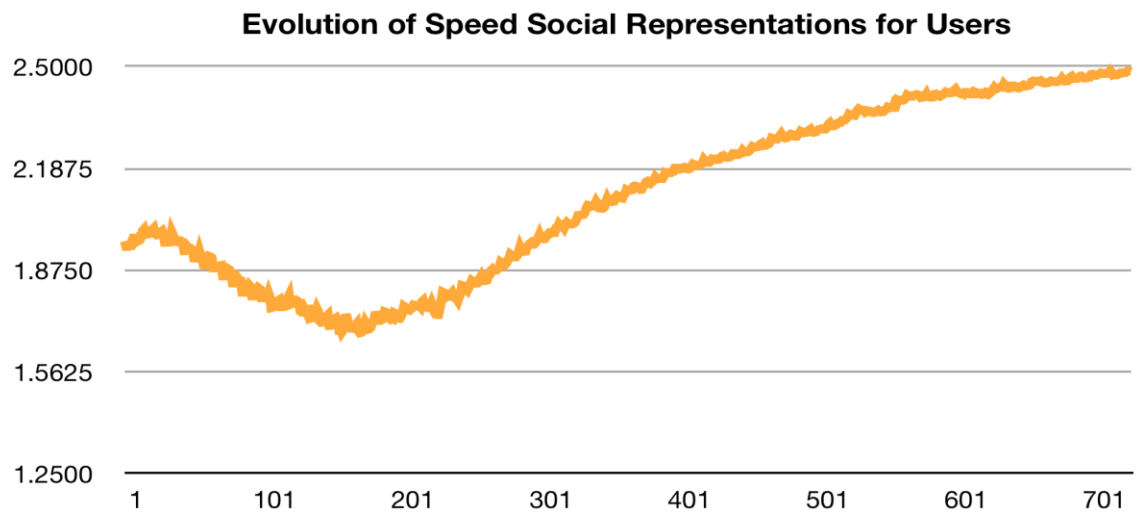
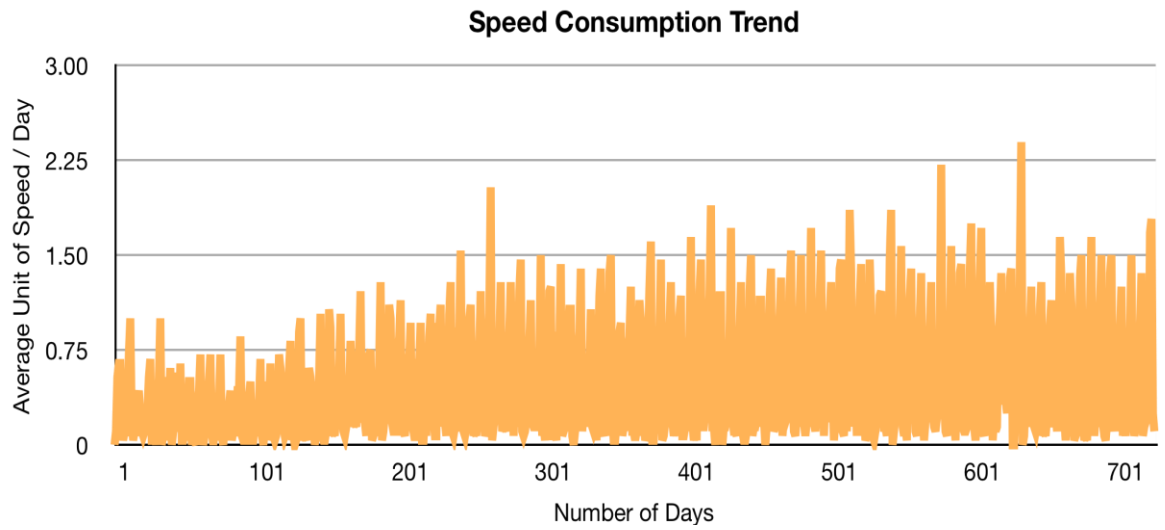
Consumption Trends and SocialRepresentations Evolutions for Heroin



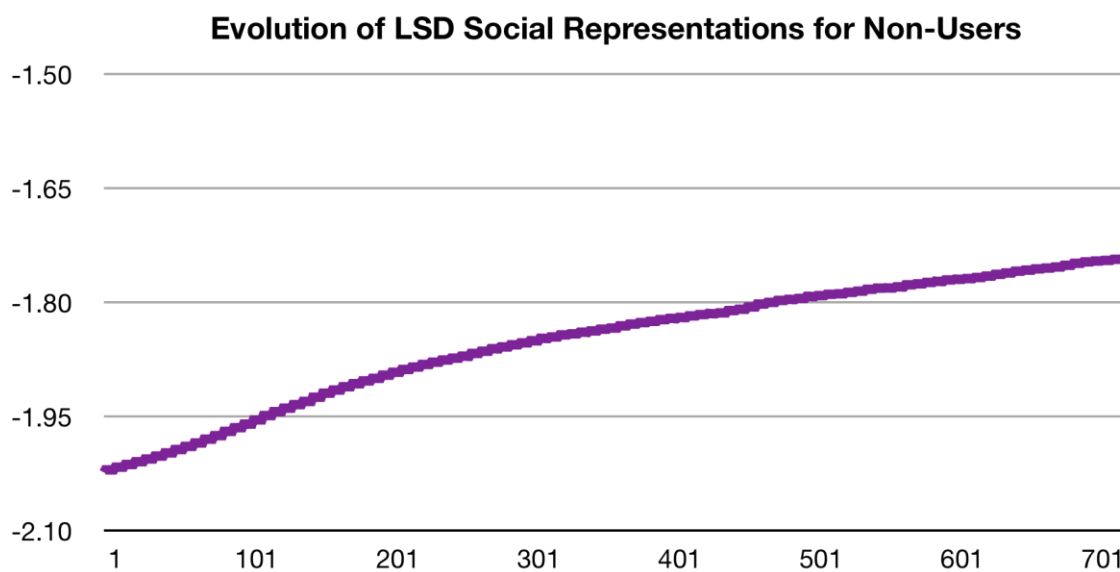
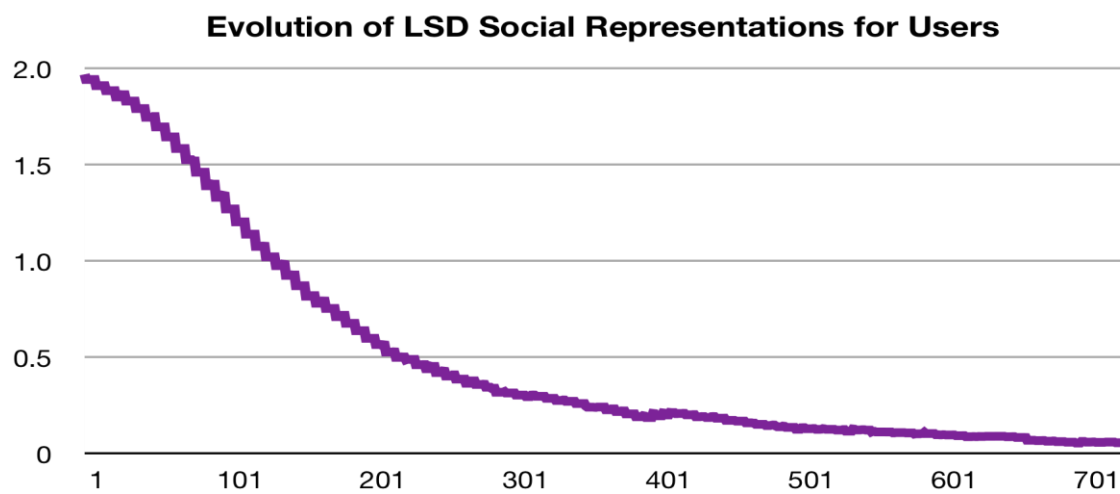
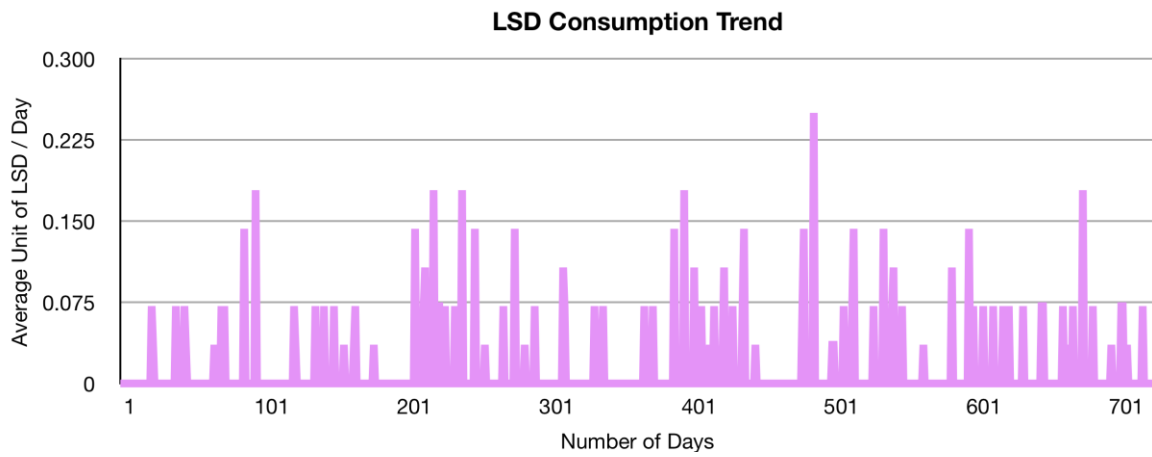
Consumption Trends and SocialRepresentations Evolutions for Methamphetamine



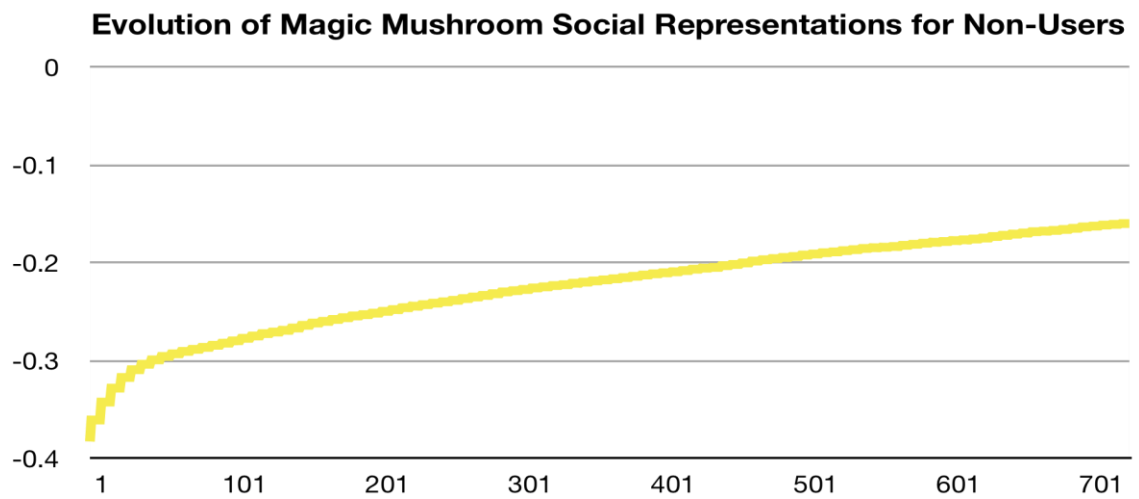
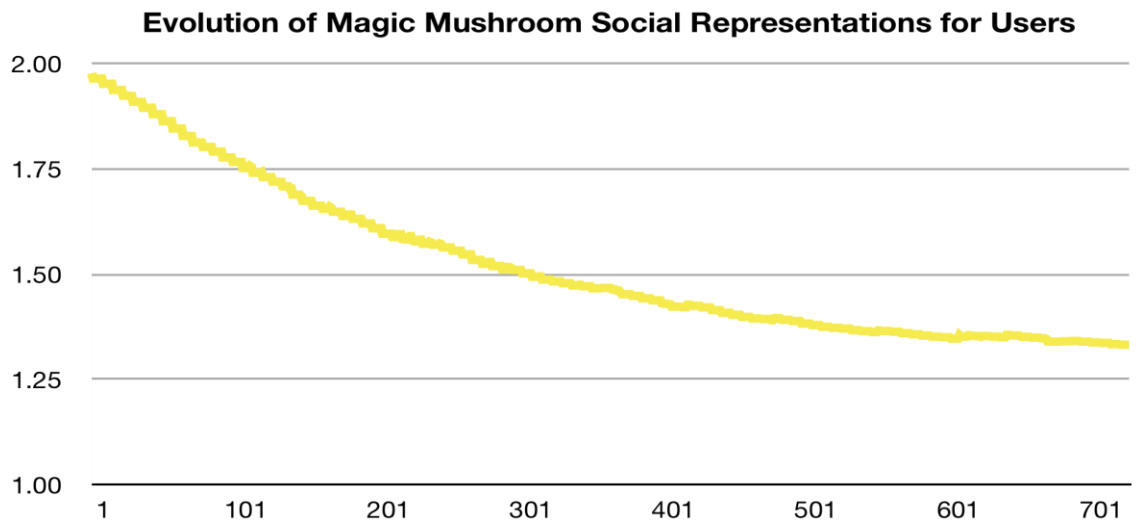
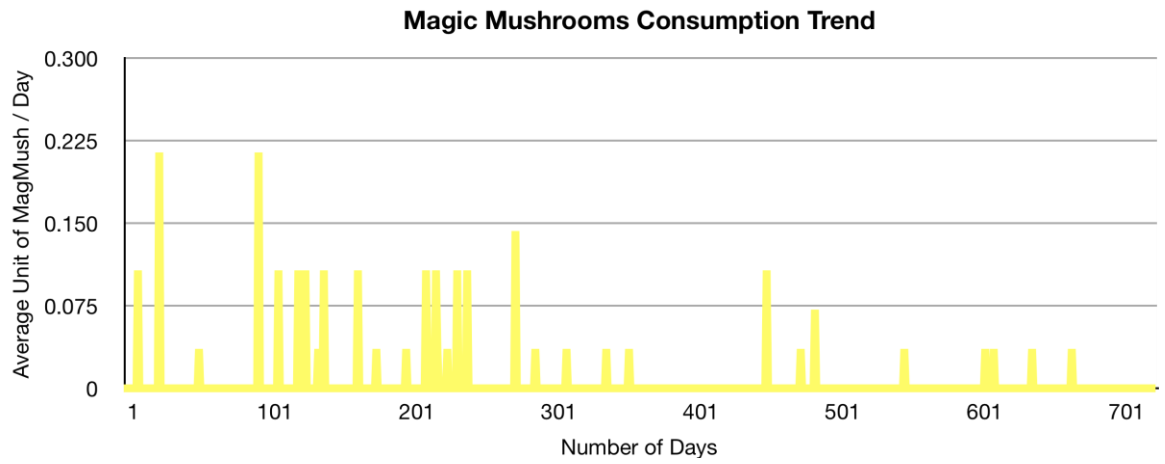
Consumption Trends and SocialRepresentations Evolutions for Speed.



Consumption Trends and SocialRepresentations Evolutions for LSD.



Consumption Trends and SocialRepresentations Evolutions for Magic Mushrooms



Annex 11. NeuralBoxSim outputs.

The first set of five behaviors (Behavior-Intake) corresponds to the behaviors exhibited by agents just after the intake. The second set of five behaviors corresponds to behaviors agent will experience during the majority of the comedown.

The initial values of Health and Sanity of the 'Brain' are 70. The "Var. Health" and "Var. Sanity" designated the maximum loss affecting these attributes during the overall action of the drug. This duration is represented by the "Duration Effects" which represents the number of ticks during which the agents feel the action of the substance tested.

OD means "Overdose". This event needs to be distinguished from the complete loss of Health/Sanity, which can occur during the comedown phase. Agents with a Var.Health or Var.Sanity inferior to 0 are considered as deceased or insane due to the overall action of the substance.

Alcohol values:

Alcohol	1	2	4	8	12	20	40	100
Alcohol S1								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Happy	Happy	Happy	Happy	Happy	Happy	Psychotic	Psychotic
item 2 Behavior Intake	Relax	Relax	Relax	Sedated	Sedated	Sedated	Sedated	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Slow	Slow	Erratic	Erratic
item 4 Behavior Intake	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Prosocial	Normal	Normal
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Normal	Normal	Depressed	Psychotic	Psychotic
item 2	Normal	Normal	Normal	Normal	Normal	Normal	Sedated	Sedated

Behavior CD		al	al	al	al	al		
item 3 Behavior CD	Normal	Normal	Normal	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Aggressive
Var. Health	0	0	0	0	0	0	OD	OD
Var. Sanitty	0	0	0	-0.75	-2.05	-5.8	OD	OD
Duration Effect	1	2	4	6	8	11	x	x
Alcohol S3								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Happy	Psychotic
item 2 Behavior Intake	Normal	Normal	Relax	Relax	Relax	Sedated	Sedated	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Slow	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial	Normal
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Normal	Depress	Depress	Depress	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Anxious	Sedated	Sedated	Sedated
item 3 Behavior CD	Normal	Normal	Normal	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Aggressive	Aggressive
Var. Health	0	0	0	0	-0.25	-0.75	-0.5	OD

Var. Sanitty	0	0	0	0	-0.25	-0.75	-4.4	OD
Duration Effect	0	0	2	6	7	12	18	x
Alcohol S5								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Normal	Normal	Normal	Happy	Happy	Happy	Happy	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Relax	Relax	Relax	Sedated	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial	Normal
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Depress	Depress	Depress	Depress	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Sedated	Sedated	Sedated	Sedated	Sedated
item 3 Behavior CD	Normal	Normal	Normal	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	-0.25	-0.25	-0.25	-1.85	-10.86
Var. Sanitty	0	0	0	-0.5	-0.8	-2.5	-9.7	-44
Duration Effect	0	0	0	5	13	18	26	34
Alcohol S7								
item 0 Behavior	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Intake								
item 1 Behavior Intake	Normal	Normal	Normal	Normal	Happy	Happy	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Relax	Relax	Sedated	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Prosocial	Normal	Normal
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Depress	Depress	Depress	Depress	Depress	Psychotic	Psychotic
item 2 Behavior CD	Normal	Anxious	Sedated	Sedated	Sedated	Sedated	Sedated	Sedated
item 3 Behavior CD	Normal	Slow	Slow	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	-0.25	-1.25	-3.2	-14.83	-35.83
Var. Sanitty	0	0	0	-2.55	-8	-16	-83.4	-122.6
Duration Effect	0	5	12	18	22	28	33	43

Cannabis values:

Cannabis	1	2	4	8	12	20	40	100
Cannabis S1								
item 0 Behavior Intake	Normal	Normal	Normal	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate
item 1	Normal	Happy	Happy	Happy	Happy	Happy	Psychotic	Psychotic

Behavior Intake							c	c
item 2 Behavior Intake	Relax	Relax	Relax	Relax	Sedated	Sedated	Sedated	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Normal	Normal
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Psychotic	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Relax	Relax	Relax	Sedated	Sedated
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Slow	Slow
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Var. Health	0	0	0	0	0	-0.5	OD	OD
Var. Sanitty	0	0	-0.25	-0.5	-1.34	-7.06	OD	OD
Duration Effect	2	4	6	10	12	15	x	x
Cannabis S3								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Hallucinate	Hallucinate

item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Psychoti c	Psychoti c
item 2 Behavior Intake	Normal	Normal	Relax	Relax	Relax	Relax	Sedated	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Norm al	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Prosocia l	Prosoci al	Prosoci al	Prosoc ial	Normal	Normal
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Norm al	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Normal	Depres s	Depre ss	Psychoti c	Psychoti c
item 2 Behavior CD	Normal	Normal	Normal	Normal	Anxiou s	Anxio us	Sedated	Sedated
item 3 Behavior CD	Normal	Normal	Normal	Normal	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Norm al	Normal	Normal
Var. Health	0	0	0	0	0	-0.25	OD	OD
Var. Sanitty	0	0	0	0	0	-0.8	OD	OD
Duration Effect	0	0	3	3	8	16	x	x
Cannabis S5								
item 0 Behavior	Normal	Normal	Normal	Normal	Normal	Norm al	Hallucin ate	Hallucin ate

Intake								
item 1 Behavior Intake	Normal	Normal	Normal	Happy	Happy	Happy	Happy	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Relax	Relax	Relax	Relax	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Prosocial	Prosocial	Normal
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Depress	Depress	Depress	Depress	Depress	Psychotic
item 2 Behavior CD	Normal	Normal	Anxious	Anxious	Anxious	Anxious	Anxious	Sedated
item 3 Behavior CD	Normal	Normal	Slow	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Normal
Var. Health	0	0	0	0	-0.25	-0.25	-1.8	-7.5
Var. Sanitty	0	0	0	-0.5	-0.8	-2.4	-10	-62.89
Duration Effect	0	0	4	12	16	21	27	36
Cannabis S7								
item 0	Normal	Normal	Normal	Normal	Normal	Norm	Normal	Hallucin

Behavior Intake						al		ate
item 1 Behavior Intake	Normal	Normal	Normal	Normal	Happy	Happy	Happy	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Relax	Relax	Relax	Relax	Sedated
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Painful
item 1 Behavior CD	Normal	Depress	Depress	Depress	Depress	Depress	Depress	Depress
item 2 Behavior CD	Normal	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious
item 3 Behavior CD	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive
Var. Health	0	0	-0.5	-0.5	-0.75	-1.25	-2.15	-24.63
Var. Sanitty	0	0	-0.75	-3.115	-4.8	-9.15	-43.03	-78.93
Duration Effect	1	3	11	20	25	27	37	5

Cocaine values:

Cocaine	1	2	4	8	12	20	40	100
Cocaine S1								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Happy	Happy	Happy	Psychotic	Psychotic	Psychotic	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Energetic	Energetic	Energetic	Erratic	Erratic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Normal	Depressed	Psychotic	Psychotic	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Erratic	Erratic	Erratic
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive
Var. Health	0	0	-0.75	-2.1	-4.65	OD	OD	OD
Var. Sanitty	0	0	-1.25	-4.8	-9.55	OD	OD	OD
Duration Effect	1	2	4	10	14	x	x	x

Cocaine S3								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Normal	Happy	Happy	Happy	Happy	Psychot ic	Psychot ic	Psychot ic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Energe tic	Energe tic	Energet ic	Energe tic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Prosoci al	Prosoci al	Prosoci al	Prosoci al	Prosoci al	Aggres sive	Aggress ive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Depres s	Depress	Depres s	Depress	Psychot ic	Psychot ic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Normal	Slow	Slow	Slow	Erratic	Erratic
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Aggress ive	Aggres sive	Aggress ive
Var. Health	0	0	0	0	-0.8	-2.15	OD	OD
Var. Sanitty	0	0	0	-0.25	-1.75	-5.45	OD	OD
Duration Effect	0	1	5	11	15	20	x	x
Cocaine S5								
item 0	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Behavior Intake								
item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Normal	Energetic	Energetic	Energetic	Energetic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Slow	Slow	Slow	Slow	Slow	Erratic
item 4 Behavior CD	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	-0.75	-0.75	-1.15	-6.6	OD
Var. Sanitty	0	0	0	-1.9	-3.6	-11.8	-34.5	OD
Duration Effect	0	2	10	16	20	25	31	x
Cocaine S7								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Psychot ic	Psychot ic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Normal	Energe tic	Energet ic	Energe tic	Energeti c	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Prosoci al	Prosoci al	Prosoci al	Prosoci al	Aggres sive	Aggress ive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Depress	Depres s	Depres s	Depress	Depres s	Depress	Psychot ic	Psychot ic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Slow	Slow	Slow	Slow	Slow	Slow	Erratic	Erratic
item 4 Behavior CD	Normal	Aggres sive	Aggres sive	Aggress ive	Aggres sive	Aggress ive	Aggres sive	Aggress ive
Var. Health	-0.25	-0.25	-0.5	-0.83	-2.29	OD	OD	OD
Var. Sanitty	-1.3	-2.2	-6.25	-12.61	-33.76	OD	OD	OD
Duration Effect	7	18	23	31	35	x		

Ecstasy values:

Ecstasy	1	2	4	8	12	20	40	100
Ecstasy S1								
item 0	Normal	Halluci	Halluci	Halluci	Halluci	Halluci	Halluci	Halluci

Behavior Intake		nate	nate	nate	nate	nate	nate	nate
item 1 Behavior Intake	Happy	Happy	Happy	Psycho tic	Psycho tic	Psycho tic	Psycho tic	Psycho tic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Energetic	Energetic	Energetic	Erratic	Erratic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Psycho tic	Psycho tic	Psycho tic	Psycho tic	Psycho tic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	-0.25	-0.75	-1.5	OD	OD	OD
Var. Sanitty	0	0	-0.75	-3.85	-10.54	OD	OD	OD
Duration Effect	2	4	8	12	14	x	x	x
Ecstasy S3								
item 0 Behavior Intake	Normal	Normal	Normal	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate
item 1 Behavior Intake	Normal	Happy	Happy	Happy	Psycho tic	Psycho tic	Psycho tic	Psycho tic
item 2 Behavior	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Intake								
item 3 Behavior Intake	Normal	Energetic	Energetic	Energetic	Energetic	Energetic	Erratic	Erratic
item 4 Behavior Intake	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Depressed	Depressed	Depressed	Depressed	Depressed	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Sedated	Normal
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	0	0	0	-2	OD
Var. Sanitty	0	0	0	-0.5	-2.7	-3.45	-20.43	OD
Duration Effect	0	2	5	12	16	21	26	x
Ecstasy S5								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Hallucinate	Hallucinate	Hallucinate	Hallucinate
item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Normal	Energetic	Energetic	Energetic	Energetic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive

item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Depres s	Depres s	Depres s	Depres s	Depres s	Depres s	Psycho tic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Sedate d	Sedate d	Sedate d	Normal
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Normal	Aggres sive	Aggres sive	Aggres sive	Aggres sive	Aggres sive	Aggres sive
Var. Health	0	0	0	0	0	-0.25	-0.75	OD
Var. Sanitty	0	0	-0.5	-0.8	-2.05	-11.25	-27.3	OD
Duration Effect	0	3	11	16	21	26	30	x
Ecstasy S7								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior Intake	Normal	Normal	Normal	Happy	Happy	Happy	Happy	Psycho tic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Normal	Normal	Energet ic	Energet ic	Energet ic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Aggres sive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Depres s	Depres s	Depres s	Depres s	Depres s	Depres s	Depres s	Psycho tic
item 2 Behavior CD	Normal	Normal	Normal	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Normal

item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Normal	Aggres sive	Aggres sive	Aggres sive	Aggres sive	Aggres sive	Aggres sive
Var. Health	0	0	0	0	0	0	0	OD
Var. Sanitty	0	-0.7	-2.05	-6.15	-8.85	-39.33	-72.85	OD
Duration Effect	5	13	19	26	32	35	7	x

Heroin values:

Heroin	1	2	4	8	12	20	40	100
Heroin S1								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Happy	Happy	Happy	Happy	Happy	Happy	Psycho tic	Psycho tic
item 2 Behavior Intake	Relax	Relax	Sedate d	Sedate d	Sedate d	Sedate d	Sedate d	Sedate d
item 3 Behavior Intake	Normal	Normal	Normal	Erratic	Erratic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Prosoci al	Prosoci al	Prosoci al	Prosoci al	Prosoci al	Prosoci al
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 2 Behavior CD	Normal	Normal	Relax	Sedate d	Sedate d	Sedate d	Sedate d	Sedate d
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Behavior CD								
Var. Health	0	0	0	-0.72	-1.75	OD	OD	OD
Var. Sanitty	0	0	0	-0.5	-0.8	OD	OD	OD
Duration Effect	2	4	8	11	13	x	x	x
Heroin S3								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Normal	Happy	Happy	Happy	Happy	Happy	Happy	Psycho tic
item 2 Behavior Intake	Normal	Relax	Relax	Sedate d	Sedate d	Sedate d	Sedate d	Sedate d
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Prosoci al	Prosoci al	Prosoci al	Prosoci al	Prosoci al
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Painful	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Depres s	Depres s	Depres s	Normal	Normal
item 2 Behavior CD	Normal	Normal	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Sedate d	Sedate d
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Var. Health	0	0	0	-0.25	-0.25	-0.25	OD	OD
Var. Sanitty	0	0	0	0	-0.5	-0.5	OD	OD
Duration Effect	0	2	4	10	14	21	x	x
Heroin S5								

item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Happy	Happy
item 2 Behavior Intake	Normal	Normal	Relax	Relax	Sedate d	Sedate d	Sedate d	Sedate d
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial
item 0 Behavior CD	Normal	Normal	Normal	Painful	Painful	Painful	Painful	Painful
item 1 Behavior CD	Normal	Normal	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed
item 2 Behavior CD	Normal	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	-0.25	-0.5	-1.75	-5.6	OD
Var. Sanitty	0	0	0	-0.25	-0.5	-1.2	-5.3	OD
Duration Effect	0	1	8	15	19	24	30	x
Heroin S7								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Happy	Psychotic
item 2	Normal	Normal	Relax	Relax	Sedate	Sedate	Sedate	Sedate

Behavior Intake					d	d	d	d
item 3 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial	Normal
item 0 Behavior CD	Painful	Painful	Painful	Painful	Painful	Painful	Painful	Painful
item 1 Behavior CD	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed
item 2 Behavior CD	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	-0.25	-0.25	-0.25	-1.37	-5.81	-6.37	-57.8	OD
Var. Sanitty	0	0	-0.4	-1.58	-2.37	-2.97	55.96	OD
Duration Effect	12	18	25	31	35	39	46	x

LSD values:

LSD	1	2	4	8	12	20	40	100
LSD S1								
item 0 Behavior Intake	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate
item 1 Behavior Intake	Normal	Normal	Happy	Psychotic	Psychotic	Psychotic	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Energetic	Energetic	Energetic	Erratic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive

item 0 Behavior CD	Norma l	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Psycho tic	Psycho tic
item 2 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l
item 3 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l
item 4 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Aggres sive	Aggres sive
Var. Health	0	0	0	-0.25	-0.25	-1.25	-5.63	-79.31
Var. Sanitty	0	0	-0.5	-2.41	-7.93	-26.7	-79.38	- 113.52
Duration Effect	6	6	9	12	15	20	3	4
LSD S3								
item 0 Behavior Intake	Norma l	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior Intake	Norma l	Norma l	Norma l	Happy	Psycho tic	Psycho tic	Psycho tic	Psycho tic
item 2 Behavior Intake	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l
item 3 Behavior Intake	Norma l	Norma l	Energe tic	Energe rtic	Energe rtic	Energe rtic	Erratic	Erratic
item 4 Behavior Intake	Norma l	Norma l	Norma l	Norma l			Aggres sive	Aggres sive
item 0 Behavior CD	Norma l	Norma l	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Depres s	Depres s
item 2 Behavior CD	Norma l	Norma l	Norma l	Norma l	Anxiou s	Anxiou s	Anxiou s	Anxiou s
item 3 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l
item 4 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Aggres sive
Var. Health	0	0	0	0	0	0	0	-4.72

Var. Sanitty	0	0	0	-0.25	-0.75	-1.95	-14.76	-75.8
Duration Effect	0	2	4	6	12	16	22	5
LSD S5								
item 0 Behavior Intake	Norma l	Norma l	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior Intake	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Psycho tic	Psycho tic
item 2 Behavior Intake	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l
item 3 Behavior Intake	Norma l	Norma l	Norma l	Energe tic	Energe tic	Energe tic	Erratic	Erratic
item 4 Behavior Intake	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Aggres sive	Aggres sive
item 0 Behavior CD	Norma l	Norma l	Norma l	Norma l	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior CD	Norma l	Norma l	Norma l	Norma l	Depres s	Depres s	Depres s	Depres s
item 2 Behavior CD	Norma l	Norma l	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Anxiou s
item 3 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l
item 4 Behavior CD	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Aggres sive
Var. Health	0	0	0	0	0	-0.25	-0.25	-1.5
Var. Sanitty	0	0	0	-0.5	-2.05	-5.65	-16.35	-73.39
Duration Effect	0	0	6	13	17	23	28	4
LSD S7								
item 0 Behavior Intake	Norma l	Norma l	Norma l	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior Intake	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Psycho tic	Psycho tic
item 2 Behavior Intake	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l	Norma l
item 3 Behavior Intake	Norma l	Norma l	Norma l	Norma l	Energe tic	Energe tic	Energe tic	Energe tic
item 4 Behavior	Norma	Norma	Norma	Norma	Norma	Norma	Norma	Norma

Intake								
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Hallucinate	Hallucinate	Hallucinate
item 1 Behavior CD	Normal	Normal	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed
item 2 Behavior CD	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious	Anxious
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	0	0	0	0	-0.25
Var. Sanitty	0	0	-0.85	-1.85	-5.45	-17.98	-54.04	-71
Duration Effect	2	11	11	22	26	32	36	3

Psilocybin values:

MagMush	1	2	4	8	12	20	40	100
MagMush S1								
item 0 Behavior Intake	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate
item 1 Behavior Intake	Normal	Normal	Happy	Psychotic	Psychotic	Psychotic	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Normal	Energetic	Energetic	Energetic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Hallucinate	Hallucinate	Hallucinate	Hallucinate	Hallucinate
item 1 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Psychotic	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

CD								
item 4 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Aggres sive	Aggres sive
Var. Health	0	0	0	-0.25	-0.25	-1.25	-5.58	-78.83
Var. Sanitty	0	0	-0.5	-0.95	-1.9	-8.19	-44.03	-97.45
Duration Effect	2	3	6	8	12	16	21	x
MagMush S3								
item 0 Behavior Intake	Norma 	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior Intake	Norma 	Norma 	Norma 	Happy	Happy	Happy	Psycho tic	Psycho tic
item 2 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 3 Behavior Intake	Norma 	Norma 	Norma 	Energe tic	Energe tic	Energe tic	Erratic	Erratic
item 4 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Aggres sive	Aggres sive
item 0 Behavior CD	Norma 	Norma 	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Depres s
item 2 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Anxiou s	Anxiou s	Anxiou s
item 3 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 4 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
Var. Health	0	0	0	0	0	0	-0.5	-2.22
Var. Sanitty	0	0	0	0	0	-0.6	-3.35	-41.63
Duration Effect	0	2	3	4	6	11	18	22
MagMush S5								
item 0 Behavior Intake	Norma 	Norma 	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Happy	Psycho tic	Psycho tic
item 2 Behavior	Norma	Norma	Norma	Norma	Norma	Norma	Norma	Norma

Intake								
item 3 Behavior Intake	Norma 	Norma 	Norma 	Energe tic	Energe tic	Energe tic	Erratic	Erratic
item 4 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Aggres sive	Aggres sive
item 0 Behavior CD	Norma 	Norma 	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior CD	Norma 	Norma 	Norma 	Norma 	Depres s	Depres s	Depres s	Depres s
item 2 Behavior CD	Norma 	Norma 	Norma 	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Anxiou s
item 3 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 4 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Aggres sive	Aggres sive
Var. Health	0	0	0	0	0	0	0	0
Var. Sanitty	0	0	0	-0.25	-0.5	-2.3	-9.7	-43.78
Duration Effect	0	0	2	7	11	16	23	31
MagMush S7								
item 0 Behavior Intake	Norma 	Norma 	Norma 	Halluci nate	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Psycho tic
item 2 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 3 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Energe tic	Energe tic	Energe tic	Erratic
item 4 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Aggres sive
item 0 Behavior CD	Norma 	Norma 	Norma 	Norma 	Halluci nate	Halluci nate	Halluci nate	Halluci nate
item 1 Behavior CD	Norma 	Norma 	Depres s	Depres s	Depres s	Depres s	Depres s	Depres s
item 2 Behavior CD	Norma 	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Anxiou s	Anxiou s
item 3 Behavior	Norma	Norma	Norma	Norma	Norma	Norma	Norma	Norma

CD								
item 4 Behavior CD	Norma	Norma	Norma	Norma	Aggres	Aggres	Aggres	Aggres
					sive	sive	sive	sive
Var. Health	0	0	0	0	0	0	0	
Var. Sanitty	0	0	-0.5	-1.7	-3	-4.5	-28.05	-74.09
Duration Effect	0	3	10	16	20	25	32	5

Methamphetamine values:

Meth	1	2	4	8	12	20	40	100
Meth S1								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Happy	Happy	Happy	Happy	Psycho	Psycho	Psycho	Psycho
					tic	tic	tic	tic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Energe	Energe	Energe	Erratic	Erratic	Erratic	Erratic	Erratic
	tic	tic	tic					
item 4 Behavior Intake	Normal	Prosoci	Prosoci	Prosoci	Aggres	Aggres	Aggres	Aggres
		al	al	al	sive	sive	sive	sive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Normal	Normal	Normal	Psycho	Psycho	Psycho
						tic	tic	tic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Normal	Normal	Normal	Erratic	Erratic	Erratic
item 4 Behavior CD	Normal	Normal	Normal	Normal	Normal	Aggres	Aggres	Aggres
						sive	sive	sive

Var. Health	0	0	-0.25	-4.23	-12.07	OD	OD	OD
Var. Sanitty	0	0	-0.5	-7.19	-20.74	OD	OD	OD
Duration Effect	4	5	8	13	17	x	x	x
Meth S3								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Happy	Happy	Happy	Happy	Happy	Happy	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Energetic	Energetic	Energetic	Erratic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Normal	Depressed	Depressed	Depressed	Depressed	Psychotic	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Normal	Slow	Slow	Slow	Erratic	Erratic
item 4 Behavior CD	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	-0.25	-0.7	-1.65	OD	OD
Var. Sanitty	0	0	0	-0.5	-1.4	-4.8	OD	OD
Duration Effect	1	2	6	12	16	20	x	x
Meth S5								
item 0	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Behavior Intake								
item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Happy	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Normal	Energetic	Energetic	Energetic	Energetic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Slow	Slow	Slow	Slow	Slow	Erratic
item 4 Behavior CD	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	-0.25	-0.5	-0.75	-6.85	OD
Var. Sanitty	0	0	-0.5	-1.3	-4.05	-12.7	-33.55	OD
Duration Effect	0	4	11	17	21	27	34	x
Meth S7								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Normal	Normal	Happy	Happy	Happy	Happy	Psychotic	Psychotic
item 2 Behavior	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Intake								
item 3 Behavior Intake	Normal	Energetic	Energetic	Energetic	Energetic	Energetic	Erratic	Erratic
item 4 Behavior Intake	Normal	Normal	Normal	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior CD	Normal	Depressed	Depressed	Depressed	Depressed	Depressed	Psychotic	Psychotic
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Normal	Normal	Slow	Slow	Slow	Slow	Erratic	Erratic
item 4 Behavior CD	Normal	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	0	-0.25	-0.5	-1.21	-73.65	OD
Var. Sanitty	0	0	-0.5	-0.75	-1.5	-4	-73.72	OD
Duration Effect	0	2	9	15	18	24	2	x

Speed values:

Speed	1	2	4	8	12	20	40	100
Speed S1								
item 0 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 1 Behavior Intake	Happy	Happy	Happy	Happy	Happy	Psychotic	Psychotic	Psychotic
item 2 Behavior Intake	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior Intake	Energetic	Energetic	Energetic	Erratic	Erratic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Normal	Prosocial	Prosocial	Prosocial	Prosocial	Aggressive	Aggressive	Aggressive
item 0 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

item 1 Behavior CD	Norma I	Norma I	Norma I	Norma I	Norma I	Psycho tic	Psycho tic	Psycho tic
item 2 Behavior CD	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I
item 3 Behavior CD	Norma I	Norma I	Norma I	Norma I	Energe tic	Erratic	Erratic	Erratic
item 4 Behavior CD	Norma I	Norma I	Norma I	Aggres sive	Aggres sive	Aggres sive	Aggres sive	Aggres sive
Var. Health	0	0	-0.75	-2	-6.9	-30.45	OD	OD
Var. Sanitty	0	0	-0.75	-5.15	-8.09	-29.21	OD	OD
Duration Effect	2	6	8	12	15	19	x	x
Speed S3								
item 0 Behavior Intake	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I
item 1 Behavior Intake	Norma I	Happy	Happy	Happy	Happy	Happy	Psycho tic	Psycho tic
item 2 Behavior Intake	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I
item 3 Behavior Intake	Norma I	Energe tic	Energe tic	Energe tic	Erratic	Erratic	Erratic	Erratic
item 4 Behavior Intake	Norma I	Norma I	Norma I	Prosoci al	Prosoci al	Prosoci al	Aggres sive	Aggres sive
item 0 Behavior CD	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I
item 1 Behavior CD	Norma I	Norma I	Norma I	Depres s	Depres s	Depres s	Depres s	Psycho tic
item 2 Behavior CD	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I
item 3 Behavior CD	Norma I	Norma I	Norma I	Slow	Slow	Slow	Slow	Erratic
item 4 Behavior CD	Norma I	Norma I	Norma I	Norma I	Norma I	Norma I	Aggres sive	Aggres sive
Var. Health	0	0	0	-0.25	-0.7	-1.01	-15.15	OD
Var. Sanitty	0	0	0	-0.25	-0.8	-1.61	-19.86	OD
Duration Effect	0	1	2	8	11	16	23	x
Speed S5								

item 0 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 1 Behavior Intake	Norma 	Norma 	Norma 	Happy	Happy	Happy	Happy	Psycho tic
item 2 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 3 Behavior Intake	Norma 	Norma 	Energe tic	Energe tic	Energe tic	Energe tic	Erratic	Erratic
item 4 Behavior Intake	Norma 	Norma 	Norma 	Prosoci al	Prosoci al	Prosoci al	Prosoci al	Prosoci al
item 0 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 1 Behavior CD	Norma 	Norma 	Depres s	Depres s	Depres s	Depres s	Depres s	Depres s
item 2 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 3 Behavior CD	Norma 	Slow	Slow	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Norma 	Norma 	Norma 	Aggres sive	Aggres sive	Aggres sive	Aggres sive	Aggres sive
Var. Health	0	0	0	-0.25	-0.25	-1	-7.85	OD
Var. Sanitty	0	0	-0.25	-1.25	-2.3	-6.72	-26.15	OD
Duration Effect	0	1	4	12	17	21	28	x
Speed S7								
item 0 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 1 Behavior Intake	Norma 	Norma 	Norma 	Happy	Happy	Happy	Happy	Psycho tic
item 2 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma
item 3 Behavior Intake	Norma 	Norma 	Energe tic	Energe tic	Energe tic	Energe tic	Erratic	Erratic
item 4 Behavior Intake	Norma 	Norma 	Norma 	Norma 	Prosoci al	Prosoci al	Prosoci al	Aggres sive
item 0 Behavior CD	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma 	Norma

item 1 Behavior CD	Normal	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed
item 2 Behavior CD	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
item 3 Behavior CD	Slow	Slow	Slow	Slow	Slow	Slow	Slow	Slow
item 4 Behavior CD	Normal	Normal	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive	Aggressive
Var. Health	0	0	-0.25	-0.25	-0.75	-1.95	-13.9	-23.16
Var. Sanitty	0	-0.25	-2.3	-6.25	-9.25	-24.29	-73.35	-73.08
Duration Effect	2	8	15	23	26	31	3	2