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HALLUCINATORY ALTERED STATES OF CONSCIOUSNESS AS VIRTUAL REALITIES

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"[...] our normal waking consciousness, rational consciousness as we call it, is but one special type of consciousness, whilst all about it, parted from it by the filmiest of screens, there lie potential forms of consciousness entirely different. We may go through life without suspecting their existence; but apply the requisite stimulus, and at a touch they are there in all their completeness, definite types of mentality which probably somewhere have their field of application and adaptation. No account of the universe in its totality can be final which leaves these other forms of consciousness quite disregarded."

William James (1902) The Varieties of Religious Experience, p. 388.

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ABSTRACT

The purpose of this doctoral thesis is to investigate *altered states of consciousness* (ASC) that are marked by hallucinations, occur during hypnosis, or are induced by psychedelic drugs. A multidisciplinary approach is used for enabling the integration of methods and results from various fields of human sciences, such as psychology and phenomenology. The included four studies focus on significant changes occurring in the human mind during deliberately induced, first-person reportable, non-ordinary subjective experiences. Theoretical issues concern the definition and classification of altered consciousness, while empirical research approaches the phenomena with an experimental study on hypnosis and sleepiness, and an online study on psychedelic drug use.

Study I ("Hallucinatory Altered States of Consciousness") is a theoretical analysis that proposes a working definition of hallucinatory ASC based on objectively detectable and subjectively experienced changes in neurocognitive subsystems. To solve the 'selection–definition ordering problem' (i.e., whether to define ASC by selected phenomena, or to select phenomena as ASC by a definition), a stepwise operationalization procedure is also proposed.

Study II ("Hypnotizability, Sleepiness, and Subjective Experience") describes an empirical hypnosis study in 90 subjects by using one newly developed and three previously established self-rating scales. Results indicate that hypnotizability correlates positively with both habitual daytime sleepiness and instantaneous sleepiness after the hypnotic procedure, hence sleep and hypnosis may share common, putatively neurobiological mechanisms regarding transitions between ASC.

Study III ("Coping, Life Purpose, and Spirituality in Psychedelic Drug Users") is based on an online questionnaire survey of 667 psychoactive drug users. Findings point out that psychedelic drug use may facilitate the gain of *autognosis* (self-knowledge) by rehearsing personal coping strategies in exceptional mental situations. As autognostic psychedelic drug use correlates positively with coping and spirituality, it may also act as a protective factor against drug-related problems.

Study IV ("Sacramental and Spiritual Use of Hallucinogenic Drugs") is a commentary article arguing that sacramentally and spiritually used psychedelic drugs (*'entheogens'*) are associated with a search of metaphysical insight rather than with a mere need to alter one's perception. Therefore, ritual and ceremonial use of hallucinogenic drugs deserves its own category in a drug instrumentalization framework: "to facilitate spiritual and religious activities".

The thesis utilizes the overarching concept of *virtual realism*, stating that phenomenal-level consciousness manifests as a *world-simulator* by which the mind–brain complex experiences its own *virtual* information processing as *subjective reality*. Hence, deliberate manipulation of the experience *set and setting* parameters by psychologically, pharmacologically, and technologically induced hallucinatory ASC can be a naturally integrable and effective method to extend human consciousness.

Keywords: consciousness; altered states of consciousness; hallucinations; drowsiness; hypnosis; psychedelic drugs; subjective experience; virtual reality

TIIVISTELMÄ

Tohtorinväitöskirjani tutkii hallusinaatioihin liittyviä, hypnoosin aikana tapahtuvia, tai psykedeelisten aineiden aikaansaamia *muuttuneita tajunnantiloja* (MTT). Aihetta lähestytään ihmistieteiden eri alojen, kuten psykologian ja fenomenologian, menetelmiä ja tuloksia yhdistävästä monitieteisestä näkökulmasta. Sisällytetyt neljä tutkimusta keskittyvät ihmismielen merkittäviin muutoksiin tahallisesti aikaansaatuun, omasta näkökulmasta kerrottujen, epätavallisten subjektiivisten kokemusten aikana. Teoreettisina aiheina ovat MTT:n määritelmä ja luokitus, käytännön tutkimukset lähestyvät ilmiöitä niin kokeellisen hypnoosi- ja uneliaisuustutkimuksen kuin myös psykedeelisten aineiden käyttöä kartoittavan internet-tutkimuksen menetelmin.

Tutkimus n:o 1 ("Hallusinatoriset MTT-t") on teoreettinen analyysi, jossa ehdotetaan neurokognitiivisten alajärjestelmien muutosten objektiivisen havaitsemiseen ja subjektiivisen kokemiseen perustuva MTT-työmääritelmä. Artikkelin ehdottaa myös askeleittaisen operationalisointimenettelytavan, jolla ratkeaa ns. 'valinta-määrittäjä-järjestysongelma' (eli valitaanko ensin MTT-ilmiöitä MTT-käsitteen määrittämistä varten, vai määritelläänkö ensin MTT-käsite MTT-ilmiöiden valintaa varten).

Tutkimus n:o 2 ("Hypnoosiherkkyys, uneliaisuus, ja subjektiivinen kokemus") on 90 henkilön kokemusperäinen hypnoositutkimus, jossa käytetään yhtä uutta ja kolmea vakiintunutta itsearviointimittaria. Tulokset osoittavat, että hypnoosiherkkyys korreloi positiivisesti sekä tavanomaisen päiväuneliaisuuden että hypnoosin jälkeisen välittömän uneliaisuuden kanssa, mikä viitanee unen ja hypnoosin yhteisiin neurobiologisiin mekanismeihin MTT:jen välisissä siirtymisissä.

Tutkimus n:o 3 ("Hallinta, tarkoitus, ja henkisyys psykedeelisten aineiden käyttäjillä") perustuu psykoaktiivisten aineiden 667 käyttäjän internet-kyselyyn. Löydökset osoittavat, että psykedeelisten aineiden käyttö voi edistää itsetuntemusta harjoittamalla henkilökohtaisia hallintatoimintoja mielen poikkeuksellisissa tilanteissa. Tiedostava psykedeelisten aineiden käyttö korreloi positiivisesti hallinnan ja henkisyyden kanssa toimien suojatekijänä aineidenkäytön ongelmia vastaan.

Tutkimus n:o 4 ("Hallusinogeenien sakramentaalinen ja hengellinen käyttö") on kommentti-artikkeli, jonka mukaan sakramentaalisesti ja hengellisesti käytetyt psykedeelit (*enteogeenit*) liittyvät pikemminkin metafyyssisten oivallusten etsintään kuin pelkkään havaitsemisen muuttamistarpeeseen. Täten hallusinogeenien rituaalinen ja seremoniallinen käyttö ansaitsee oman kategoriansa aineiden instrumentalisaation viitekehyksessä: "hengellisten ja uskonnollisten toimintojen edesauttaminen".

Teos hyödyntää *virtuaalisen realismin* käsitettä, jonka mukaan fenomenaalisen tason tajunta ilmenee *maailma-simulaattorina*, jolla mieli-aivot -kokonaisuus kokee oman *virtuaalisen* tiedonkäsittelynsä *subjektiivisena todellisuutena*. Kokemusten *set* ja *setting* -muuttujien tahallinen manipulointi psykologisesti, farmakologisesti, ja teknologisesti aikaansaatuun hallusinatoristen MTT:jen avulla voi olla luontaisesti yhdistettävä ja tehokas menetelmä ihmistajunnan laajentamiseksi.

Avainsanat: tajunta; muuttuneet tajunnantilat; hallusinaatiot; uneliaisuus; hypnoosi; psykedeeliset aineet; subjektiivinen kokemus; virtuaalitetodellisuus

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Levente Móró

ABBREVIATIONS

AR	augmented reality
ASC	altered state(s) of consciousness
DMT	N,N-dimethyltryptamine
EEG	electroencephalography
ESS	Epworth Sleepiness Scale
fMRI	functional magnetic resonance imaging
HGSHS:A	Harvard Group Scale of Hypnotic Susceptibility Form A
ISS	Intrinsic Spirituality Scale
KSS	Karolinska Sleepiness Scale
LD	lucid dreaming
LSD	lysergic acid diethylamide
MEG	magnetoencephalography
MR	mixed reality
NCC	neural correlates of consciousness
NMDA	N-methyl- <i>d</i> -aspartate
NPS	new/novel psychoactive substances
NREM	non-rapid eye movement
PET	positron emission tomography
PCI	Psychological Immune Competence Inventory
PIL	Purpose in Life [test]
PSQI	Pittsburgh Sleep Quality Index
PSYINDEX	psychedelic index [scale]
QSHE	Questionnaire on Subjective Hypnotic Experiences
RBD	REM sleep behavior disorder
REM	rapid eye movement
SMT	Self-Model Theory of Subjectivity
SoC	state(s) of consciousness
tDCS	transcranial direct current stimulation
TMS	transcranial magnetic stimulation
VR	virtual reality

1 PREFACE

The present doctoral thesis is the application of my Information Technology MSc-level skills to my PhD-level academic studies. Upon starting my endeavor, I used to refer to this particular combination of cognitive neuroscience and IT engineering as "cognitive neuroinformatics". Indeed, computerized information processing is crucial in each step of modern scientific research, from the acquisition and analysis of digital data with advanced tools and methods, to an easily understandable visualization of results for public presentation. The development of IT tools and databases is far from the competence field of a scientific researcher; rather, it is the task of a *Scientific Research Engineer* – a title that I fancy to define my 'hybrid' activities with. As all my cognitive neuroscientific engineering solutions have eventually contributed to studies and theses of my colleagues (e.g., [Noreika et al., 2011](#); [Salminen-Vaparanta et al., 2013](#)), the field of my own thesis here is *not* cognitive neuroscience.

From 2003 on, I have had the pleasure, honor, and privilege to belong to Prof. Antti Revonsuo's Consciousness Research Group at the Centre for Cognitive Neuroscience in the University of Turku, Finland. During these years, our enthusiastic research team has explored and covered several subfields within consciousness research: from dreaming, hypnosis, and anesthesia to epilepsy, meditation, and visual awareness. Besides theoretical work and psychological methods, such as questionnaires, interviews and diaries, we have utilized various technical methods, such as electroencephalography (EEG), transcranial magnetic stimulation (TMS), and transcranial direct current stimulation (tDCS).

In this doctoral thesis, I present some of my studies related to one of the main common interests of our research group, namely *altered states of consciousness* (ASC). Within this broad topic, my special areas of interest included the relationship between various ASC, the mechanisms of hallucinations, the subjective effects of mind-altering substances, the neural basis of dreaming, and the phenomenon of lucid dreaming. Customary to practices in basic scientific research, only some of these studies have yielded publications for me and/or my colleagues so far, and many of them are still half-done 'works in progress', waiting for further resources or motivation. These yet uncompleted studies will be discussed at the end of this thesis as recommendations for further research.

During the course of my PhD studies with a psychology major, my focus within the discipline has gradually shifted from the initial neuropsychological orientation to a more sociopsychological direction. This shift can be explained by factors such as group dynamics and research funding, as well as by personal influences that guided my interests toward social and societal dimensions, for example health research, harm reduction, drug user communities, and drug policy. Since 2010, the emerging

phenomenon of New Psychoactive Substances (NPS) has become another core area of my expertise, next to psychedelic drugs. In this thesis, I attempt to summarize my relevant findings within my initially chosen disciplines and topics, to fit them coherently into a multidisciplinary bio-psycho-socio-spiritual framework, and to explain further the complex phenomenon of altered consciousness.

The reference to *virtual reality* (VR) in the thesis title requires an additional explanation already here in the beginning. Originally, the scope of the current doctoral thesis was ambitiously – and admittedly; naïvely – set to include VR in a dual form: both as a theoretical metaphor of '*world-simulation*', and as a three-dimensional computer technology (that I had a previous interest in and experience with). However, after spending a few years of my thesis work by programming thousands of lines of a novel software platform for VR-based data visualization, I slowly realized the inadequacy of my resources and gave up pursuing this wholly new line of research. Therefore, the VR term will be used throughout this thesis only as a metaphorical notion to explain the theory synthesis of '*virtual realism*', while VR as a computer technology remains merely a potential future research interest with no actualized relevance to the present thesis.

Concluding this preface, I perhaps owe an explanation about why did it take 14 years to get my doctoral thesis done... The reason is definitely not a decreased interest in the topics of consciousness and ASC; I still think that these are the most fascinating scientific themes one can ever study and explore. Because of this interest, I have been cumulatively involved in an enormous amount of ASC-related academic and non-academic activities, many of them being mere 'sidetracks', i.e., irrelevant to my doctoral thesis. Since 2003, I have attended 90 conferences and meetings in 22 countries, published 8 international peer-reviewed articles and 4 book chapters on totally 'off-topics' (e.g., religion, sex workers, NPS), taught 2 semesters my own ASC course at a Buddhist University, provided drug-related crisis intervention at 57 parties/festivals, trained 200+ international volunteers, supervised 11 psychedelics-related under-/graduate student theses, participated in 4 EU projects as a drug expert, peer-reviewed 13 manuscripts for scientific journals, founded a Multidisciplinary Society for Psychedelic Studies and a Medical Cannabis Association, and so on. Fortunately, I do not regret any of this 'wasted' time, as all these ASC-related interactions have significantly defined who I am today.

During the 14 years of my doctoral studies, I received a total of 74,178 EUR in stipends, which corresponds roughly to 4 years of an assistant's salary in Finland (around 1,500 EUR/month). Hence, my doctoral studies have also taught me novel ways to stretch the penny (eurocent) without having to take ASC-unrelated day jobs—for which survival skills I am also grateful to the University of Turku.

2 INTRODUCTION

The scientific study of *consciousness* has emerged as a particularly fascinating subfield that aims to explore an 'ultimate mystery': the subjective experience of reality. Even though the topic has been long debated by philosophers, recent developments in neuroimaging have provided a particularly practical set of novel tools for exploring the mind–brain connection. In the last 20 years, consciousness research has emerged as a recognized field in studying the 'science of subjectivity', with its dedicated academic journals, professional organizations, and international conferences. Consciousness research is importantly related also to cognitive neuroscience, a multidisciplinary academic field (referred to as 'the biology of the mind') that studies the relationship between the brain and mental processes, such as attention, learning, memory, and perception.

Regardless of its importance and hence available resources, the topic of consciousness may be one of the toughest scientific-philosophical issues to investigate. Not only that even the definition of the phenomenon has always been (and still is) far from consensus, there are underlying theoretical doubts about whether it is possible at all for humans to understand their own consciousness 'from the inside'. By digging deeper into the historical roots of the consciousness debate, one may find even tougher issues, such as the concept of the soul, the mind–body problem, and serious metaphysical considerations. Obviously, the presently emerging science of consciousness is not likely to make any ultimate breakthroughs in the near future, but instead it may become a rigorous basic science for a systematic investigation of all related phenomena. Research topics may vary from animal minds and artificial intelligence to exceptional experiences and quantum theories—and the most relevant for this thesis: *states of consciousness* (SoC).

Within consciousness research, phenomenologically oriented approaches study both normal waking consciousness and also a broad range of phenomena that are commonly labeled as *altered states of consciousness*. Some of the most typical examples of such phenomena are dreaming, hypnosis, meditation, hallucinations, and various exceptional trance experiences (e.g., induced by chanting, dancing, and drumming). The underlying concept behind these studies is that temporary alterations in the mind–brain complex can reveal certain mechanisms that are not particularly detectable during the default baseline, or 'normal' mode of operation. Even though measurements of neural activity can yield valuable data about what happens in the brain during these special situations, phenomenology dominates the picture because of the unusual and often exceptionally rich subjective experience that the person lives through. Besides collecting and analyzing these experiences, the search for the neural correlates of these phenomena is at the core of ASC research.

Today, the still relatively marginal studies of dreaming, hypnosis, and meditation have become accepted areas within cognitive neuroscience. While rigorous scientific publications delve into the details of brain activity during these special situations, the theoretical background seems to clear out only slowly for all these subfields. Albeit nocturnal dreaming is an abundantly frequent phenomenon, even basic questions concerning its categorization, function, and content-producing mechanisms are still being answered. Similarly, in hypnosis research, there is a vividly ongoing "state–nonstate debate" on whether hypnotic induction creates a particularly distinguishable mode of operation in the mind–brain complex or is explainable with concepts like expectations, cognitive strategies, demand characteristics or motivation, with sound reasoning from both sides (actually, more than two sides). As meditation studies root in oriental traditions, fundamental linguistic and cultural differences make it especially difficult to understand the vast theoretical and practical knowledge behind what seems to be merely "sitting with eyes closed". Clearly, there are lots of challenging questions to study within the topically and disciplinarily fragmented ASC field.

Hypnosis and psychedelics are often associated with complex visual experiences that are not directly related to the surrounding physical space. Some of these mental occurrences can be termed as *hallucinations* when fulfilling certain criteria defined by current theories. Similar to cases of other ASC phenomena, the notion of hallucination is far from being unambiguous, as notably different types of experiences are described under one term. Moreover, as many of the hallucinations are related to known pathologies like schizophrenia or alcoholism, there is also a debate on whether hallucinations are a sign of mental illness or not. Although hallucinations may provide rich phenomenological content as well as genuinely unique neuroimaging data, assessing clinical populations may require additional special methods, hence making hallucination research notably more difficult to conduct.

Altering another person's consciousness by hypnosis is not at all an easy or automatic task. Success depends also on numerous extrapersonal factors in the hypnotic induction procedure, but primarily it is the subject's inherent hypnotic susceptibility that matters. Among numerous consciousness-altering techniques, perhaps the most straightforward method is the application of psychoactive substances, in particular hallucinogenic drugs. Neuropharmacological pathways are quick, effective, and reliable routes to induce notable mental changes, with relatively minimal effects on bodily functions. Psychedelic (i.e., "mind-manifesting") drugs are capable of significantly altering practically all subsystems of consciousness, thus they qualify as great potential tools for the research of the mind. Unfortunately to science, mind-altering substances of this category became societally and culturally stigmatized so that human research has been virtually non-existent for the last five decades,

until very recently. Because of this *de facto* taboo status, it is assumedly *psychedelic science* that has the greatest unexplored research potential at the moment within the ASC branches.

Even though social drug research provides only a thin layer of information about hidden populations of underground drug user subcultures, it is an evidently general finding that drug use as a phenomenon shows enormous variance. Complexity is not only due to the neuropharmacological differences between the vast array of psychoactive substances – several hundreds and still counting – but also due to some less investigated psychosocial factors of drug use. It is notable that a significant number of drug studies focus on drug-related problems, such as abuse, addiction, injecting drug use, and virus-borne epidemics. While these topics are indeed important from a public health point of view, they create a strong bias in representing the overall nature of drug use, which is most often non-problematic. From this broader scope, the simple research question "What psychosocial factors are likely to lead toward drug use?" expands to three other questions: What psychosocial factors are likely to (1) protect against all drug use; (2) result in problem drug use; and (3) protect from problem drug use? Clearly, the history of hallucinatory ASC is most closely related to the third question, hence this thesis explores motivational factors, purposes, and intentions of non-problematic drug use.

From subjects' viewpoints, there are striking differences between individual accounts of specific ASC. It is still not yet known what brain mechanisms yield the experience of dreaming (or the lack of it) during the same sleep stages on different occasions. Similarly, individual differences in hypnotic susceptibility are difficult to predict, and the relative proportions of highly susceptible and non-susceptible persons are roughly equal in size. In contrast, inducing an ASC with psychoactive drugs is always effective due to the direct neuropharmacological manipulation of the brain. However, the quality of the induced mind-alteration shows remarkable individual differences in its course and experienced content, varying from life-enhancing supreme bliss to traumatic hellish paranoia. Explanations for all these differences are likely to require a multidisciplinary approach, as the involved variables are assumed to be both neurocognitive and psychosocial.

During various ASC, phenomenally experienced cognitive and perceptual changes are often accepted as 'real', without self-reflections on the state alteration itself. By not being compared, the transient subjective reality gets unbound from previous states of subjective reality, which enables potentially significant changes in space-time and object perception, cognitive-emotional processing, thought associations, abstract thinking, etc. Using the *world-simulation* metaphor, this process can be conceptualized as if the mind-brain complex was running its *virtual reality* generator in a changed mode of operation. To continue with this technically based analogue: operational differences can be

thought of as the various 'settings' or 'configurations' of consciousness subsystems in the VR simulator. The differences in VR configuration can be systematically examined between (1) different ASC in the same individual, (2) different individuals in the same ASC, and (3) the baseline SoC and an ASC in the same individual.

The metaphoric use of VR in the context of ASC leads to a novel approach to consciousness that could be called '*virtual realism*'. Despite holding a different view on consciousness, *virtual realism* does not conflict with physicalist, biological realist, nor dualist theories. It claims neither an inner representation of an external physical reality, nor an outward projection of an internally generated mental reality as the primary explanation on conscious experience. *Virtual realism* holds that phenomenally experienced subjective reality is what consciousness primarily 'does' and is about: a process that systematically organizes the confluence of complex information into an individual experience of existence. In this sense, *virtual realism* acknowledges (but does not limit itself to) the physical constraints of its operating environment. Still, it also leaves possibilities open for yet unknown metaphysical variables that may affect the *world-simulator* mechanism by the mind–brain complex.

The present doctoral thesis explores the topic of ASC by using the VR metaphor as its conceptual basis. In particular, the thesis ponders conceptual definition problems of ASC, charts various phenomena, compares similarities and differences, and thus investigates the possible configurations of VR mechanisms on cognitive, psychological, social, and spiritual levels. Under the unifying theme of induced altered states, the thesis includes a theoretical ASC study, an experimental hypnosis study, a psychedelic drug survey study, and a commentary article on the functions of hallucinatory drug use.

The diversity of topics touched and methods applied within the thesis may make the impression of an exploratory "bits-and-pieces" approach to ASC. Given the current state of research in this unexplored area, this impression holds admittedly true: ASC is indeed a fragmented field within the similarly fragmented field of consciousness research. Nevertheless, with the basic conceptual and experimental work presented here, I wish to insert my own fragment of contribution into the 'puzzle-work' of my chosen field of interest. Hopefully, on one day, orchestrated scientific and philosophical efforts will come up with novel ideas and methods for unifying several lines of studies on all these fascinating aspects of the conscious experience.

3 BACKGROUND

3.1 Consciousness

3.1.1 *The science of consciousness: A brief history*

For a discussion starter about consciousness, it seems appropriate to echo the frequent statement: The problem of consciousness is one of the last great undiscovered mysteries of science. The emerging importance of the topic is evident: In 2005, one of the world's top scientific journals, *Science* magazine put the question "What Is the Biological Basis of Consciousness?" on its Top 25 Big Questions list ([Kennedy & Norman, 2005](#); [Miller, 2005](#)). However, the question of consciousness is indeed not a new one. The issue relates to such perpetual and fundamental questions as the concept of the soul, the mind–body problem, and other metaphysical considerations concerning the nature of reality—all of these have been subjects of philosophical enquiry for centuries.

Debates on 'thinking' and 'mental' issues had surged from the Age of Enlightenment on, especially as modern Western philosophy took shape and became influenced by the dualist ideas of its early pioneer René Descartes (1596-1650). Even though studies on the anatomy and physiology of the human body had been increasingly carried out by the emerging natural sciences, the mental domain – along with its putative connections to the physical domain – remained predominantly the territory of philosophers, such as Locke (1632-1704), Leibniz (1646-1716), Hume (1711-1776), and Kant (1724-1804).

In the end of the 19th century, consciousness as a study topic took a distinguished place in the wake of the then-novel discipline of psychology and related philosophical thought. One of the foremost pioneers of psychology, the prominent thinker William James (1842-1910) referred to consciousness as an ever-flowing stream of thought ([James, 1892](#)). Along with his contemporaries Wilhelm Wundt and Edward B. Titchener, James studied consciousness by introspection—a method that consequently became gradually backgrounded under the influence of behaviorism from the early 20th century on. For the following decades, behaviorists had bracketed consciousness by reducing the focus of investigation to publicly observable bodily behavior. The behaviorist paradigm practically dominated psychology until the 1960s, when cognitive science took a different approach by studying internal information processing mechanisms, such as memory, perception and language comprehension. It is also to be noted that in the following decades, remarkable interdisciplinary convergences with brain sciences occurred in philosophy, phenomenology, and psychology, as well as in the aforementioned cognitive sciences.

"Classical" consciousness-related research has been carried out by detailed analysis of neurological cases – e.g., split-brain studies, blindsight – throughout the 20th century. Modern neuroscientific studies of consciousness began to take shape in the 1990s, the declared "decade of the brain". The new approach, embedded within the emerging interdisciplinary field of cognitive neuroscience, was enabled by the rapid development of brain imaging methods, such as functional magnetic resonance imaging (fMRI), magnetoencephalography (MEG), and positron emission tomography (PET). Consciousness studies have become more and more a part of scientific research, instead of the sole domain of classical 'armchair philosophy'. At the same time, new conceptual directions such as neurophilosophy and neurophenomenology began to contribute to the field of consciousness research, making it a guided multidisciplinary effort instead of a merely exploratory one.

3.1.2 Contemporary consciousness science

As of the early 21st century, needs for scientific research programs on consciousness have been specified, and cognitive neuroscience was found as the most fruitful approach despite some of its obstacles ([Revonsuo, 2000a](#)). The mind–body (or mind–brain) issue is certainly not as straightforward as Descartes imagined by asserting that the pineal gland is the principal "seat of the soul". To date, neurophysiological research has not been able to find support for the concept that the pineal gland or any similar single brain 'center' could sufficiently provide complex mental functions, such as consciousness ([Damasio, 2000](#)). Rather, it seems that complex operations of cortical and subcortical structures are relevant and necessary for consciousness to be present. Albeit some candidate neurophysiological markers of consciousness have proved illusory, there is also promising ongoing research on, e.g., a temporo-parietal-occipital 'hot zone' of the posterior cerebral cortex where the best current anatomical candidates for the neural correlates of consciousness are located ([Boly et al., 2017](#); [Koch, Massimini, Boly, & Tononi, 2016](#)).

Consciousness-involved brain networks can be revealed by a systematic charting of the neural correlates of the phenomenal experience. However, we also need to find out about the 'explanatory correlates' of consciousness, i.e., how phenomenal experiences can exist in the first place ([Seth, 2009](#)). The integration process of distinct sensory input into a single seamless conscious content – the binding problem – is also of scientific interest. Furthermore, the tasks of measuring contents and states of consciousness are also challenging, especially as both notions are still subjects of ongoing conceptual debates. From a clinical aspect, various psychiatric disorders with a relevance to consciousness are also of interest for studies. Such a characteristic syndrome is depersonalization disorder (DPD), in which the

subjective feeling becomes 'unreal' for the patient due to a significant detachment of several aspects of the self and the environment ([Sierra & David, 2011](#)).

The scope of consciousness studies is not at all limited to humans only, but it may also extend to animal consciousness and machine consciousness. The phenomenal experience in its complexity is clearly beyond the fundamental state of being merely *sentient* (which is attributed to animals), or of being *intelligent* (an achievable property of computational systems). Further research on primates, other mammals, and even some birds are in progress; simultaneously, contemporary computational and robotic models of consciousness are being built in an attempt to simulate – and perhaps later to instantiate – conscious properties ([Seth, 2010](#)). Contemporary consciousness science is thus an increasingly coordinated multidisciplinary effort that currently includes a wide range of conceptual, philosophical, neural, cognitive, computational, quantum physical etc. approaches (to be detailed in the following subchapters). Indeed, the complexity of the consciousness issue requires a convergence of manifold approaches; due to a notably increasing amount of efforts, optimism for making substantial advances in consciousness science is prevailing ([Seth, 2010](#)).

3.1.3 Conceptual clarifications

So what is consciousness about, and what does it mean to be conscious? As expectable, there are many possible answers to these questions, depending on the various definitions and notions of consciousness. In lay language, the term '*conscious*' is often associated with an awake and alert state, as opposed to being in an '*unconscious*' state during anesthesia or in coma. However, necessity for these two state criteria can be conceptually questioned, for example, by bringing up the case of dreaming—a state with substantial ongoing mental experience, in the lack of wakefulness and alertness. In philosophical debates, *primary*, *phenomenal*, or *core consciousness* refers to the subjective experience of being 'here and now', or having the feeling of an 'inner presence' ([Revonsuo, 2006](#)). Another common notion of the 'C-word' refers to *awareness*, i.e., having an experience, having phenomenal consciousness. Consciousness may be also transitively directed at the environment, some object, or the experience itself, to reflect upon some content. This latter type of consciousness is often defined as *secondary*, *reflective*, *access*, or *extended consciousness* ([Block, 1995](#); [Revonsuo, 2006](#)). When referring to information processing in terms of being able to access specific pieces of content, the proper dipole terms of *conscious* are either *nonconscious* or *unconscious*; while nonconscious material means the total lack of subjective experience and therefore can never become conscious, unconscious material, in principle, can.

Apart from *in vitro* basic neuroscientific research, but in addition to *in silico* computational modeling, a large part of consciousness research happens *in vivo* by using human subjects who are able to report their phenomenal, subjective experiences. Such reporting may be asked retrospectively, or in 'real-time' during experiments where subjects may optionally perform cognitive tasks, and/or could be measured by neurophysiological instruments. From a phenomenological viewpoint, consciousness is crucially related to the *subjective* character of the experience. As Nagel ([1974, p. 436](#)) originally put it: "[...] fundamentally an organism has conscious mental states if and only if there is something that it is to *be* that organism—something it is like *for* the organism". Thus, it is suggested that in order to give a proper explanation for the subjective conscious experience, biological research programs should reconceptualize consciousness as the phenomenal level of organization in the brain ([Revonsuo, 2000a](#)). As the conceptual background for this thesis, I used Revonsuo's *biological realism* as a basic approach to the scientific study of consciousness; however, I tend to be open also for (an information technology based type of) *pragmatism*, in order to develop my own, fully compatible position of *virtual realism*.

3.1.4 Philosophical explanations

The problem of consciousness is a – or perhaps: *the* – core issue in contemporary debates within the philosophy of mind. Albeit it would be virtually impossible to provide a thorough, or even a brief overview here, some relevant approaches must be introduced in order to caption the wider conceptual background of consciousness studies, in particular, the viewpoint of *biological realism*. It is important to keep in mind that no single widely accepted theory of consciousness exists, but the field is characterized by tens of competing and occasionally starkly contradicting approaches. While radical *eliminativist* approaches deny the whole existence of consciousness, and others think that at least its qualitative properties are merely illusory *epiphenomena*, most theories attempt to guide philosophical and empirical endeavors into the topic of consciousness—with the exception of *strong emergent materialists* who claim that humans will never be capable of solving this mystery (for more detailed overviews, see e.g., [Noreika, 2014](#); [Van Gulick, 2017](#)).

It is to be noted that the presence of a phenomenal, subjective, qualitatively felt experience is held to be centrally important for consciousness. Metaphysical theories propose to explain the ontological status of consciousness in relation with the physical world (including the brain) by using known arguments from the classical mind–body problem in philosophy. The predominant distinction is between *dualist* theories claiming the ontological independence and irreducibility of the mind and the physical world, as opposed to *monist* theories arguing for one substance only—in the case of *physicalism*: matter. Materialist theories may take a *reductionist* stance by assuming identity between

mental and physical processes and states, or – as in the case of *biological naturalism* – may conceptualize consciousness as an *emergent*, qualitative, subjective, high-level brain function that has causal powers, and is ontologically irreducible ([Searle, 1992, p. 1](#); [Searle, 2007](#)). *Biological realism*, the background for this thesis, is also a *weak emergent materialist* approach very close to biological naturalism ([Revonsuo, 2010, p.28](#)).

Interestingly, certain philosophical theories may accept a possible co-existence of the dualist–monist opposite assumptions, like the strong and weak versions of *ontological pluralism* do ([Turner, 2010](#)). Moreover, some further theories do not have metaphysical commitments at all; for instance, *functionalism* focuses only on input, processing, and output—regardless of the substrate implementing these functions. In a similarly neutral way, *pragmatist* approaches promote only an assumedly most promising empirical methodology (e.g., neurobiology) as a currently best instrument to go, nevertheless they remain open to be replaced after sufficient exploration with that tool ([Noreika, 2014](#); [Van Gulick, 2017](#)).

A notable philosophical endeavor is the Self-Model Theory of Subjectivity (SMT) by Metzinger ([2003](#)), who utilizes a constraint-satisfaction approach to explain phenomenal experience. The SMT describes minimal consciousness as the presence of a world: a transparently experienced, coherent, global model of reality within a virtual window of presence. The central ontological claim of the SMT is that "no such things as selves exist in the world" ([Metzinger, 2005, p. 3](#)); the notion of a *self* is eliminated as a theoretical entity, and handled as a very special kind of representational, dynamic content of a phenomenal self-model. This theory has special relevance as it ponders the reality of subjective experience as a presented world-model: SMT is a significant conceptual contribution to the development of the idea of *virtual realism* that will be described later in this thesis.

There are also ongoing philosophical debates about the possible functions of consciousness, the *self* (or *ego*), and the problem of free will; however, these topics are not addressed in this thesis. It must be kept in mind that philosophy is just one, formalized disciplinary approach that seeks answers to ultimate human questions. Besides intellectual and academic approaches, there is a vast quantity of informal beliefs, anecdotes, speculations, and myths about the nature of man, reality, soul, and world. Even though these topics are also not being discussed in this thesis, cultural aspects are nevertheless related to a broader understanding of the long-lasting quest for consciousness; see e.g., an overview of the *soul concept* in human cultures by Frecska, Móró, and Wesselman ([2011](#)).

3.1.5 Neural level research methods

The search for the biological basis of consciousness – or more precisely, for its *neural correlates* – is one of the core focuses within empirical consciousness research. A considerable line of neurobiological studies is focusing on *visual consciousness* ([Crick & Koch, 1990](#); [Crick & Koch, 2003](#); [Koch, et al., 2016](#)), more precisely on mechanisms that transiently bind together information from neurons related to the features of a processed visual object. It is suggested that coherent synchronous gamma band oscillations (around 40 Hz) activate short-term working memory, thus perform the binding function of consciousness. The relevance of higher-order consciousness to synchronous gamma activity has been pointed out also by inducing self-reflective awareness in dreams (that hence became lucid dreams) through frontal low current stimulation of gamma activity with tDCS ([Voss et al., 2014](#)). Other visual system based theories propose that there is no final integrator station in the brain, thus consciousness should not be thought of as a unity, but instead binding occurs between spatiotemporally distributed *micro-consciousnesses* ([Zeki, 2003](#)). Another neural approach is the Dynamic Core Hypothesis ([Tononi & Edelman, 1998](#)), which states that conscious experience occurs only if a distributed complex functional cluster of neuronal groups achieves high integration in hundreds of milliseconds through reentrant interactions in the thalamocortical system. (This hypothesis has been developed further into the Information Integration Theory, see below in detail.)

The contrasting of *conscious* and *unconscious* states has been used in both anesthesia-related and dreaming-related consciousness research that examined certain neurophysiological and neuropharmacological processes. According to a prominent receptor-level neural theory, it is the NMDA (N-methyl-d-aspartate) synapse that implements binding mechanisms for large-scale neuronal cell assemblies. The spatiotemporal activity pattern of such assemblies produces a specific class of computational processes, which instantiate those higher-order self-reflexive mental representations that are necessary and sufficient for the occurrence of phenomenal states. An (almost) complete inhibition of the NMDA-dependent processes, like during anesthesia with ketamine, leads to a loss of consciousness, while their partial inhibition leads to an ASC ([Flohr, 2006](#)). A recent PET study that searched for the minimal neural correlates of consciousness by investigating the re-emergence of consciousness after anesthetic-induced unconsciousness has found that a core network involving subcortical and limbic regions becomes functionally coupled with parts of frontal and inferior parietal cortices ([Långsjö et al., 2012](#)). Dissociation between the presence of subjective experiences and observed responsiveness during anesthesia was also shown in our EEG study ([Noreika, et al., 2011](#)).

The differences between *conscious* and *nonconscious* modes of information processing are at another focus of neurocognitively oriented research. Contrastive analysis studies measure the presence or absence of conscious perception of a particular content, and compare the differences in neural activity during the experimental conditions ([Aru, Bachmann, Singer, & Melloni, 2012](#)). Recent dream studies have found significant correlations in TMS-evoked EEG responses between subjects who reported having dreamt and others who did not recall conscious experiences when woken up from non-rapid eye movement (NREM) sleep ([Nieminen et al., 2016](#)). Moreover, researchers have been able to predict whether a subject will report the presence or absence of their NREM sleep dream experiences by monitoring low-frequency activity in posterior cortical areas ([Siclari et al., 2017](#)). Besides 'on/off' type differences, other approaches study the gradual alteration in consciousness on a *presence–absence continuum*, e.g., during epileptic seizures ([Yu & Blumenfeld, 2009](#)). Brain networks underlying phenomenal consciousness can be also explored by charting *non-responsive* states, such as during the fully conscious *locked-in syndrome* and the nonconscious *unresponsive wakefulness syndrome* (UWS, formerly called *vegetative state*), or the *minimally conscious state*, where a reduced set of consciousness and responsiveness is still maintained ([Giacino, Fins, Laureys, & Schiff, 2014](#); [Laureys, Owen, & Schiff, 2004](#)).

3.1.6 Phenomenological and other approaches

Due to the subjective nature of the lived experience, the phenomenology of consciousness has become an increasingly essential part of recent empirical studies. As already envisioned by early pioneers such as James, novel directions within the science of consciousness are expected to emphasize the fusion of phenomenology, embodiment, and cognitive neuroscience ([Taylor, 2010](#)). In order to tackle the hard problem of subjectivity, the need for matching third-person objective measurements with "the view from within" – i.e., first-person reported accounts – has therefore created the field of *neurophenomenology* ([Varela & Shear, 1999a](#); [Varela & Shear, 1999b](#)). Recently, several interview techniques to obtain systematic and detailed subjective reports have been also put forward as "second-person methods" ([Olivares, Vargas, Fuentes, Martínez-Pernía, & Canales-Johnson, 2015](#)). The descriptive phenomenological approach, stemming originally from Husserlian philosophy, has been robustly incorporated into psychology as a qualitative method ([Giorgi, 1997](#)). Another empirical approach is to quantify the subjective experience with self-report questionnaires, such as the Phenomenology of Consciousness Inventory (PCI) by Pekala ([1991](#); [Pekala, Steinberg, & Kumar, 1986](#)). The phenomenological significance of ASC, in particular of psychedelic experiences, has been

repeatedly pointed out lately by multidisciplinary approaches from philosophy, psychology, and the neurosciences ([Horváth, Szummer, & Szabó, 2017](#); [Szabó, Horváth, & Szummer, 2014](#)).

A large number of non-philosophical, non-neural approaches are also dealing with consciousness from cognitive, informational, and quantum physical points of view, out of which only a few are selected to be mentioned here very briefly. Evidence from minimally contrastive pairs of similar events, i.e., differences between *conscious* and *nonconscious* modes of information processing of a particular content, have been captured in a single coherent cognitive framework, the Global Workspace Theory (GWT) by Baars ([1988](#), [1997](#)). This cognitively oriented theory illustrates working memory with a theater metaphor, where attention acts as a selective spotlight that directs focal consciousness on conscious events on the stage. Based on the GWT, neural level explanations has been also put forth later, notably the Global Neuronal Workspace model by Dehaene and Changeux ([1998](#)) that describes the interaction between a distributed and interconnected global workspace neurons and specialized neural processing modules ([for a review, see e.g., Dehaene & Changeux, 2011](#)).

A highly influential recent approach to the problem of subjectivity is the Information Integration Theory (IIT), stating that consciousness corresponds to the capacity of a system to integrate information ([Oizumi, Albantakis, & Tononi, 2014](#); [Tononi, 2004](#)). The theory quantifies a system's consciousness by assigning a Φ value for a subset of elements (called a *complex*) for the amount of information that can be integrated. Conscious experience may therefore be specified by the variables of informational interactions between elements within a complex. Since its debut, the IIT has been developed by Tononi et al. into its current 3.0 version ([Oizumi, et al., 2014](#)), and is a subject to vivid ongoing theoretical contributions ([e.g., Jonkisz, 2015](#)) and practical applications ([Casali et al., 2013](#)).

A proposed quantum physics model for consciousness ([Hameroff & Penrose, 1996, 2014](#)) puts consciousness-related information processing at the subcellular level of cytoskeletal microtubules within each neuron. However, no experimental confirmations have been directly supporting this or other quantum theories of consciousness ([e.g., Beck & Eccles, 1992](#)), for which reason they are considered to be far too speculative, hence difficult to implement into any current experimental research. Nevertheless, highly interesting fundamental hypotheses are being put forward in this area, such as the tentative 'neuro-ontological' interpretation based on a biophysical approach by Frecska et al. ([2011](#)); this concept emphasizes the important role of ASC in enabling non-local subneuronal 'direct-intuitive' information processing.

Finally, it is to be emphasized here that the field of consciousness studies is still – and probably will always be – far from united. Some approaches may be incompatible with other

approaches, may criticize each other, or may even dismiss the whole 'problem' of consciousness. For instance, even one of the most influential consciousness-related philosophical papers – with around 2500 citations –, where David Chalmers ([1995, p. 202](#)) defined that "[t]he really hard problem of consciousness is the problem of experience" (i.e., the subjective aspect), has been criticized for being "set up against a backdrop of questionable metaphysical, epistemological and phenomenological assumptions" ([Ratcliffe, 2007, p. 483](#)). These debates are nevertheless welcome, as they may and hopefully will advance the field of consciousness studies into novel conceptual directions.

3.2 Altered states of consciousness

In the mind–brain complex, there exists a plethora of unusual, special, 'altered' modes of operation, parted from the usual, everyday, 'baseline' state of consciousness only "*by the filmiest of screens*" ([James, 1902, p. 305](#)). These marked neurocognitive alterations of consciousness are both philosophically and scientifically fascinating, as they demonstrate great variability within the potential spectrum of altered states of consciousness (ASC). It has been already stated by one of the field's early pioneers that in order to develop a comprehensive psychology, the data from ASC cannot be ignored ([Tart, 1975/2001](#)). Likewise, contemporary theories of consciousness should also be able to conceptually explain and integrate these special states.

While some ASC may occur naturally or spontaneously, and some are of pathologic origin, many others can be deliberately induced by "*various physiological, psychological, or pharmacological maneuvers or agents*" ([Ludwig, 1966, p. 225](#)). Listings of "*relatively common and/or intensively studied*" ASC usually include phenomena such as hypnagogic (drowsy pre-sleep) state, dreaming sleep, hypnosis, meditative states, and mystical or transcendental experiences. Moreover, ASC lists include states induced by sensory deprivation, psychoactive drugs (such as alcohol, cannabis, lysergic acid diethylamide (LSD), etc.), starvation and diet, sexual activity (ending in orgasm), respiratory maneuvers (e.g., hyperventilation), repetitive rhythm (e.g., trance states achieved by drumming, dancing, and chanting), and relaxation techniques; ASC may also occur during certain psychotic disorders ([Farthing, 1992](#); [Tart, 1975/2001](#); [Vaitl et al., 2013](#)). Subjective experience may be absent temporarily during dreamless sleep, or permanently in a vegetative state or coma; these situations are not ASC but states of non-consciousness.

Conceptual issues regarding ASC, such as its definitions, are still not consensually agreed-upon. Perhaps the most classical definition of ASC was coined by Tart ([1975/2001, p. 208](#)) as: "*A qualitative alteration in the overall pattern of mental functioning, such that the experiencer feels his consciousness is radically different from the way it functions ordinarily*". Farthing ([1992](#)) gives the

following definition in his textbook: "An altered state of consciousness is a temporary change in the overall pattern of subjective experience, such that the individual believes that his/her mental functioning is distinctly different from certain general norms for his/her normal waking state of consciousness".

From these definitions of what an ASC is, three commonalities can be pointed out immediately. First, there is a self-evaluation criterion, i.e., the definitions are based on how the subject feels or believes about his/her state of consciousness (which, of course, may not be consensual, as we can have ASC without realizing we are in an ASC, such as during regular, non-lucid dreaming). Second, self-detected alterations occur in mental functioning, i.e., the definitions refer to the psychological domain as the source of data. Third, changes in mental functioning refer to an (unspecified) ordinary or 'normal' baseline state of the subject (as assessed by the subject himself/herself), i.e., there is a comparison involved. By looking at the above lists of selected ASC and at the above attempts to define them, it is hard to decide if the ASC were involved in a listing on the basis of a pre-assembled ASC definition, or if the definitions were made on the basis of a pre-compiled ASC listing. To my understanding, this conceptual 'selection–definition ordering problem" has never before been dealt with; its possible solution is offered in my Study I ([Móro, 2010](#)).

Besides these above (phenomenological) factors of ASC experiences, it is useful to specify what features are being *altered* also by concepts of cognitive and phenomenological psychology; four influential listings are reviewed here. Tart ([1975/2001](#)) mentions 10 *subsystems*: Exteroception, interoception, input-processing, memory, sense of identity, emotions, evaluation and decision-making, subconscious, motor output, and space/time sense. Pekala ([1991](#); [1986](#)) lists 12 major (and 14 minor) *dimensions* in his PCI as follows: altered experience, arousal (decreased relaxation), altered state of awareness, attention, internal dialogue, imagery, memory, negative affect, positive affect, rationality, self-awareness, and volitional control. Farthing ([1992](#)) has a 14-item list about *dimensions of conscious experience*: Attention, perception, imagery and fantasy, inner speech, memory, higher-level thought processes, meaning or significance of experience, time experience, emotional feeling and expression, arousal, self-control, suggestibility, body image, and sense of personal identity. Similarly, Hobson ([2007](#)) enumerates 9 *mental elements* (or *capacities of mind*, or *components of consciousness*): Perception, attention, memory, orientation, thought, narrative, instinct, intention, and volition. Strikingly, the lists are far from overlapping: 'memory' is the only common item mentioned on all four of them, despite all enlisted terms are important notions in various disciplines studying the mind. The lack of unambiguously separable and easily definable mental subsystems reflects perhaps a similar

difficulty in assigning straightforward single roles for cortical areas on the neurocognitive side of consciousness research.

Animal observations revealed that deliberate state-altering seems to play an important role, as if there exists a natural force that motivates the pursuit of intoxication; a "fourth drive" following hunger, thirst, and sex ([Siegel, 2005](#)). Moreover, ASC studies from archeological and evolutionary perspectives have also examined the fascinating questions: Why induced ASC are so inherently part of the human experience in every major culture that we know about? Could there be any potentially great benefits of mind-altering, or is it just an epiphenomenal "intoxication side-effect" ([Froese, 2015](#))?

The relationship between various (pairs of) ASC is also of continuous research interest. For instance, similarities and differences between hypnosis and meditation have been reflected upon with an increasing interest by several researchers (e.g., [Benedittis, 2015](#); [Holroyd, 2003](#)). Another line of study examined the presence and lack of insight during lucid dreams and psychosis, respectively ([Dresler et al., 2015](#)). It has been also suggested that sleep studies may foster the scientific understanding of hypnosis ([Kahn & Hobson, 2003](#)).

In order to shed light on the phenomenon of ASC from a human viewpoint, it is essential to capture the intentions behind state-altering efforts by better understanding the functions of psychoactive drug use as the perhaps most widespread and general ASC-inducing method. Such a newly proposed concept is *drug instrumentalization* by Müller and Schumann ([2011](#)), introducing the idea that humans are deliberately changing their mental states by drugs, "*in order to facilitate other, non-drug-related behaviors*". This framework will be further discussed below in Study IV.

3.2.1 Measuring induced ASC with questionnaires

Contemporary research directions on various ASC explore both the contents of these states as well as their underlying mechanisms. Systematic studies have been done on charting and measuring the phenomenological dimensions of ASC ([Studerus, Gamma, & Vollenweider, 2010](#)), to explain their psychobiology ([Vaitl, et al., 2013](#)) and functional neuroanatomy ([Dietrich, 2003](#); [Hobson, 2002](#); [Vollenweider & Geyer, 2001](#)), to clarify their role in religion and spirituality ([Bartocci, 2004](#)), and to investigate their applicability in psychotherapy ([Buckley & Galanter, 1979](#); [Field, 1992](#)). Next, the most important questionnaire studies relevant to the current thesis, in particular because of the measurement of psychoactive substance related ASC, will be briefly introduced.

The pioneering ASC-measuring scale – besides PCI – was the originally German language APZ (*Aussergewöhnliche Psychische Zustände*) questionnaire by Dittrich et al. ([1985](#)). The APZ was followed by its psychometrically improved version (OAV), and an extended version including visual and auditory

hallucinations (5D-ASC). These questionnaires have been psychometrically tested and translated to several other languages. The acronym OAV comes from the initial letters of the original German names of its three primary dimensions: 'oceanic boundlessness', 'dread of ego dissolution', and 'visionary restructuralization'. Recently, the OAV has been analyzed and modeled by multiple methods, and 11 new lower order scales were constructed out of its original three primary and one secondary dimensions, in order to better assess drug induced ASC. These 11 new factors of ASC are: Experience of unity, Spiritual experience, Blissful state, Insightfulness, Disembodiment, Impaired control and cognition, Anxiety, Complex imagery, Elementary imagery, Audio-visual synesthesiae, and Changed meaning of percepts ([Studerus, et al., 2010](#)); for a recent review see Preller and Vollenweider ([2016](#)).

Another ASC-measuring scale, the HRS (Hallucinogen Rating Scale), was developed by Strassman and his colleagues ([Strassman, Qualls, Uhlenhuth, & Kellner, 1994](#)) during human experiments with N,N-dimethyltryptamine (DMT) administration, later validated with, e.g., ayahuasca study data ([Riba, Rodriguez-Fornells, Strassman, & Barbanoj, 2001](#)). Psychedelics-related ASC studies also utilize the Challenging Experience Questionnaire ([Barrett, Bradstreet, Leoutsakos, Johnson, & Griffiths, 2016](#)), the Mystical Experience Questionnaire ([MacLean, Leoutsakos, Johnson, & Griffiths, 2012](#)), and the Ego-Dissolution Inventory ([Nour, Evans, Nutt, & Carhart-Harris, 2016](#)).

3.2.2 Hallucinations in ASC

In certain subsets of ASC, the core sensory experience may radically alter and result in experiences of various hallucinations. Perception without a corresponding external stimulus is generally considered a sign of strong mental alteration, hence the presence of hallucinations is taken as a definitive indicator of an ASC. Hallucinations may occur in all – visual, auditory, olfactory, gustatory, or tactile – sensory modalities ([Aleman & Larøi, 2008](#)). Remarkably many types of hallucinatory phenomena are natural and sleep-related (with an ongoing conceptual debate whether dreaming itself counts as a hallucination or not), but can also occur during pathological medical conditions, such as in schizophrenia or alcohol withdrawal. Hallucinations can be deliberately induced by hypnotic suggestions ([Orne, 1959](#)), sleep deprivation ([West, Janszen, Lester, & Cornelisoon, 1962](#)), and photic stimulation ([ffytche, 2008](#)), as well as by psychedelic substances ([Nichols, 2004](#)), deliriant plants ([Díaz, 1977](#)), and dissociative drugs ([Rolland et al., 2014](#)).

The manifold definitions of hallucination are commonly referring to the person's subjective experience (i.e., the phenomenal level), the involvement of the sensory domain, a distinction between external and internal sources of information, and to the 'trueness' of hallucinations. However, in terms of information sources, 'external' and 'internal' do not seem to be independent from or alternative to

each other, but rather appear as consecutive stages in the information processing chain. Hence, it is suggested that the definitions of hallucination should look at the modulation of information instead of merely looking at the source of information ([Móro, 2010](#)).

Metacognitive processes, such as self-reflection, insight, and 'reality testing' may make a categorical difference between knowingly perceived 'pseudohallucinations' from genuinely believed 'true' hallucinations, depending on whether the subject knows if he/she is hallucinating or not ([Rolland, et al., 2014](#)). It is to be noted that because of this 'impairment', many definitions and descriptions of hallucination are expressed by using negative value-judging terminology, e.g., 'abnormal', 'misrepresented', or 'erroneous'. This may even lead to the social dismissal of the whole hallucinatory phenomena ([Shanon, 2003](#)). Nevertheless, hallucinations offer a fascinating terrain with rich subjective contents that are being explored also by phenomenologically oriented cognitive neuroscience studies of dreaming and hypnosis.

Besides its clinical and scientific importance, the phenomenon of hallucinations has strong connections also with philosophical and theoretical issues ([Macpherson & Platchias, 2013](#)). In particular, the philosophy of perception is exploring existential and ontological questions of 'reality' (and 'unreality') that are highly relevant also for the philosophy of mind and hence also for consciousness studies. These relevancies will be described in connection with the 'virtual reality' concept elaborated later in this thesis.

3.3 Dreaming

Albeit none of the articles in this doctoral thesis are directly related to dreaming, brief remarks on the topic are nevertheless included here because of multiple reasons. Firstly, the phenomenon of dreaming has high relevance to the *world-simulation* concept and metaphor, a core topic in developing the *virtual realism* stance later in this dissertation. Secondly, a particular sleep-related phenomenon detailed in Study II, namely sleepiness, is somewhat related to the (also sleep-related) phenomenon of dreaming. Thirdly, as dreaming has interesting connections with hypnosis (being another topic of Study II), a brief introduction of the wider context is also justified here, as follows.

Dreaming is a major ASC that is relatively well-known and studied-upon in comparison with other altered states. The phenomenon of dreaming has always fascinated mankind – both practically and metaphysically – as it seems to open a richly experienceable gateway to 'alternative realities' or 'other dimensions'. Mechanisms, contents, and the possible functions of dreaming have been explored by experiments in psychology and neuroscience, thus the topic conveniently belongs to the (relatively

new) field of cognitive neuroscience ([Nir & Tononi, 2010](#)). Albeit studies of dreaming are occasionally related to the sleeping process and its clinically relevant disturbances (e.g., [Valli et al., 2012](#)), it is also of great scientific interest to find out about the neural correlates of dreaming by studying dreaming vs. dreamless sleep (e.g., [Noreika, Valli, Lahtela, & Revonsuo, 2009](#))—keeping in mind that various types of sleep experience may occur in different stages of sleep, including the NREM stage ([Windt, Nielsen, & Thompson, 2016](#)). Within consciousness studies, the phenomenon of dreaming is crucially important because of being a naturally occurring, abundantly available ASC that can be explored by collecting subjective experience reports.

Using a metaphor from a then-novel computer technology area, Revonsuo ([1995](#)) put forward the idea that *"dreaming is an organized simulation of the perceptual world; a virtual reality"*. In his influential Threat Simulation Theory, Revonsuo ([2000b](#)) advanced his concept further by suggesting that as an internal phenomenal 'world-simulation', dreaming may serve as a model system for consciousness. Defined as an 'immersive spatiotemporal hallucination' ([Windt, 2010](#)), dreaming indeed creates a realistic environment that is usually being perceived from a first-person perspective, and is only minimally coupled with external sensory input. Due to conceptual concerns and practical problems with the adequacy and feasibility of the dream model, alternative study approaches, e.g., the contrastive analysis of dreaming with other states, have been also suggested ([Windt & Noreika, 2011](#)).

An unusual form of dreaming, namely lucid dreaming (LD) occurs when a sleeping person is able to gain 'meta-awareness' on his/her momentary SoC, and consequently to understand that he/she is in a state of dreaming ([Voss, Holzmann, Tuin, & Hobson, 2009](#)). The existence of LD is an important piece of evidence in showing that the dream state may involve also metacognitive processes ([Kahan & LaBerge, 1994](#)) due to a *"reactivation of areas which are normally deactivated during REM sleep"* ([Dresler et al., 2012, p. 1017](#)). It has been recommended that the topic of LD should move from its marginal place to a *"center stage in the emerging science of consciousness"* ([Hobson, 2009, p. 43](#)), and that experimental consciousness research on LD should utilize various electrophysiological, brain imaging, and cortical stimulation methods in order to find out about the involved brain regions ([Noreika, Windt, Lenggenhager, & Karim, 2010](#)), as shown in numerous recent LD experiments (e.g., [Dresler, et al., 2012](#); [Dresler, et al., 2015](#); [Voss, et al., 2014](#)). Other aspects of sleep- and dream-related phenomena, such as hypnagogic experiences related to drowsiness, have been also studied recently by ASC researchers (e.g., [Noreika et al., 2015](#)).

3.4 Hypnosis

Hypnosis is a technique that uses attention-focusing verbal suggestions to induce subjective and behavioral changes in another person. The phenomenon has both consciousness-related theoretical and widely applied practical contributions, the latter in the fields of psychotherapy and anesthesiology ([for a thorough overview, see e.g., Terhune, Cleeremans, Raz, & Lynn, in press](#)). Debates about whether hypnosis involves a distinct altered mental state have been going on throughout the whole history of hypnosis ([Kirsch, 2011](#)), occasionally leading to experimental results. For example, in a recent elegant study that contributed to the *state theory* (i.e., considering that in some cases hypnosis may involve a special state), Kallio et al. ([2011](#)) have linked involuntary saccadic eye movements to a qualitatively different special state in one highly hypnotizable subject. A similar debate within the hypnosis research community concerns whether a narrow or a broad definition of hypnosis should be used; while the narrow definition includes a necessary trance induction procedure, the broad definition does not ([Kirsch et al., 2011](#)).

Besides searching for the neural correlates of hypnosis, a notable number of studies have attempted to find out reliable correlates of hypnotic susceptibility, in order to predict subjects' responsiveness in advance. Cognitive abilities that have been shown to correlate with hypnotizability are, e.g., absorption ([Tellegen & Atkinson, 1974](#)), fantasy proneness ([Lynn & Rhue, 1988](#)), and empathy ([Wickramasekera II & Szlyk, 2003](#)). Behavioral indicators of hypnotizability are more difficult to estimate, even though self-scoring of own behavior during hypnosis has been proven to strongly correlate with observer-scored behavior ([Bentler & Hilgard, 1963](#)).

In ASC research, it seems also feasible to explore hypnosis by comparing its similarities and differences with other self-describable 'mindbody states' (this excellent term was coined by Thomas B. Roberts in connection with his Multistate Theory ([2013](#)), in order to avoid the ambiguous common language expression of 'SoC'). On the basis of imagination and visualization involved in a non-alert, drowsy state, the experience of hypnosis has been occasionally described as 'dream-like' ([for a comparison, see e.g., Hobson, 2002, pp. 98-101](#)). However, significant neurophysiological differences between dreaming during sleep and hypnosis during wakefulness make this particular resemblance hard to utilize in practical research. For this reason, in our Study II ([Móro, Noreika, Kallio, & Revonsuo, 2011a](#)), not sleep but a somewhat resembling physiological state, drowsiness during daytime sleepiness, was chosen for comparison with hypnosis. It is to be noted also here that hypnosis may also share common mechanisms with another interesting ASC, meditation, via top-down modulation of attention and de-automatization processes ([Lifshitz, Campbell, & Raz, 2012](#)).

3.5 Psychedelic drugs

The utilization of various psychoactive substances for a myriad of reasons has been an apparent characteristic of human behavior and culture for millennia ([Baker, 1994](#); [Winkelman, 1995](#)). There seem to be no clear dividing lines, but only temporally and geographically changing agreements on definitions of concepts like 'food', 'spice', 'medicine', and 'drug'—neither is there a simple answer to the question "*why people use drugs?*". Mind-altering substances (in particular, anesthetics and hallucinogens) may be highly relevant to be used in scientific experiments for studying consciousness – but studying the general human use of mind-altering substances may also be equally fascinating in itself. In particular, the non-drug factors *set* and *setting* ([Zinberg, 1984](#)) – simply put, personal attitudes and the environment of drug use, respectively – seem to play key roles in modulating the experience.

Within the last decade, psychedelic drug research has become a rapidly developing area in consciousness science, and it is also increasingly connecting with cognitive neuroscience. Recently, a handful of clinical trials have delivered excellent results in using psilocybin for tobacco smoking cessation ([Johnson, Garcia-Romeu, & Griffiths, 2017](#)), treating patients with 3,4-methylenedioxy-methamphetamine (MDMA) in post-traumatic stress disorder (PTSD) ([Mithoefer, Wagner, Mithoefer, Jerome, & Doblin, 2011](#)), giving LSD for end-of-life anxiety in terminally ill people ([Gasser, Kirchner, & Passie, 2015](#)), or administering ketamine to alleviate symptoms of treatment-resistant depression ([Zarate et al., 2006](#)). After 30-40 years of legally unobstructed but practically halted research worldwide, the current '*Psychedelic Renaissance*' ([Sessa, 2012](#)) has already made substantial contributions to the understanding of brain mechanisms during drug-induced ASC, as neuroimaging studies on the effect of psychedelics in healthy human subjects have become increasingly permitted and performed in the last few years ([Roseman, Leech, Feilding, Nutt, & Carhart-Harris, 2014](#); [Schartner, Carhart-Harris, Barrett, Seth, & Muthukumaraswamy, 2017](#); [Tagliazucchi, Carhart-Harris, Leech, Nutt, & Chialvo, 2014](#)). These studies aim to discover neural correlates of the psychedelic state, to integrate this newly obtained knowledge into existing conceptual frameworks, as well as to hypothesize new theories that explain the mechanisms of consciousness and its alterations.

Such a new theory of conscious states informed by neuroimaging research with psychedelic drugs is the entropic brain hypothesis ([Carhart-Harris et al., 2014](#)) that is based on brain connectivity data obtained from fMRI and MEG studies with psilocybin. The authors concluded that for the mind-brain to enter into a primary disorganized ASC, the normally highly organized neurodynamic activity in the default mode network (DMN) must collapse and decouple from the medial temporal lobes. Another, but similarly neuroimaging-based interesting effort is Gallimore's ([2015](#)) explanatory

modeling of the psychedelic state, based on the conceptual framework of a foremost contemporary theory of consciousness, namely the IIT ([Oizumi, et al., 2014](#); [Tononi, 2004](#)). The new model suggests that while cognitive flexibility, creativity, and imagination are indeed enhanced in the psychedelic state, this happens at the expense of cause-effect information, as the brain's ability "to organize, categorize, and differentiate the constituents of conscious experience" is impaired.

There is a wide consensus that scientific research with psychedelic drugs seems to have a considerable – and so far very underexplored – potential for studying human consciousness in novel ways. For instance, Crick and Koch's ([2005](#)) theory about the claustrum playing a key role in consciousness becomes even more interesting given the fact that the consciousness-altering hallucinogenic plant *Salvia divinorum*'s main ingredient salvinorin A is a strong agonist of κ -opioid receptors that are found in the claustrum in high density ([Stiefel, Merrifield, & Holcombe, 2014](#)).

The context of neuroscientific and psychological experiments provides only one particular and highly controlled set and setting for drug use, with a sole purpose to obtain data by measurements and/or (self-)observation of subjects. On the contrary, drug use situations 'out there' 'in the real world' are characterized by extremely complex combinations of drugs and drug use purposes. Hence, studying drug use may offer excellent opportunities also for other disciplines like anthropology, cultural studies, ethnography, humanities, and social sciences to make interdisciplinary contributions in order to understand drugs; not only on neurobiological and psychological, but also on social and cultural levels.

The phenomenology of drug-induced ASC is much understudied, despite of an abundance of experience reports and public discussion readily available online ([Barratt, 2012](#)). For a more detailed investigation of exceptional mental states, concepts of transpersonal psychology may also be involved ([Maslow, 1969](#)). Subjects may describe their experiences as transcendental, religious, and spiritual; in such sacramental use contexts, psychedelic drugs are termed '*entheogens*' (literally: "*becoming divine within*") ([Roberts, 2001](#); [Ruck, Bigwood, Staples, Ott, & Wasson, 1979](#); [Schultes & Hofmann, 1979](#)).

Interpretations of these experiences may get a deeper meaning by expanding the currently utilized bio-psycho-social scheme with a 'spiritual' level of explanation ([Bishop, 2009](#)). In this new four-level scheme, the notion of spirituality refers to certain belief systems that are usually based on personally meaningful, direct subjective experiences of the transpersonal kind. Thus, an inclusion of the level of spirituality claims no objective existence of non-material metaphysical dimensions (along with populating mind-independent entities), but is merely used to denote an abstract human concept system with substantial explanatory power regarding cognition and behavior. These topics will be further discussed below in Studies III and IV.

4 AIMS

Albeit the topic of this doctoral dissertation is ASC, the four included articles indeed show variability in their approaches and themes. However, the studies can be tied together under the term of 'cognitively and pharmacologically induced ASC', which is to be differentiated from spontaneously or pathologically occurring ASC. The first thing to be pointed out is that the notion of ASC is not defined clearly and consensually, but it refers to a group of diverse phenomena that are either included in or excluded from various lists. Furthermore, there are still ongoing debates on whether or not certain phenomena qualify as a *state*. Besides one theoretical article addressing the definitions of ASC, this thesis is also looking at the relationship between ASC phenomena with an empirical study. Two additional articles of the thesis survey and clarify the great variability that may occur between subjects during certain ASC (within a special cultural context).

The above mentioned general objectives of the thesis can be further narrowed down to specific one-per-study research objectives, as follows:

- 1) To construct a working definition for ASC that could yield a technical conceptualization and operationalization procedure to solve the selection–definition ordering problem.
- 2) To investigate the relationship between distinct ASC, in particular between hypnotic susceptibility and daytime sleepiness.
- 3) To study psychosocial factors that are associated with self-perceived benefits, such as enhanced coping, in drug-induced ASC experiences related to spirituality.
- 4) To provide evidence that could support a distinctive categorization of sacramentally and spiritually used hallucinogenic drugs, compared with other biopsychosocial functions of the use of other drugs.

Given the diverse types of the four included articles (a theoretical, an empirical, a survey-based, and a commentary), their order of appearance in this thesis has no particular significance. Therefore, they are being introduced in the original chronological order of publication, which may hence reflect merely my scientific research and writing process, not any logically consecutive arrangement.

5 ORIGINAL STUDIES

5.0 General overview

Studies I, II, III, and IV in this dissertation explore various ASC, from hypnosis to psychoactive and psychedelic drug use. These selected topics are admittedly only a narrow subset of the numerous phenomena generally regarded as ASC. Other important ASC, such as dreaming, anesthesia and meditation, are indeed also greatly interesting from consciousness studies' point of view. In general, the four studies are connected by their common aim to investigate various aspects of induced ASC. Scientifically challenging problems are the definition(s) of ASC, relationship between distinct ASC, differentiating factors between same-type ASC, human purposes to utilize ASC, and the usability of certain ASC for consciousness research. As it would be practically impossible to study all the above mentioned aspects for each above mentioned, my studies are selectively addressing *some* aspects within a certain ASC, while omitting other aspects within another ASC—or comparing only a few ASC (not all of them) with each other. For broader background, Study I gives a thorough overview of ASC and hallucinations, Study II introduces the topic of hypnosis, and Study III describes psychedelics in more detail.

Study I ("*Hallucinatory Altered States of Consciousness*") is a theoretical analysis on certain concepts and definitions of ASC and hallucinations; it proposes a working definition of a hallucinatory ASC, and a 'self-mapping' stepwise operationalization procedure for a systematic ASC comparison.

Study II ("*Hypnotizability, Sleepiness, and Subjective Experience*") describes an empirical study that found significant positive correlations between hypnotic susceptibility and habitual/instantaneous sleepiness in 90 subjects by one newly developed and three previously established self-rating scales.

Study III ("*Coping, Life Purpose, and Spirituality in Psychedelic Drug Users*") is based on an online questionnaire survey of 667 psychoactive drug users, concluding that psychedelic drug use with the purpose of autognosis (self-knowledge) is associated with higher scores of coping and spirituality.

Study IV ("*Sacramental and Spiritual Use of Hallucinogenic Drugs*") is a commentary article arguing that sacramentally and spiritually used psychedelic drugs ('entheogens') are not merely used for altering perception, but deserve their own category in a *drug instrumentalization* framework.

5.1 Study I: Hallucinatory Altered States of Consciousness

([Móro, 2010](#)), see full-text in the Original Publications section.

5.1.1 Literature overview

Dreaming, hypnosis, meditation, and other non-ordinary hallucinatory states are commonly referred to as ASC—in the lack of exclusive selections or commonly accepted definitions of what an ASC exactly is. ASC listings mentioned in the literature are rather exemplary than comprehensive (e.g., [Farthing, 1992](#); [Tart, 1975/2001](#); [Vaitl, et al., 2013](#)). Moreover, ASC definitions miss to provide exact classification criteria for assessing altered – as opposed to baseline – states of consciousness. There is still a rather common basis from cognitive science’s point of view on the question of *what* subsystems, dimensions, or elements of consciousness are being altered in an ASC (e.g., [Farthing, 1992](#); [Hobson, 2007](#); [Tart, 1975/2001](#)), despite differences in both naming and the number of items enlisted.

ASC are particularly interesting from the viewpoint of subjective experiences. The phenomenal level of description is about the ongoing first-person experience, described and referred to as the *stream of consciousness* ([James, 1902](#)), the *what-is-it-like-to-be* feeling ([Nagel, 1974](#)), or as *inner presence* ([Revonsuo, 2006](#)). The classical ASC literature describes alteration mechanisms with terms and models from cognitive psychology and neuropharmacology: temporary destabilizing and reprogramming activity on the individual’s default pattern-making processes ([Tart, 1975/2001](#)), distinct alterations in neurotransmitter levels at certain locations in the prefrontal cortex ([Hobson, 2002](#)), or disinhibitory mechanisms in serotonergic pathways of cortico-striato-thalamic brain areas ([Vollenweider & Geyer, 2001](#)).

Definitions of 'hallucination' are as manifold as those of ASC, incorporating references to the *sensory domain*, concepts of an *external–internal* distinction, and the notion of *trueness* ([Esquirol, 1845/1965](#); [Horowitz, 1975](#); [VandenBos, 2007](#)). Contemporary research ([Aleman & Larøi, 2008](#)) defines 'hallucination' as "*conscious sensory experience that occurs in the absence of corresponding external stimulation of the relevant sensory organ and has a sufficient sense of reality to resemble a veridical perception*". This approach considers hallucinations – regardless of opposing psychological or medical viewpoints – on their continuity with normal experience ([Aleman & Larøi, 2008](#)).

5.1.2 Original proposal

Study I ([Móro, 2010](#)) is a theoretical article that (a) performs a multi-part conceptual analysis of certain aspects of hallucinatory ASC, (b) contributes a working definition of ASC, and (c) proposes a stepwise operationalization procedure to capture, filter, and group relevant ASC phenomena. Starting with commonalities found in current definitions of ASC, issues with self-evaluation, sources of data, and baseline comparison are analyzed first, then the concept of alterations is examined with respect to temporal dynamics, change mechanisms, and mental subsystems. After this, hallucinatory phenomena are discussed – regarding their various definitions, the relationship between external and internal, and the 'trueness' issue of hallucinations – and a technically based working definition of ASC is contributed. Conclusive to the analysis, a stepwise operationalization procedure is proposed.

The analysis concludes that division between changed sensory experience ('hallucinations') and cognitive experience ('delusions') is unclear, and therefore consciousness alteration should be assessed from a broader perspective, i.e., with respect to all mental subsystems that may change during an ASC. It also concludes that *external* and *internal* are not alternatives to or independent from each other. Rather, they are mutually interacting stages in the information processing mechanisms: external information is always processed internally, but at the same time, exteroception is fundamentally modulated by internal processes, such as attention, memory, and emotion.

The study concluded with a temporary working definition of ASC as: *“A hallucinatory altered state of consciousness is a transiently stable mode of operation on supervenient levels in the mind–brain complex, where objectively detectable characteristic changes in the internal information processing mechanisms of neurocognitive subsystems may be subjectively experienced as changes in phenomenal content and overall psychological functioning, as compared with prior and posterior baseline states of the individual.”* This definition may conceptually guide the process of searching for ASC candidate phenomena: it includes a temporal dimension, addresses the dilemma of considering long-lasting changes of consciousness as an ASC, extends the level of view from psychological to neurocognitive, and involves a quantifiable comparison of individual prior/ posterior baseline SoC.

As a theoretical solution for the mutually exclusive 'selection–definition ordering problem' described earlier, Study I proposes a stepwise operationalization procedure (that is yet to be carried out in practice by future studies). By this 'self-mapping' procedure, alterations of mental subsystems are quantified in first-person subjective experience reports that describe ASC candidate phenomena. From median values in each dimension for each ASC candidate, multidimensional distances can be computed to describe the core ASC typicalities, thus to result in a final grouping of ASC phenomena.

5.2 Study II: Hypnotizability, Sleepiness, and Subjective Experience

([Móro, et al., 2011a](#)), see full-text in the Original Publications section.

5.2.1 *Aims and methods*

Study II aimed to investigate the relationship between hypnotizability and three aspects of sleep: habitual daytime sleepiness, increased instantaneous drowsiness (after the hypnotic procedure), and night sleep quality. We also examined whether self-scored subjective experiences may provide additional data on hypnotizability that would not be detected by standard self-scored behavior.

A total of 90 volunteer participants (71 females, 19 males) attended one of the four sessions of a hypnotic induction procedure that was played from pre-recorded audio. Before the procedure, participants were asked to mark their current (pre-test) state of sleepiness on the Karolinska Sleepiness Scale (KSS) form. After the 45-minute session, subjects were asked to score their post-test state of sleepiness on another KSS form, and to fill the Harvard Group Scale of Hypnotic Susceptibility Form A (HGSHS:A) and our own novel Questionnaire on Subjective Hypnotic Experiences (QSHE). In addition, subjects were asked to score the online versions of the Epworth Sleepiness Scale (ESS) and the Pittsburgh Sleep Quality Index (PSQI) at their homes shortly after the session.

5.2.2 *Results and conclusions*

The main findings show that hypnotizability correlates positively with both habitual daytime sleepiness and instantaneous sleepiness after the hypnotic procedure. We found a significant habitual daytime sleepiness difference in ESS scores between lower and upper halves of the HGSHS:A total score group, and a significant instantaneous sleepiness difference between KSS pre-test and post-test scores in HGSHS:A mediums, lows, and all participants. Results support the idea that sleep and hypnosis may share some common mechanisms that may be related to the ability to quickly change the psychophysiological set into a more relaxed one, or to dedicate a sufficient amount of attention to immersing into less externally driven mental content. Results also indicated that subjective self-evaluation by the novel QSHE correlated strongly and positively with the standard HGSHS:A scale. Moreover, QSHE even found a significant correlation in KSS post-test scores that HGSHS:A did not find; this indicates that hypnosis-related self-evaluation may be a useful tool in some cases when comparing with other subjectively rated scales, such as those concerning sleepiness. Thus, our findings justify the use of subjective self-evaluation methods when experiencing phenomena that have been traditionally evaluated by various observational and/or behavioral methods.

5.3 Study III: Coping, Life Purpose, and Spirituality in Psychedelic Drug Users

([Móro, Simon, Bárd, & Rácz, 2011b](#)), see full-text in the Original Publications section.

5.3.1 Aims and methods

Study III aimed to investigate psychedelic drug use in connection with the themes of coping, life purpose, and spirituality, as historical and anecdotal evidence pointed to such relationship in non-problematic, *autognostic* (self-knowledge increasing) drug users. In an online questionnaire survey, we collected a total of 667 answers from respondents who had previously used or currently used psychedelic and/or other psychoactive drugs. After excluding respondents with self-assessed drug use problems, 589 subjects (247 females, 342 males; age $M = 23.8$, $SD = 6.4$) were taken into further analyses. Coping, life purpose, and spirituality were measured with the Psychological Immune Competence Inventory (PICI), the Purpose in Life (PIL) test, and the Intrinsic Spirituality Scale (ISS), respectively. Based on drug types, drug use purposes, and the importance of the experience, a PSYNDEX (psychedelic index) score was computed for 277 participants. By this score, we separated the target PSY group (autognostic psychedelic drug users) from the C1 control group (users of mostly other drugs for mostly other purposes) and from the C2 control group (alcohol-and-tobacco-only users). Fifty members from each group were matched by age, type of residence, and highest educational level.

5.3.2 Results and conclusions

Results indicated that the use of psychedelic drugs with a purpose to enhance self-knowledge was less associated with problems, and correlated positively with both coping (PSYNDEX–PICI: $r = .137$, $p < .01$, $n = 366$) and spirituality (PSYNDEX–ISS: $r = .339$, $p < .001$, $n = 277$). As verified by a Mann-Whitney test, matched ISS scores in the PSY target group were also significantly higher in comparison with control groups C1 ($U = 689$, $Z = -3.870$, $p < .001$, $N = 100$) and C2 ($U = 697.5$, $Z = -3.811$, $p < .001$, $N = 100$). PIL scores correlated negatively with the total number of drug types used ($r = -.144$, $p < .001$, $N = 589$) and with the number of nonpsychedelic drugs used ($r = -.124$, $p < .01$, $N = 589$), but did not correlate with the number of psychedelic drugs used.

Albeit the meaning of the term 'spirituality' may be ambiguous, it seems that a spiritually inclined attitude in drug use may act as a protective factor against drug-related problems. The autognostic use of psychedelic drugs may be thus hypothesized as a 'training situation' that promotes self-enhancement by rehearsing personal coping strategies and by gaining self-knowledge.

5.4 Study IV: Sacramental and Spiritual Use of Hallucinogenic Drugs

([Móro & Noreika, 2011](#)), see full-text in the Original Publications section.

5.4.1 Literature overview

Study IV is an open peer commentary on a proposed new framework theory for non-addictive psychoactive drug use ([Müller & Schumann, 2011](#)). The target article introduces the concept of *drug instrumentalization*, i.e., the idea that humans are deliberately changing their mental states by drugs, *"in order to facilitate other, non-drug-related behaviors"* ([p. 293](#)). In their approach, Müller and Schumann consider non-addictive drug consumption as a *"stable and widespread behavior in its own right"* ([p. 293](#)), which is a rare and welcomed standpoint in the predominantly problem-oriented field of drug studies.

Müller and Schumann ([2011](#)) argue that *"drug instrumentalization behavior may provide a functional adaptation to modern environments based on a historical selection for learning mechanisms that allow the dynamic modification of consummatory behavior"* ([p. 293](#)). Elaborating this concept, the target article lists an eight-item classification of the proximate mechanisms of psychoactive drug use. In this classification, hallucinogenic drugs are generally associated with changes in perception and cognition, thus thought to be consumed primarily for their sensory perception changing properties.

5.4.2 Original proposal

In our open peer commentary ([Móro & Noreika, 2011, p. 319](#)), we argued that *"[...] the religious use of hallucinogenic drugs stems from a human search of metaphysical insight rather than from a direct need for cognitive, emotional, social, physical, or sexual improvement"*. In support of our view, we enlisted archeological evidence and historical documentation suggesting that hallucinogenic psychoactive drugs have been used for ritual and ceremonial purposes around the world and across the ages. Therefore, *"the sacramental and spiritual intake of hallucinogenic drugs goes so far beyond other biopsychosocial functions that it deserves its own category in the drug instrumentalization list"*.

5.4.3 Conclusion

In their authors' response, Müller and Schumann accepted our idea: *"We fully agree with this suggestion and add this as ninth instrumentalization goal to the list as: Facilitating spiritual and religious activities"* ([p. 330](#)). As our proposal managed to extend their initial eight-item instrumentalization list, we feel contended with our article resulting in a significant impact on this professional debate.

5.5 Citations of the studies

As of June 2016, it could be of academic relevance to review some of the papers that have been citing the four Original Publications since their first publication dates in 2010 and 2011. The following brief review is meant to demonstrate the international contribution of my studies on later research; moreover, it may also serve as a brief update to the present directions of the studied topics. An automatically updated online list of citing articles is being maintained by Google Scholar Citations ([2017](#)); in order to avoid circular citations, the citing papers will not be cited here.

Study I ("*Hallucinatory Altered States of Consciousness*") has 10 citations to date. It has been referred to in a former colleague's (current supervisor's) PhD thesis and in one of his online publications about the neural correlates of a state of consciousness. The study was also cited in the context of the experience of ASC in shamanic ritual, in a book about the origins of religion in the Paleolithic, and in a paper about phantasy and the phenomenological significance of ASC. It was also mentioned in a publication about medieval steam lodge rituals among American Indians, and in a master's thesis about 'Autonomous Cephalocaudal Paresthesia' (also called Autonomous Sensory Meridian Response), a euphoric tingling sensation that starts from the back of the head. In connection with hallucinations, citations were also made in a philosophy of science journal, in an online philosophy paper (in Polish), and in a master's thesis in philosophy about drug instrumentalization (in Czech).

Study II ("*Hypnotizability, Sleepiness, and Subjective Experience*") has 3 citations to date. Besides being referred to in the above mentioned PhD thesis of the supervisor, it was also cited in a Mexican master's thesis about the effect of hypnotherapy on sleep quality in women with breast cancer (in Spanish), and in a Finnish master's thesis about the effects of scale and order of administration on suggestibility testing (in Finnish).

Study III ("*Coping, Life Purpose, and Spirituality in Psychedelic Drug Users*") has become a 'flagship' of my publications by 33 citations to date. Of these, there are two self-citations: a paper that reviews the main subject pool for Study III (i.e., the Hungarian Psychedelic Community, 'Daath'), and another about harm reduction of NPS use. The themes of the top three citing articles (that are now more cited than my Study III paper) include the hallucinogenic effects of salvinorin A in humans, the association of classic psychedelic use with reduced psychological distress, and the factor analysis of the Mystical Experience Questionnaire. Other citing papers are about self-experimentations with psychedelics among mental health professionals in the former Czechoslovakia, drug use and harm reduction in the Goa trance scene in Belgium, and purpose in life of college students in the Midwestern USA. Interestingly, a further citing article of Study III touches the topic of entoptic images and

phosphenes; the latter topic was covered also by one of our TMS studies in a research project and yielded a publication for my colleagues. Journal citations were also made in connection with topics such as mental health consequences of hallucinogen use in self-identified spiritual contexts, the 'e-psychnaut' subculture and its NPS use, and the potential of psychedelics in healthcare from a neurophenomenological viewpoint. The paper was cited by a US doctoral thesis that studied the first-person hermeneutic phenomenology of the lived experience in persons using shamanic sacred plant mind–body medicines, and listed in an Argentine doctoral monograph (in Spanish). In an academic book about religion and spirituality across cultures, the paper was cited in a chapter on the topics of mindfulness, consciousness, spirituality, and well-being. (Other citing papers have not been cited so far, and are omitted from this enlisting.)

Study IV ("*Sacramental and Spiritual Use of Hallucinogenic Drugs*") has 3 citations to date. The most cited of these three articles describes findings of an international drug survey on harms and benefits associated with psychoactive drugs. The topics of the second citing journal article are ayahuasca, psychedelic studies, and health sciences; the third citing paper is a review article from Mexico, on the transdisciplinarity among neurosciences and religions (in Spanish).

In conclusion, the international influence of the Original Publications seems to point to an existing academic interest in the topics of altered consciousness, hallucinations, and particularly psychedelics. Indeed, the latest 'psychedelic renaissance' has been characterized by an increasing academic collaboration between resourceful and well-funded institutions worldwide. Similarly, many topics within the wide spectrum of ASC phenomena could be also drawn together from separate sources. The growing number of academic thesis works (from BA and MA degrees up to doctoral level) indicates also the need for educating and supervising an emerging new generation of ASC researchers. Given the many subfields, a multidisciplinary approach toward the topics of altered consciousness, hallucinations, and psychedelics are to be emphasized; for a confluence, academic educational efforts (such as doctoral programs and summer schools) could be well warranted.

6 DISCUSSION

Hallucinatory ASC are scientifically and philosophically intriguing mindbody states, with a promise to shed light on certain core mechanisms of consciousness (in where the term 'consciousness' refers to the phenomenal level of organization in the brain, describable by subjective experiences). The 'science of subjectivity', based on first-person approaches like neurophenomenology, has recently become an accepted field within cognitive neuroscience and consciousness research. Personal accounts of exceptional experiences during ASC – no matter if not objectively observable as direct behavior of the subject – can indeed serve as valid data, once approached with rigorous scientific methodology that takes into account various confounding factors of reporting (including confabulations, sense-making explanations, individual metaphysical beliefs, cultural contexts, etc.). Contributing theoretical work and empirically based scientific results of the thesis are detailed below.

6.1 Theoretical implications

In the field of hallucinatory ASC, theoretical work in Study I concentrates on 'technical' issues, such as definitions, listings, and the use of notions regarding the concepts. The approach is rather from a cognitive psychology viewpoint, and not from that of traditional ASC-contributing disciplines, such as philosophy of mind, clinical psychology, or psychiatry. By a theoretically developed working definition, a hallucinatory ASC is a "metastable mode of operation on supervenient levels in the mind–brain complex, where objectively detectable characteristic changes in internal information processing mechanisms of neurocognitive subsystems are subjectively experienced as changes in phenomenal content and overall psychological functioning". Unlike other definitions that use objective 'reality' for comparison, the contributed working definition of hallucinations accepts the validity of subjective experiences, and it places ASC into a timeframe to be compared with its immediately preceding and subsequent SoC. For solving the 'selection–definition ordering problem' (i.e., whether to define ASC based on selected phenomena, or to select phenomena as ASC based on a definition), a stepwise operationalization procedure is proposed. In order to describe the core ASC typicalities, this 'self-mapping' procedure examines first-person subjective experience reports, quantifies alterations of mental subsystems in ASC candidate phenomena, and computes multidimensional distances from median values in each dimension for each ASC candidate. Albeit not carried out in practice in Study I, the proposed stepwise operationalization procedure is described in sufficient detail to be open for other researchers to implement in the future, hopefully in the form of a fruitful research collaboration.

In the field of hypnosis studies, the results of the empirical Study II add to the rather marginal subfield of comparative hypnosis research, where the word 'comparative' is used in the sense of comparing other ASC with the hypnotic state (or *nonstate*, depending on conceptualization). Similarities and differences between two ASC can be measured on the subjective, behavioral, and physiological levels, including possibly neurophysiological and brain imaging methods as well as eye movement tracking. Relatively few trait or state characteristics that predict hypnotic susceptibility have been identified so far, therefore finding new ones, such as sleepiness, is welcome. In particular, research on new traits – for instance, sleepiness – that are related to other ASC can contribute also to comparative ASC studies, so it is even more welcome from the perspective of consciousness science. Our newly developed QSHE instrument for subjective self-scoring of hypnotic response has been proven useful by this empirical hypnosis study in 90 subjects, therefore appears worthy of further applications. Results indicate that hypnotizability (measured by HGSHS:A) correlates positively with both habitual daytime sleepiness (measured by ESS) and instantaneous sleepiness after the hypnotic procedure (measured by post-test KSS). These findings are thought to hint that sleep and hypnosis may share common, putatively neurobiological mechanisms regarding transitions between ASC. Shedding light in more detail on the nature of this connection would require various individual chartings of subjects regarding e.g., their sleep habits, cortical connections, and neurochemical characteristics.

In the field of psychedelic drug research, Study III represents the minority among general drug studies in its goal to find out about self-reported positive experiences of drug use. This approach is in contrast with the majority of psychoactive drug studies that experiment on the receptor-level, describe analytical drug detection methods, involve animal behavior research, report cases of adverse effects, or survey populations of problematic drug users. Our findings on autognostic psychedelic drug use add to a growing body of evidence from lately revived psychedelic studies indicating non-problematic lay drug use ([Krebs & Johansen, 2013](#); [Pisano et al., 2017](#)), efficient clinical applications ([Grob, Bossis, & Griffiths, 2013](#); [Morgan, McAndrew, Stevens, Nutt, & Lawn, 2017](#)), and enhanced psychological benefits ([Friedman, 2006](#); [Letheby, 2015](#)). Increasing recognition of the vast potential of psychedelics – along with their very low level of risk – seems to slowly undermine the current prohibition-oriented drug policy regime regarding hallucinogenic substances ([Haden, Emerson, & Tupper, 2016](#)), pointing out a need for their legal reclassification. Thus, a theoretical implication of this study is its contribution to the evidence base that should *ideally* guide political decisions of drug control—as opposed to current ideologically driven 'drug war' measures that are not only counterproductive to public health, but may occasionally also disrespect (or even violate) basic human rights.

In the field of sacramental and spiritual drug use studies, the short commentary of Study IV summarizes evidence for a millennia-long drug use within religious or spiritual settings. In their target article, Müller and Schumann ([2011](#)) enlisted eight proximate mechanisms of psychoactive drug use: (1) Improved social interaction; (2) Facilitated sexual behavior; (3) Improved cognitive performance and counteracting fatigue; (4) Facilitated recovery from and coping with psychological stress; (5) Self-medication for mental problems; (6) Sensory curiosity – Expanded perception horizon; (7) Euphoria, hedonia, and high; and (8) Improved physical appearance and attractiveness. Our arguments contributed substantially to the theory of drug instrumentalization by convincing the original authors to expand their list with a hallucinogen-specific item: (9) Facilitating spiritual and religious activities. This theoretical advancement was made possible by a broadly based approach to drug studies: supporting evidence was gathered from the disciplines of humanistic psychology, religious studies, ethnobotany, cross-cultural medicine, and psychotherapy. The achieved success in providing a wider perspective on an important drug topic can be attributed to the multidisciplinary attitude learned from the fields of both cognitive neuroscience (in general) and consciousness science (in particular).

6.1.1 Theory synthesis: 'virtual realism'

When carrying out theoretical or practical ASC research, it is extremely easy to get fascinated by the observation of how state changes between two very different SoC can occur within short time periods in the very same mind–brain complex of the same individual. Or, how unexpectedly different state changes may occur after applying similar induction methods to different individuals. These observations, along with the causal power of subjective reality, point towards considering the mind–brain complex as a *world-simulator*, and justify the use of the technological metaphor of *virtual reality* for phenomenal consciousness ([Metzinger, 2003, p. 25](#)). Loosely building on the metaphor of a 'brain-in-a-vat', concepts of *virtualism* have been put forward in various, e.g., presentational ([Revonsuo, 1995](#)), enactive ([Noë, 2004](#)), or representational ([Clowes & Chrisley, 2012](#)) forms. In particular, the phenomenon of dreaming has been strongly considered as a simulation by, e.g., the Threat Simulation Theory ([Revonsuo, 2000c](#)) and the Social Simulation Theory ([Revonsuo, Tuominen, & Valli, 2016](#)).

By modern technological analogs, the *world-simulator* concept assumes a VR generator that operates within a brain (as a 'hardware') and a mind (as an 'operation system'), and produces a transparent experience of presence within a subjective reality (as an 'application'). Hence, the concept of VR in the context of ASC is more than a convenient metaphor: it also provides a paradigm to explore the phenomenon of consciousness by studying its alterations as 'parameters' or 'settings' of the virtual

world it just simulates as the subjective reality for a person. It is to be noted that the concept of *virtualization* involves the possibility of multiple instances of the *something* that is being virtualized. In computer examples: multiple *virtual windows* with different content can be shown on one physical display screen, or multiple *virtual machines* with different operation systems can be run on one physical computer hardware. However, in a consciousness-based VR simulation, the limitations of linear data processing and silicon-based physical machinery do not occur.

It can be conceptualized that on the level of phenomenal consciousness, perceptions of the currently surrounding physical environment are processed into and represented also as a virtual environment. While this physical-perception-based virtual environment is special in the way that it is practically continuously present during wakefulness, it can indeed cease in the absence of immersive first-person spatio-temporal simulational phenomenality (e.g., during deep sleep, or dreamless REM sleep) ([Windt, et al., 2016](#)). It can be also replaced with a non-physical-perception-based, yet also fully immersive other virtual environment (e.g., in dreaming sleep, or complex closed-eye hallucinations). Open-eye hallucinations during wakefulness may present an intriguing third possibility, namely the partial overlap of the physically based virtual environment with a hallucinatory virtual environment, where a reciprocal interaction between physical and virtual elements can be also possible.

This latter possibility resembles a currently emerging subset of VR that is termed *augmented reality* (AR), where bits of visual or textual information are linked on top of the visual presentation of the physical environment. The idea behind AR is to generate and present relevant information transparently while at the same time leaving the physical environment also perceivable (in contrast with VR that blocks the perception of the physical environment, and fully replaces it with a simulated one). In AR's passive form, information is presented on top of the physical environment with no spatial correspondence. An example of this passive AR is the use of *head-up display* (HUD) technology by projecting instrument-generated data onto the windscreen of aircrafts. In a more advanced form of AR, physical space and its items are 'understood' via scanning and image processing methods by a computing unit, so that computer-generated virtual content can be transparently and exactly mapped on top of the digitally tracked physical environment. For example, moving brackets around a person's face on the display screen of a digital camera are simple AR items computed in real-time. The technologically most advanced AR solutions – e.g., a viewer wearing transparent display glasses while walking around a 3D item that is projected on a table surface, perceiving it from different angles, and possibly also interacting with it – are increasingly being referred to as *mixed reality* (MR), albeit this latest term is not yet defined unambiguously.

The *world-simulation* concept can be exemplified by lucid dreaming (LD) and REM sleep behavior disorder (RBD). In LD, the dreamer gains metacognitive insight that his/her currently perceived, fully immersive phenomenal environment is not the surrounding (physical) environment, but 'just' a simulated (virtual) environment. In RBD, the dreamer's motor behavior seems to be driven by the phenomenal environment, without the person being aware of the constraints of the physical environment. Simulated (virtual) environment can be 'taken as real': both regular and lucid dreams may go on with or without check-ups ('reality tests') for bizarre phenomena; both real and pseudohallucinations may persist with or without one's cognizance of their hallucinatory nature. This may happen because *self-reflection* – including the ability to evaluate one's own current SoC – is not required for experiencing an immersive (physical or virtual) phenomenal environment as 'real'.

The 'flavor' of *virtualism* presented here is purposefully termed as *virtual realism*: it emphasizes both the technological connection with VR and the apparent *realness* of non-physically originated perception as the core subjective experience. The concept of virtual realism elaborates the idea that anything subjectively considered as *real* is the result of transparent information processing mechanisms on the phenomenal level of consciousness. Virtual realism applies to all subsystems of consciousness, including not only sensory perception (that in computer-based VR is overwhelmingly visual), but also other, technologically non-simulable, intangible features such as interoception, emotion, and sense of self. Moreover, abstract subjective experiences without any claimable counterparts in physical space – such as intuitive knowledge, entity encounters, sense of transcendence, etc. – are held to be virtually real; interestingly, these exceptional experiences are more likely related to ASC than to baseline SoC. Due to the potentially realistic nature and subsequent causal power of *any* subjective experience, the concept of virtual realism disregards the importance of whether a temporally preceding stimulus for that piece of experience has a (mental presentation of a) representational counterpart in physical space—albeit it often, but not necessarily, indeed has one.

In summary, findings from various induced hallucinatory ASC support the concept that phenomenal-level consciousness is *virtual*: the continuous existence of internal information processing manifests as the *subjective reality* for the individual. *Virtual realism* points out also that the *world-simulator* accepts different degrees of correspondence, coherence, and immersiveness within the experienced environment. Deliberate manipulation of subjective experience *sets* and *settings* by psychologically, pharmacologically, and technologically induced hallucinatory ASC – e.g., hypnosis, hallucinogens, and VR – can be a naturally integrable and effective method for 'designing synthetic mindbody states' ([Roberts, 2013](#)), hence to extend human consciousness beyond current limitations.

6.1.2 ASC studies and the VR metaphor

The connection between the four ASC studies and the VR metaphor deserves a detailed explanation, as follows:

Study I pointed out that ASC are characterized by typical changes in the subsystems of consciousness, and hallucinations are results of changes in the information processing chain. Starting with two compiled lists of ASC candidate phenomena and mental subsystems, we can find, categorize, and quantify references to alterations of subsystems in first-person reports describing subjective experiences. By computing distances from median values in each dimension for each ASC candidate, we can then compute multidimensional distances that would describe the core ASC typicalities. Hence, typical changes of the consciousness subsystems during an ASC can be seen as typical parameters that describe a configuration of a simulated virtual world. By this above proposed stepwise operationalization procedure, the parameter space can be mapped: involved subsystems and their quantified changes can define a group of 'core' ASC phenomena. Thus, we can quantitatively define the parameters of a VR *world-simulation* within consciousness subsystems that are needed for a certain state to be subjectively experienced as an ASC instead of a baseline SoC. This knowledge could potentially open up novel methods to create artificial simulations of computer-based virtual realities that use psychological technologies to manipulate the subsystems of consciousness in order to achieve subjectively experienced ASC for the person immersed in a VR environment.

Study II explored a relationship between two distinct SoC, hypnosis and sleepiness, and hypothetically explained the found correlation by broadly referring to certain shared neurobiological background mechanisms. These mechanisms may include, for instance, individually measurable quantities for the easiness to change the baseline SoC to an ASC, the persistence of that ASC, and the time to return back to the baseline SoC. The resulting numbers, if quantified, can be seen as the *world-simulator's* meta-parameters that describe temporal patterns of the transition process between simulated virtual worlds. In this study, within-subject correlations between VR simulator meta-parameters (characterizing the transitions to/from a sleepy or hypnotic state) were found out.

Study III shed light on the applicability of hallucinatory ASC, both as via self-induced procedures within various sets and settings, and as potential clinical therapeutic tools because of their inherent mechanisms to manipulate subjective reality in beneficial ways. In connection with psychedelics, the VR metaphor is applicable to hallucinatory ASC as 'simulator training situations'. Deliberately provoked temporary exceptional experiences may be utilized to rehearse coping strategies in novel, unusual, or straightforwardly 'chaotic' altered states, hence potentially helping to

gain self-knowledge about one's mental functioning when facing unexpected non-ordinary states and situations. Moreover, the great variability in phenomenal outcomes – even when using the same types and amounts of substances by different persons under various sets and settings – emphasize the importance of non-drug factors, i.e., the internal parameters within one's VR simulator.

Study IV emphasized the importance of *set* and *setting* variables (beyond the pharmacological constants of a drug type and, partially, its dosage) in creating the complex and abstract contents of a virtual world. These variables include a large number of difficultly measurable parameters, such as attitudes, expectations, (sub)cultural contexts, goals, intentions, meanings, and even metaphysical assumptions based on individual religious and/or spiritual worldviews. The basic claim here is that the subjective experience is in no way a direct and predictable output of the type and quantity of a neuropsychopharmaceutical input (i.e., the ingested drug). Rather, mental contents and observable behavior during a psychedelics-induced ASC is highly unpredictable, unless taking into account the person's prior *set* and *setting*, which may at least partially and coarsely predict some aspects of his/her experience. It is yet to be seen whether these non-drug parameters could be 'loaded' into a computer-based VR simulator to achieve intended kinds of phenomenal experiences.

6.2 Limitations and biases

Findings could be argued to be theoretically limited and biased due to the underlying philosophical approach of *biological realism* that serves as a starting point for the concepts elaborated and the studies carried out. On a general level, studying subjective experiences by introspective verbal reports on conscious contents has several well-known limitations; items enlisted by Farthing (1992) – forgetting, reconstruction errors, verbal description difficulties, distortion through observation, censorship, experimental demands, and lack of independent verification – are all applicable here too. There are also many practical limitations of ASC research in particular, as the studied phenomena may manifest only rarely and not in all subjects (or not as expected), can be hard to measure by the usual research methods, or can even lead to difficult experiences for some subjects.

Moreover, the researcher's personal involvement in, interaction with, and experience of the studied community and topics could be also considered as a possibly biasing factor in evaluating 'neutrality' toward the researched themes. Nevertheless, a researcher's personal experience with hallucinatory ASC – such as dreaming, hypnosis, or psychedelics – could be conceived to work as an additional motivational factor that keeps up his/her interest in the chosen topics. Subjective experiences in the studied phenomena may indeed give extra insights, but obviously these insights should be handled as idiosyncratic pieces of subjective data that are definitely not generalizable to

draw any conclusions for the whole phenomenon at hand. It seems to be widely accepted within disciplines studying subjective phenomena that the only factor that counts scientifically is the proper application of rigorous methodology within high-quality research (as measured by accepted international peer-reviewed publications), and not the presence or absence of personal subjective experiences in the studied topics per se. The involvement of multiple investigators with various degrees of personal interest could also help maintain objectivity—or counterbalance subjectivity.

6.3 Recommendations for further research

The 'hallucinatory ASC' theoretical paper describes a stepwise operationalization procedure to chart ASC by a multidimensional mapping. Obviously, it is highly recommended for other researchers in this subfield to carry out the described procedure in order to obtain the first-ever theory-based practical classification of ASC. Thus, practical implications of the hallucinatory ASC paper could possibly contribute – albeit possibly only in a much further phase – to a stable definition and an agreed-upon classification system for ASC phenomena; with the help of the article's theoretical input, a (nearly) definitive ASC list could be constructed. Other possible future research ideas would include a semantic analysis of the terms by which hallucinations are defined. This examination could well point out many flaws of mutual definitions, circular references, and loosely interpreted popular notions of 'hallucination' that are nevertheless shaping the way we think about the whole phenomenon.

The 'hypnosis vs. sleepiness' experiment points out that studying the fluctuating levels of daytime sleepiness and arousal could be another promising avenue of research that could further the understanding of hypnosis. Moreover, it indirectly suggests also the feasibility of exploring other 'dream-like' states, e.g., the drowsy pre-sleep (hypnagogic) state, with further ASC-comparative hypnosis research. Findings from the hypnosis and drowsiness study may also be used in putting together a novel psychological instrument that measures hypnotic susceptibility traits by combining the most relevant core questions from various previous studies. Another easily implementable research idea would be the comparison of hypnotic susceptibility with meditation traits. This could be carried out simply by assessing the hypnotic suggestibility on a standard scale (like the HGSHS:A) in a group of long-term practicing meditators. Ideally, and in its simplest form, a mere correlation between the number of years spent by practicing (various kinds of) meditation and the scale-quantifiable hypnotizability score could hint at a relationship between these two ASC. Hypothetically, a long practice of going into a meditative state could have trained the person's ASC-changing background mechanisms to speed up the transitional process, i.e., long-term meditators could be expected to be more susceptible to hypnotic suggestions and therefore to score higher on the susceptibility scale.

The 'psychonauts' online survey collected data to form a matrix of 23 drug types (actually, only 22 real drugs, plus the fictional sham drug '*Relevin*') and 14 drug use purposes. Detailed relationships within this cross-table will be analyzed and described in an article currently under preparation; preliminary findings indicate that the major hallucinogens, such as LSD, mescaline, and *Psilocybe* spp. mushrooms, are most typically used for autognosis, such as self-medication, self-knowledge, and religious/spiritual purposes. Further studies about psychedelics are recommended to touch the topic of the so-called 'bad trips' (consensually termed as 'difficult experiences' in the literature and among crisis intervention professionals), for instance by exploring and categorizing the underlying psychological and environmental factors that contribute to their initial negative considerations. Another very interesting line of forthcoming studies could be the investigation of the mechanisms by which those at-the-time negative experiences can be later interpreted as personally meaningful life events that carry a 'teaching' and become eventually useful for the person involved.

The 'sacramental use of psychedelics' commentary article points out many serious and deep connections between certain 'drugs' and religion/spirituality. These are to be examined further with studies by disciplines within the humanities (e.g., anthropology, ethnography, cultural studies, theology, etc.). Relevant topics could include also law studies, as there are current exemptions from the international narcotics conventions regarding the use of certain hallucinogenic substances for religious purposes. Fundamentally, the (actually non-existent evidence base of the) background principles of the current drug prohibition regime can be questioned by pointing out that even the system itself does not consider all controlled psychoactive drugs as being unconditionally 'evil' per se, but accepts the possibility of their legal status—depending not on chemical structure, but use purpose.

7 CONCLUSIONS

In conclusion, one-sentence summaries are compiled to capture the essence of each study and the doctoral thesis as a whole:

- I. A hallucinatory ASC is a metastable mode of operation on supervenient levels in the mind–brain complex, where objectively detectable characteristic changes in internal information processing mechanisms of neurocognitive subsystems are subjectively experienced as changes in phenomenal content and overall psychological functioning (*Study I, Section 5.1*).
- II. Sleep and hypnosis may share common, putatively neurobiological mechanisms regarding transitions between ASC, as hypnotizability correlates positively with both habitual daytime sleepiness and instantaneous sleepiness after the hypnotic procedure (*Study II, Section 5.2*).
- III. Psychedelic drug use may facilitate the gain of self-knowledge by rehearsing personal coping strategies in exceptional mental situations, and it correlates positively with spirituality that may act as a protective factor against drug-related problems (*Study III, Section 5.3*).
- IV. Sacramental and spiritual use of hallucinogenic drugs for ritual and ceremonial purposes is associated with a human search for metaphysical insight, therefore having a distinct drug instrumentalization goal: to facilitate spiritual and religious activities (*Study IV, Section 5.4*).
- V. Hallucinatory ASC can be conceptualized as subjectively experienced virtual world-simulations running on the phenomenal level of the mind–brain complex, with uniquely configured parameters describing changes in subsystems of consciousness (*Studies I-IV*).
- VI. Virtual realism states that phenomenal-level consciousness experiences the continuous existence of its own internal information processing, and accepts it as the subjective reality with different degrees of correspondence, coherence, and immersiveness (*Section 6.1.1*).
- VII. Deliberate manipulation of subjective experience sets and settings by psychologically, pharmacologically, and technologically induced hallucinatory ASC can be an integrable and effective method to extend human consciousness beyond current limitations (*Section 6.1.1*).

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ORIGINAL PUBLICATIONS

- I. **Móró, L.** (2010). Hallucinatory Altered States of Consciousness. *Phenomenology and the Cognitive Sciences*, 9(2), 241-252.
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- III. **Móró, L., Simon, K., Bárd, I., & Rácz, J.** (2011). Voice of the Psychonauts: Coping, Life Purpose, and Spirituality in Psychedelic Drug Users. *Journal of Psychoactive Drugs*, 43(3), 188-198.
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- IV. **Móró, L., & Noreika, V.** (2011). Sacramental and Spiritual Use of Hallucinogenic Drugs. *Behavioral and Brain Sciences*, 34(6), 319-320.
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