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Carranante, G.; Elk, M. van; Yaden, D.; Elk, M. vvan

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CHAPTER

Reconceptualizing Altered States of Consciousness Using Network-Based Tools: A Conceptual Engineering Approach

Géraldine Carranante, Michiel van Elk

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Abstract

Progress in the scientific study of altered states of consciousness (ASCs) has been hindered by methodological and conceptual problems. At a methodological level there is a lack of agreement on the scales and instruments used to measure and categorize ASCs. At a conceptual level, existing typologies (such as trigger-based, phenomenology-based, attribution-based, neurobiological, and psychopathological approaches) face difficulties with demarcating different states and in organizing the field of investigation in a clear and productive way. The authors propose a new method of classification for this research field that will mitigate these problems by providing better typologies to study ASCs. In this chapter the authors lay out the epistemological foundations of such an approach, arguing that scientific progress can be made through an iterative process of conceptual refinement. On this approach, ASCs can be conceived of as a network of nodes, in which different clusters of states can be identified. At a methodological level, network-based models offer the potential to calculate network properties (e.g., centrality measures), while at a conceptual level they offer flexibility in terms of the nodes that can be included in the network (these could encompass features of experience, as well as contextual, social and biological features). The authors argue that a network-based model outperforms existing conceptual approaches for fostering current scientific research. By doing so, the authors also offer methodological tools to organize the research field of ASCs, which helps scientists to produce more precise scientific results and to foster interdisciplinary transmission of results.

Keywords: epistemology, altered states of consciousness, typology, philosophy of science, network, scale

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Introduction: What Are Altered States of Consciousness (ASCs)?

Across all times and cultures people have reported experiences that stand out compared to our ordinary understanding and functioning. Expert meditators describe experiences of pure consciousness events. People with epilepsy can have an out-of-body experience, in which they experience their body from an outside perspective. Religiously devoted believers engage in intense prayer practices that are characterized by the experience of a two-way communication between oneself and God. Shamans in indigenous cultures can contact spiritual realms through the ingestion of mind-altering substances. In many cases, people tend to frame and interpret these experiences in a supernatural way as they seemingly provide compelling evidence for a non-materialist view of reality.

In his *Varieties of Religious Experiences* (1902), William James already argued for the relevance of studying these extraordinary experiences, as according to him they ultimately provide insight in the functioning of the human mind. Psychological research over the past decades in turn has moved the study of these altered states forward from being a topic considered to be fringe science to a booming research field that is further fueled by the recent psychedelic renaissance (Pollan, 2019). At the same time, in the literature there seems to be a lack of consensus about how these experiences should be defined and categorized. Different definitions have been proposed, including the umbrella terms “altered states of consciousness” (ASCs) (Tart, 1972) and “non-ordinary or extraordinary experiences” (Taves et al., 2023). Also more specific labels have been used such as mystical, religious, spiritual, paranormal experiences; self-transcendent experiences (Yaden et al., 2017); states of non-dual awareness (Gamma & Metzinger, 2021); and pure consciousness events (Stace, 1960). These terms in turn are used to refer to such different experiences as the feeling of a presence, voice-hearing experiences, encounters with spiritual entities, channeling, prophesy, speaking in tongues, lucid dreaming, hypnagogic states, astral travel, cosmic unity experiences, leaving one to wonder what the common denominator (if any) of these experiences would be.

In this chapter we will start by outlining different taxonomies and instruments that have been developed to categorize and measure these states. We argue that each of these approaches suffers from several conceptual and methodological shortcomings. Scientific progress is hindered by a lack of conceptual clarity. To help moving the field forward, we introduce a conceptual engineering approach, that through an iterative cycle of conceptual refinement and empirical testing will allow the emergence in the future of better and more scientifically useful categorizations of these experiences.

For doing so, we first outline the epistemological requirements that we hope to meet with our project. We then illustrate how a so-called network-based approach can provide a useful instrument for identifying how clusters of nodes can be characterized. Finally, we show how the network approach meets the requirements of our conceptual engineering project and discuss its advantages and limits. We explicitly note that we do not intend to present a new definite characterization or typology of ASCs. Instead, we provide the conceptual framework that allows future research to provide such a characterization.

Typologies of Altered States of Consciousness (ASCs)

In this chapter, we decided to adhere to the widely used nomenclature of "altered states of consciousness" (ASCs) to describe the experiences that are the focus of our project. The rationale for this is that these experiences have been thoroughly investigated and accordingly we can draw on a rich literature and a wealth of research. For instance, recently an online altered states database has been made available which documents a wide variety of different states induced through different induction methods (e.g., flicker stimulation, psychedelics, meditation, etc.). The definition of altered states is also intuitive and straightforward: it includes any state or experience that deviates from our ordinary waking consciousness. This includes deviations from everyday states both in terms of quality and frequency, depending on the habitual patterns of the person and the population at large. At the same time, the definition is inherently problematic as there is no agreed upon definition of how an ordinary state of consciousness can be defined. As an illustration, should we consider states of consciousness induced by alcohol, cannabis, caffeine, nicotine, or even headaches, fatigues, etc., as ordinary states of consciousness or altered ones?

As can be seen, this category of states is very broad and arguably vague at its boundaries. In order to use it as a starting point for our conceptual engineering project, a few notes are necessary about the paradigmatic experiences that we have in mind here. Altered states of consciousness include, for instance, those experiences that are triggered by classical serotonergic hallucinogens, such as LSD and psilocybin. Another example of altered states may be found in religious visions and hallucinations, which are experiences that tend to occur and are interpreted within the context of a traditional religious worldview. Paradigmatic examples include hearing the voice of God, seeing the Virgin Mary, and experiences of faith healing. Altered states can also include spiritual experiences, which refers to a more idiosyncratic class of experiences that may occur within a New Age or spiritualist world view. Some examples include paranormal encounters, telepathy, the feeling of spiritual energies, and near-death and out-of-body experiences. Dreams can be considered an ASC as well. Other ASCs can be triggered, for example through meditation, sensory deprivation, brain injury, or even through brain stimulation (e.g., as in experimentally induced out-of-body experiences). Finally, a key example of an ASC is mystical experiences, which are characterized by a strong sense of unity that pervades one's experience and conceptual thinking. As these examples illustrate, the class of ASCs is quite broad and many different experiences can be grouped under this umbrella term. Given this broad category of experiences, many previous researchers have attempted to demarcate different classes of ASCs more clearly. There are different ways to carve up the complex and multifaceted category of ASCs. An obvious way to demarcate these experiences is to look at their (i) trigger (e.g., psychedelic experiences are typically caused by the ingestion of a psychedelic substance), (ii) phenomenology (e.g., loss of sense of space and time, seeing of a vision), or (iii) their interpretation (e.g., "I had the feeling of a presence, and I believe it must be God"). We also distinguish here (iv) neurobiological and (v) psychopathological approaches to ASCs. Each of these approaches focuses on different features of the experience, including its triggers, its phenomenological features (e.g., feelings of unity, ineffability, and insight), psychological mechanisms (e.g., interpretation), neurobiological predispositions (e.g., 5-HT_{2a} receptor density), or pathological features (e.g., depression, hyperactivity). In what follows, we describe these different typologies and methods and briefly address the problems faced by these existing typologies.

Trigger-Based Typologies

An obvious way to categorize ASCs is to develop a typology based on the elicitor or trigger of the experience. For instance, religious experiences could be defined as experiences that occur as a consequence of engaging in religious practices, such as praying or inner-sense cultivation (Luhrmann, 2020). Non-dual experiences may be triggered through non-dual meditative practices, while psychedelic experience obviously occurs as a consequence of the ingestion of a psychedelic compound, such as a serotonergic hallucinogen. An example of a trigger-based typology can be found in the work of Alan Hobson and colleagues (2000), who developed his so-called AIM (activation input modulation) model of ASCs, which includes the dimensions information source (internal vs external), activation energy (low vs high), and processing mode (cholinergic vs aminergic). In this model, the experience can be classified according to its source (externally vs internally triggered), the effects it has on the sympathetic nervous system, and the neurotransmitters that are primarily affected by the trigger.

However, trigger-based typologies are problematic because the mapping between triggers and characteristics of experience is often far from clear. A single trigger can result in different experiences, as is well exemplified by the study of the psychedelic experience. For the sake of clarity, let's define "psychedelic experience" as an experience that has psychedelic characteristics, such as seeing the surface of an object move. This experience can be triggered by the ingestion of a serotonergic psychedelic, such as LSD, in which case we speak of a "psychedelic-induced experience." However, "psychedelic-induced experiences" can have multiple characteristics. For instance, psychedelic substances can occasion mystical-like experiences that have a profound impact on people's lives (Doblin, 1991); they can result in the experience of the meeting with spiritual and religious entities (Griffiths et al., 2019); they can impact people's supernatural beliefs (Timmermann et al., 2021); they induce feelings of awe (Hendricks, 2018), which is considered a prototypical self-transcendent or spiritual experience (Yaden et al., 2017). Thus, the same trigger can result in a variety of interrelated experiences.

On the other hand, very similar experiences can be triggered through different causes. For instance, intense attentional focus can also result in perceivable changes in the surface of objects. More generally, it has been found that using a double-blind experimental procedure, participants cannot tell the difference between an LSD or a psilocybin experience, except from its duration (Holze et al., 2022). Also, mystical experiences can be occasioned through extensive meditative practice (e.g., De Castro, 2015) or through the use of psychedelics (Griffiths et al., 2006). Thus, trigger-based typologies face the challenge that there is no clear one-to-one mapping between the cause and the phenomenology of the experience.

Phenomenology-Based Typologies

Another attempt to classify ASCs may be found in phenomenology-based approaches. These approaches take the subjective features of an experience as the starting point and try to group experiences together, based on clusters of phenomenological features. However, when looking at the phenomenological features, there appears to be a lot of overlap between different ASCs that people report. For instance, "a loss of sense of space and time" is a hallmark of psychedelic experiences, but it is also characteristic of feelings of awe, mystical experiences, and experiences of non-dual awareness. Although it could be argued that overlap between different scales is useful, because it hints at convergence in the construct under investigated, we deem it problematic because currently based on phenomenology-based approaches as-of-yet it remains opaque what that underlying construct could be.

The strong overlap between the different phenomenological features of ASCs is also reflected in the scales that are typically used to measure to what extent people had these experiences. For instance, in psychedelic research, the most widely used scales to measure psychedelic-induced experiences include the mystical experience questionnaire (MEQ; Barrett et al., 2015), the ego-dissolution inventory (Nour et al., 2016), and the five-dimensional altered state of consciousness scale (Studerus et al., 2010). However, when looking at the individual items that make up these scales, it turns out that there is quite a lot of overlap between the items used (see Table 1). These scales in turn also show conceptual overlap with the most widely used instrument to measure mystical experiences, the M-scale that was developed by Ralph Hood (1975). The problem becomes even more apparent when looking at other scales that have been developed, such as the self-transcendence scale (STS; Cloninger et al., 1993), and a recently developed the Awe Experience Scale (AWE-S) (Yaden et al., 2019). And when looking at scales that have been developed to measure religious experiences, again similar features appear as in the scales listed above (Margolis et al., 1979). Thus, it should come as no surprise that typically the scores on these scales that allegedly are supposed to measure different theoretical constructs are strongly correlated. This type of overlap is not specific to the ASCs research field: it is a general problem in psychology, due to the proliferation and redundancy of theoretical constructs and scales. These overlaps are typically considered as a danger of type-I error, as well as spurious correlations. Moreover, the proliferation of scales contributes to dilute results in different strings of research, hard to integrate and compare (see Rosenbuch et al., 2020 for an overview).

Table 1 Overview of different scales used to measure phenomenological features of ASCs, the reference to the scale and an example item showing the strong conceptual overlap between the different constructs.

Scale	Reference	Example item
Mystical experience questionnaire	Barrett et al., 2015	Experience of oneness in relation to an inner world within
Ego-dissolution inventory	Nour et al., 2016	I felt at one with the universe
Five-dimensional altered state of consciousness scale	Studerus et al., 2010	Everything seemed to unify into a oneness
M-scale	Hood, 1975	I have had an experience in which I realized the oneness of myself with all things
Self-transcendence scale (STS)	Cloninger et al., 1993	I feel that on a higher level all of us share a common bond
A typology of religious experience	Margolis et al., 1979	It seemed like a common thing in all of us, one thing we were all part of
Awe-experience scale	Yaden et al., 2019	I experienced a sense of oneness with all things

Even more problematic is that empirical research on mystical experiences is often reflective of an ideological assumption, such as for instance a perennialist view on mysticism (Hood & Chen, 2005). Dating back to the philosophical work by Walter Stace and Rudolf Otto, the basic intuition underlying this perennialist approach is that there is a common core experience, that is characterized by feelings of ineffability, noetic quality, unity, bliss, and connectedness. Common core theorists argue that this experience is likely to have a neurobiological basis and that it can be induced through different elicitors, such as sensory deprivation, meditation, or psychedelics. However, this approach is also prone to the critique by constructivists, who argue that the experiences described as mystical in fact differ between religions and cultures. For instance, looking closely at the reports from mystics, it turned out that they use quite different wording and phenomenological features to express their experience, calling into question the attempt to establish mystical experiences as a sui generis category (Katz, 2004).

Thus, approaches to provide a typology solely based on phenomenological features has been haunted by theoretical debates over which elements should be included in the typology, whether there are natural kinds of experiences, and what would be the best method to measure these experiences. And as can be clearly seen in Table 1, the field suffers from conceptual and methodological confusion as there is strong overlap between the items used to measure experiences that are labeled differently.

Interpretation-Based Approaches

Partly in response to the debate between perennialists and constructivists, an interpretation-based approach to ASCs has been proposed (Taves, 2009; we note that Taves has used the word "attribution" to characterize the interpretation of the experience; we will adhere to that nomenclature in the remainder of this section). Attribution-based approaches find their origin in attributional theories of emotion, dating back to the seminal work of Schacter and Singer (1962) and even earlier in the James–Lange theory of emotion. A key element of this approach is that an emotion is defined as the interpretation of a bodily signal, depending on one's current state and context. Thus, the same signal, such as an increase in arousal, may be interpreted as being in love in the presence of a stranger of the opposite sex or as anxiety when facing a high cliff. When applied to ASCs, in the so-called building block approach, core experiences such as the feeling of a presence, the hearing of a voice, or feelings of unity can also be "deemed" spiritual, religious, mystical, etc., based on the context and one's pre-existing world view. The attribution approach also allows the possibility that people cannot make an attribution at all (e.g., "I just had an experience, and I don't know what happened") or that a similar experience can be attributed differently depending on the context (e.g., hearing of a voice can be interpreted as a religious experience, when encountered in a church, or as a psychedelic experience when occasioned during an ayahuasca ceremony).

Attribution-based approaches to ASCs have the advantage that they circumvent some of the problems of common core and constructivist approaches. Attribution-based approaches open the possibility of the search for building blocks of human experience that may be grounded in neurobiology while also acknowledging the central role of culture and learning in shaping these experiences. At the same time, despite the variability of experiences that people report, there still seem to be phenomenological features that often tend to cluster together systematically. For instance, people who report to have synesthetic experiences are also more likely to experience the feeling of a presence or to get completely absorbed in nature (Lifshitz et al., 2019). Relatedly, there might still be core features of different classes of experiences that appear most central to these compared to other types of experiences (e.g., the seeing of geometric patterns and visuals is quite central to most psychedelic-induced experiences, while dissociative experiences are more rare). Finally, an attribution-based approach does not solve the question of how to demarcate the different classes of ASCs. Instead, the classification of experiences is completely contingent on the folk-psychological theory that individual people employ to interpret their experience (e.g., "I heard a voice and I think it was a religious experience"). This makes it difficult to conduct research as it remains unclear what constitutes a building block and whether apparently differential attributions should actually be grouped together under the same umbrella term or building block.

Neurobiological Approaches

With the emerging field of cognitive neuroscience, various researchers have tried to establish the neural correlates of ASCs (for review, see Schjoedt & van Elk, 2020; van Elk & Yaden, 2022). Establishing the neural correlates of ASCs potentially allows demarcating different ASCs, for example in terms of the brain networks involved or their "connectivity fingerprint profile" (for an attempt, see for instance https://alteredstatesdb.org/). A key advantage of a neurobiological-based approach is that it allows the definition of the neural mechanisms associated with the occurrence of a specific experience. As such it can help to determine which mechanisms are shared between experiences that differ in their phenomenology and to what extent specific neural mechanisms are unique for specific types of experiences. For instance, in our own research we found that the feeling of awe was associated with a similar decrease in the activity of the so-called default-mode network (DMN; a set of brain regions involved in self-reflection and mind-wandering), as had been observed for the psychedelic experience, suggesting a common underlying mechanism (van Elk et al., 2019). Similarly, in recent work we have shown that the connectivity profile of altered states induced by classical psychedelics (e.g., psilocybin and LSD) appears much more similar than those triggered by stimulants (e.g., amphetamines and MDMA). A key advantage of neurobiological approaches is that they have the potential to offer unifying theories of ASCs, as can be found for instance in the predictive processing theory (e.g., van Elk & Aleman, 2017) or the REBUS model (Carhart-Harris & Friston, 2019). For instance, the experience of hearing voices or the typical phenomenological features encountered during a psychedelic experience may be explained through aberrant prediction error signaling and the loosening of perceptual priors.

At the same time, neurobiological theories are currently strongly underdetermined by the data, as has been pointed out in more detail elsewhere (see for instance Schjoedt & van Elk, 2020; van Elk & Aleman, 2017; van Elk & Yaden, 2022). In brief, the available empirical evidence regarding the neural basis of ASCs is haunted by small sample sizes, high researcher degrees of freedom, and a lack of independent replication studies, thereby rendering any neurobiological characterization anecdotal at best. Another problem is that neurobiological theories are often so generic (e.g., the predictive processing framework) that it remains unclear how they could be falsified, as in principle they could accommodate any scientific finding. Furthermore, in order to avoid the so-called reverse-inverse-inference problem, neurobiological theories still rely on the use of self-report measures to make sense of the neural data, thereby rendering this approach subject to the same criticisms as discussed in this chapter's section Phenomenology-Based Typologies.

Psychopathological Approaches

Another attempt to classify ASCs can be found in the field of psychopathology. In many cases, there appears to be an overlap between the symptoms experienced by specific psychopathologies (e.g., hearing voices in psychosis) and the phenomenology of ASCs (e.g., hearing the voice of God or of a guardian angel). This has led some to speculate that ASCs may be reflective of an underlying psychopathology and that famous religious figures, such as Saint Paul or the prophet Muhammed, may have suffered from for instance epilepsy or schizophrenia (Saver & Rabin, 1997). Since the DSM-IV, the most authoritative manual for classifying mental disorders, a separate category has been proposed for "Religious or Spiritual Problems," which includes problems related to one's faith or spirituality that may be specific to one's culture (Lukoff et al., 2011). Furthermore, it is increasingly recognized that socio-cultural factors shape the content of specific psychopathologies. For instance, in relation to voice-hearing experiences in psychosis, it has been found that the type of voices experienced differ strongly between Eastern and Western cultures (Luhrmann et al., 2015). Moreover, rather than reflecting discrete categories, it has been suggested that psychosis reflects a continuum along which people can vary in terms of the frequency and intensity whereby they have voice-hearing experiences (van Os et al., 2009). This approach also holds promise for studying ASCs, as people also seem to vary in their proneness for having ASCs, as captured for instance by the personality trait of absorption (Lifshitz et al., 2019).

However, by using a psychopathology-based approach, it remains unclear if and how specific ASCs map to different clusters and axes of the DSM categories. Hypotheses about the presumed pathological basis of ASCs can also reflect an underlying agenda to pathologize these experiences, whereas a wealth of research shows that people who, for example, frequently have meaningful spiritual experiences overall score quite high on mental and physical well-being (Koenig et al., 2012). Even more problematic for a pathology-based approach is that the DSM-V categories themselves remain a matter of ongoing debate and critique as there appears to be a lot of overlap between different disorders and the symptoms characteristic thereof (McNally, 2012; Tabb, 2015). In response and relevant for the current project, alternative approaches have been developed to characterize psychopathologies, including network-based approaches.

The Varieties of Typologies and the Quest for Interdisciplinary Research

The typologies presented in this section do not correspond to incompatible and independent frameworks. For example, the psychopathological approach relies heavily on phenomenology to build its categories. One can also think of hybrid typologies between trigger-based and neurobiological approaches, in which experiences are categorized following their neurobiological proximal triggers (instead of distal triggers such as drug intake or behavioral practices). We also note that each of the different typologies is strongly related to a different scientific discipline. For instance, trigger-based approaches have been dominant in psychopharmacological research; phenomenological approaches are representative of the field of the psychology of religion and spirituality; attribution-based approaches can be predominantly found in anthropological, historical, and religious studies research; neurobiological approaches obviously have been developed within the field of cognitive neuroscience; and psychopathological approaches originate primarily from the field of clinical psychology. This variety of typologies is therefore the result of a variety of research traditions that all developed their own conceptual frameworks and methodological practices through history. This variety of traditions is undoubtedly one of the sources of ambiguity and overlap between different ASCs, as different disciplines come up with different, yet closely related, theoretical constructs, which makes it difficult to know how to integrate research in one tradition with another one.

In sum, scientific research on ASCs faces today two interdisciplinary challenges: first, in order to build on the typologies developed within various disciplines, the field should produce a *common language*; that is, a conceptual framework for translating discipline-specific findings into an interdisciplinary research field.

Secondly, this common language cannot be derived from already existing typologies described in this section. Each of the typologies face major pitfalls and they are too discipline specific. This underlines the need to develop a new method of categorization that can be truly interdisciplinary and can be adapted to characterize ASCs in a more rigorous and productive way.

Before presenting our method in ASCs as a Network of Nodes, we will first clarify our theoretical approach by proposing a "conceptual engineering method." In the next section, we thus address the fundamental question of what a suitable conceptual framework is for scientific research in order to sketch the specifications of our new method.

Requirements for a New Method of Classification

A Project of Conceptual Engineering

Our aim in this chapter is to provide a method to build a new conceptual framework for studying ASCs through a conceptual engineering approach. Conceptual engineering is, broadly speaking, the activity to assess and improve concepts (Cappelen, 2018). Concepts as different as "belief" (Clark and Chalmers, 1998), "race," "gender" (Haslanger, 2000), "truth" (Sharp, 2007), or "freedom" (Van Inwagen, 2008) have been engineered in the past. Here our goal is to provide new tools for classifying ASCs. Contrary to the example presented above, we are not trying to improve *current* concepts but we are instead offering tools to design a completely new way to categorize ASCs. In this perspective, our project fits with the second part of the following broader definition of conceptual engineering: "(i) the assessment of representational devices, (ii) reflections on and proposal for how to improve representational devices, and (iii) efforts to implement the proposed improvements" (Cappelen & Plunkett, 2020). Here we propose a way to design good representational devices (i.e., good concepts) to study ASCs.

A metaphor may help to illustrate the approach that we envision: imagine a world in which people have different ASCs, including, for example, psychedelic, religious, mystical, and spiritual experiences but do not have any words or labels to talk about them. They do not have any representational devices that allow them to group these experiences together into kinds in order to describe their resemblance, disparity, evolution, identity, etc. This example illustrates intuitively the level at which we propose our conceptual engineering project. In more technical terms, our project can be thought of as taking into account all the experiences that may fall under the extension of the fuzzy category of "ASCs." It will provide a tool to design new categories to organize the class of experiences into more fine-grained categories. Whether these new categories will resemble existing frameworks, such as for instance the AIM model or existing distinctions based on the approaches previously presented, is an open question that lies beyond the scope of the current chapter.

In a conceptual engineering project, concepts are not considered as a mere description of reality but they are also conceived as tools used in thoughts and theories that can be refined and that in turn subserve specific functions. A conceptual engineering project is therefore tied to a specific goal and a specific context. For example, Clark and Chalmers (1998) argue that their revision of the concept "belief" makes it more useful in explanation, while Haslanger offers concepts of "race" and "gender" that supposedly enhance social justice (2000). Our goal is to improve the sharing of hypotheses, results, and theories between different research fields, as well as fostering new scientific insights. This goal is placed within the current scientific context: interdisciplinary scientific research on ASCs is still in its infancy but can nonetheless build on several rich research traditions. This specific purpose and context will provide us with desiderata for better concepts. The next section explains the four criteria for designing and assessing a new conceptual framework for ASCs.

Intelligibility, Concept Utility, Openness, and Flexibility

In order to develop a scientific framework that is useful, we need to fulfill two requirements: (i) intelligibility and (ii) concept utility. A useful conceptual framework for science is a framework that allows us to formulate hypotheses, to perform experiments, and to draw good and interesting inferences from the experimental results. In other words, we are not looking for a method that helps us find a conceptual framework that adequately describes how things are in the world, but a method that allows us to investigate how things are in the world.

For clarity, let's consider a conceptual framework that categorizes ASCs into two categories: type-1 experiences and type-2 experiences. For formulating hypotheses and performing experiments on these categories, it is necessary to be able to identify and differentiate type-1 from type-2 experiences easily. This means that the identification of phenomena has to be possible and practical. For example, a pair of concepts that would categorize ASCs based on whether the experience is a felt presence experience (type 1) or not (type 2) will not be a good conceptual framework for science as there is no way for us to assess whether a particular experience meets the criterion of identification. On the contrary, behavioral criteria or criteria based on neurobiological markers makes identification of categories easier, such as whether a specific part of the brain fires during an experience. This is a requirement that we call the "intelligibility" of a conceptual framework. In an intelligible framework, concepts are operationalized, they make the identification of phenomena and data gathering possible and practical. The intelligibility of conceptual frameworks is a property that comes in degree and is obviously not the only requirement for a good scientific conceptual scheme. It is a practical criterion that says nothing about the value of type-1 versus type-2 categories in terms of concept utility.

Concept utility refers to the potential of a concept to produce useful scientific generalizations. According to epistemic utility theories, the epistemic value of a belief is constituted (at least partly) by its plausibility and its informativeness (Huber, 2008). The plausibility of a belief corresponds to its likelihood of being true. The informativeness of a belief refers to how much it says about the world. For example, the belief (B1), "ASCs share a common core," is more informative than (B2), "Psychedelic experiences undergone after the ingestion of a serotonergic hallucinogen share a common core." The former informs us about more cases than the latter. In other words, a valuable belief for science is a belief very likely to be true and that is sufficiently general. Plausibility and informativeness are usually competing against each other: the more informative a belief, the less plausible (and vice versa). A good belief, epistemically speaking, would be a belief with a good ratio between plausibility and informativeness.

Based on these notions of plausibility and informativeness of beliefs, Egré and O'Madagain (2019) derive a framework for studying the usefulness of a conceptual framework. Concept utility, in Egré and O'Madagain's words, is computed based on two competing aspects of concepts, its inclusiveness and its homogeneity, that respectively contribute to the informativeness and plausibility of beliefs produced with this concept. The inclusiveness of a concept is the range of its extension. The more items included in the extension of a concept, the more inclusive the concept. In our previous example, the concept of "ASCs" is more inclusive than the concept of "psychedelic experiences undergone after the ingestion of a serotonergic hallucinogen." A belief produced with a more inclusive concept will be more informative, that is why (B1) is more informative than (B2). The homogeneity of a concept corresponds to the similarity between the objects falling under its extension. The concept "psychedelic experiences undergone after the ingestion of a serotonergic hallucinogen" is arguably more homogeneous than "ASCs" because it can be expected that the experiences triggered by the same kind of psychedelic would have similar characteristics (we have seen earlier that it is not so clear, but let's set these complications aside for the moment). Homogeneity of concepts is correlated with the plausibility of beliefs based on these concepts. Indeed, the more homogeneous a concept, the more plausible the generalization made with it. For example, if a researcher observes a recurrent feature LSD-induced experiences and wants to generalize this observation, she will produce a more plausible generalization if she hypothesizes that this feature is common to serotonergic hallucinogen experiences than if she generalizes this feature to all ASCs.

As plausibility and informativeness and, respectively, inclusiveness and homogeneity of concepts are competing against each other, a useful conceptual framework for science is therefore constituted by concepts that are both inclusive and homogeneous to a certain extent. Coming back to our example of type-1 and type-2 experiences, this two-categories framework will have a good concept utility if (i) it groups together experiences that are sufficiently similar for hypotheses tested on a sample of experiences to be plausibly generalized to the whole categories, and (ii) it contains categories with an extension large enough for the generalization to be informative about ASCs.

However, there are two more requirements for a new conceptual framework: (iii) openness and (iv) flexibility. A conceptual framework of the field should not be committed to any specific position with respect to theory-laden debates, such as the one between the perennialists and the constructivists. This is what we call the "openness" of a conceptual framework. The more hypotheses a conceptual framework is compatible with, the more open it is.

A research field in its infancy is also a research field that will grow and probably make new discoveries in the future. How do discoveries and scientific innovations happen? Is there a way to foster them? Traditionally, the evolution of a research field can be considered as an iterative process of variation in theoretical hypotheses, accompanied by a process of selection through empirical tests and theoretical consistency with the rest of scientific knowledge. Due to this refinement cycle, the best theories are kept and improved while bad hypotheses are rejected. However, it is acknowledged that this cycle, if thought of as a gradual and incremental process, often falls short of actual scientific history and practices (Kuhn, 1962; Nersessian, 2008). Concepts are typically kept fixed within a research community until researchers become aware that their actual conceptual framework is unable to absorb persistent anomalous data. Thus, a new research field would benefit from a flexible conceptual framework, a framework that can easily be adapted to start a new cycle of hypotheses and empirical testing. We argue that these two last requirements, openness and flexibility, are appropriate given the current state of the research field of ASCs, which is still a relatively young research field (especially compared to e.g., chemistry or physics). A more mature science will instead require a robust and closed conceptual framework, a conceptual framework that builds on the best available empirical results and is intertwined with our best theories.

To summarize: to provide a common conceptual framework for integrating different research traditions working on overlapping topics in a scientific context in which there is no consensual theoretical framework, we identified four desiderata for a conceptual framework:

(1) Intelligibility: the concepts in the framework should allow researchers to easily identify the phenomenon to be scientifically tested.

(2) Concept utility: the conceptual framework should have concepts that have a good ratio between homogeneity and inclusiveness (i.e., having the widest categories of sufficiently similar objects).

(3) Openness: the conceptual framework should be compatible with as many hypotheses as possible (it has to be theoretically neutral on the debated questions in the field).

(4) Flexibility: the framework should be easily revisable.

These four desiderata all come in degrees and can serve as comparative criteria between different conceptual frameworks. We will argue in the last section that our method, the network-based approach of ASCs, fosters intelligible, flexible, and open conceptual frameworks (given some constraints in the way they are generated) for interdisciplinary research on ASCs. Furthermore, this network-based conceptual framework should be easily assessable in terms of concept utility.

The problems encountered by existing types of typologies (see Typologies of Altered States of Consciousness (ASCs)) can be described as an inability to meet these requirements. For instance, trigger-based typologies do not produce homogeneous concepts as a single trigger can cause multiple experiences and a single experience can be caused by multiple triggers. Accordingly, the generalization about experiences made on trigger-based categories will not be very plausible. This type of typology will therefore not have a good ratio for concept utility. The main problem of phenomenology-based approaches is their lack of flexibility. We have seen that different theoretical constructs have been proposed in this tradition, but they have not been integrated together into a single conceptual framework. Rather, different concepts have coexisted alongside each other, as if they belong to a variety of fixed (i.e., non-flexible) independent concepts. This lack of integration is likely to be related to the difficulty to characterize and identify experiences by relying on phenomenological characteristics, which makes it difficult to assess whether a specific experience falls under the same category as previously reported experiences. This is a problem of intelligibility. The same problem is encountered by attribution-based approaches, in which an experience cannot be identified as a specific type of experience without a direct attribution by the subject. Neurobiological approaches do not produce open frameworks as they presuppose that neurobiological mechanisms are the ground on which ASCs should be organized. Furthermore, given the current state of affairs of neurobiological theories, it is difficult to identify specific experiences, as the same brain mechanism is typically involved in a wide variety of different tasks and experiences. This leads to a lack of intelligibility. Psychopathological approaches appear limited in the scope of experiences for which they can account. Many relevant experiences are excluded a priori from this type of typology, which makes it not very open to competing hypotheses (e.g., the idea that there may be non-pathological ASCs). We also note that each of the different approaches selectively focuses on different features of the experience, while there is no framework that provides an integrative approach by including all relevant features of different altered states. In short, each of the existing typologies in the literature faces several shortcomings in relation to the requirements of a conceptual framework for studying ASCs. Therefore, in the next section we outline a new method to organize ASCs that will help find conceptual frameworks that circumvent these problems.

ASCs as a Network of Nodes

Network Approaches: A Parallel with Psychopathology

The basic idea that we put forward in this section is that a fruitful way of characterizing ASCs is to consider them as a cluster of interacting nodes in a dynamic network. In a first approach, nodes are features of an experience, but in a very broad sense. Nodes can consist of phenomenological features but also include genetic, pharmacological, neurobiological, psychological, social, and cultural features. Our network approach is inspired by the characterization of psychopathological disorders as networks of symptoms in the field of psychiatry (elaborated on below). Here, we adapt the vocabulary and prefer to use the neutral term "node" to refer to the features or characteristics of ASCs (rather than the word "symptom," which implies a normative view) and we use the term "edge" to refer to the relationships between the nodes. Rather than representing a latent construct underlying these nodes, a specific ASC can best be understood as an emergent property consisting of the interaction between these different nodes. For instance, an experience that is traditionally described as "mystical," may consist of the interaction between phenomenological features (e.g., feelings of unity, ineffability, and insight), psychological tendencies (e.g., openness to experience), neurocognitive predispositions (e.g., heightened levels of brain entropy), and genetic factors (e.g., 5-HT_{2a} receptor density). This cluster of nodes may well overlap with other types of ASCs (see Figure 1).

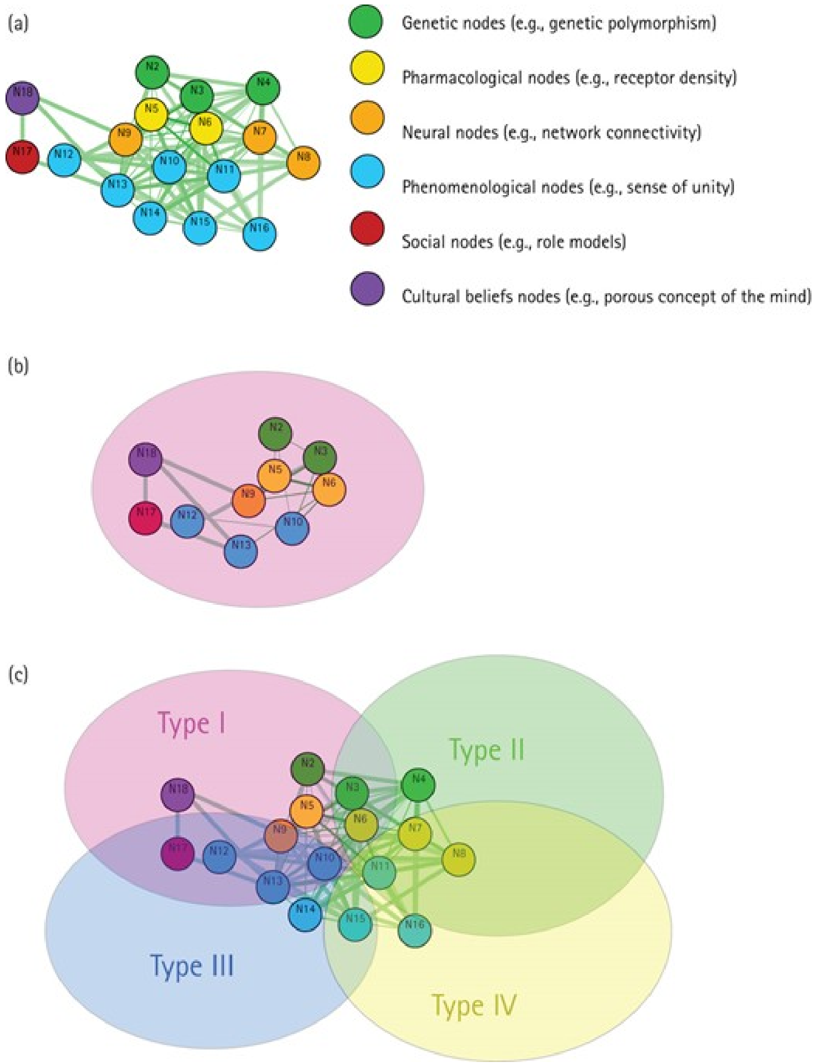

Figure 1 A conceptual engineering and network approach of ASCs. Panel A represents an ensemble of possible nodes to be included in the network, including phenomenological, biological, and socio-cultural nodes. In practice, many more nodes will initially be included to cast the net of potential experiences to be included as wide as possible. Panel B represents a singular experience consisting of a subgroup of the nodes presented in Panel A. The classification and demarcation of experiences based on observed nodes depends on an iterative cycle of conceptual refinement among experts from different scientific disciplines. Panel C represents a possible clustering of different types of experiences based on observed nodes. As can be seen, experiences can be characterized by both unique and shared nodes. The labeling of the experiences is arbitrary and may turn out to map on to the folk-psychological categories of ASCs. Ultimately, on this account, a specific experience can be conceived of as an emergent property of the cluster of nodes that is included to characterize that experience.

As briefly mentioned earlier, the idea to conceive of different experiences as a cluster of nodes is not new and important lessons may be learned from related research fields. Research in psychiatry has been haunted by a similar quest for demarcating different psychopathological disorders (Bringman & Eronen, 2018). A key assumption of the DSM-V is that psychopathological disorders represent discrete categories that can be differentiated based on a number of key symptoms. The premise underlying this approach is that different symptoms (e.g., rumination, irritability, sleeping problems) reflect an underlying latent construct (e.g., depression) that can be uncovered through a careful psychometric validation and assessment. On this account, psychopathology can be considered a hidden (i.e., unobservable) cause, that is at the basis of the different symptoms of patients. However, in the quest for demarcating different psychopathologies, it often turned out to be difficult to draw a sharp boundary between mental illnesses that showed an overlap between symptoms (e.g., depression, posttraumatic stress disorder, and burn-out). And at the same time, far from being a unitary phenomenon, mental disorders are typically quite heterogeneous and different patients (e.g., suffering from depression) may be characterized by a different constellation of symptoms (e.g., existential concerns vs eating problems vs rigidity in thinking and behavior vs withdrawal). As a consequence, the DSM categories have been a matter of ongoing debate, have frequently been updated, and have seen the emergence of ever-more fine-grained categories to accommodate the wide variety of symptoms and clusters thereof.

More recently, network-based models are gaining ground as a viable alternative to this latent construct approach (e.g., Borsboom et al., 2013). Instead of conceiving mental disorders as a latent construct, network approaches postulate that psychopathology should be conceived of as the interactions between symptoms in a complex and dynamic network. On this account, rather than searching for a latent construct underlying different observed symptoms, psychopathologies (e.g., such as "depression") are conceived of as an emergent phenomenon that is constituted by, but cannot be reduced to, an underlying network of interacting symptoms. This approach fits well with the observation that different psychopathological symptoms are often causally interrelated, for example sleeping problems result in increased irritability the next day, which in turn affects ruminative thinking. The network approach also allows for the possibility that symptoms may cluster together in different constellations, thereby accounting for the strong overlap that is typically observed between symptoms of different mental disorders. Furthermore, it is recognized that in extended networks of symptoms, genetic, pharmacological, social, and cultural factors can be incorporated as well (Borsboom et al., 2019). As a consequence, the network approach is opposed to reductionist explanations of psychopathology, according to which there might be a common cause underlying for instance depression. Instead, the network approach adopts a holistic approach, in which neither psychological, biological, or cultural levels take explanatory priority, but the symptoms emerge in complex feedback loops between the different symptoms involved. These network-based approaches are gaining ground in psychology and psychiatry as they appear better able to take into account the intricate complexities, heterogeneity, and diversity in psychopathological disorders. One significant advantage of using these network models in research is that they clearly articulate the theoretical assumptions guiding their modeling process (such as which symptoms are included, the causal connections between them, etc.). However, currently, these assumptions have proven to be quite limited and unrealistic. For instance, symptoms are predominantly modeled as operating on the same timescale and interacting with each other immediately and symmetrically (Robinaugh et al., 2020). While further development is required to refine this emerging theoretical approach, its foundational idea serves as an inspiration for research on ASCs.

Network-based approaches are grounded in basic insights from complexity science, including dynamical systems frameworks. New methodological tools that have emerged from this field allow researchers to apply network-based models, techniques, and statistics in their own research. Typically, a network is plotted as a cluster of symptoms (i.e., "nodes") that are reciprocally connected via "edges" that specify both the directionality of the connection (e.g., positive or negative) as well as the strength (i.e., thicker lines represent a stronger connection between symptoms; for example, see Figure 1). Highly connected networks are characterized by strong edges (i.e., thick lines between the nodes), where occurrence of one symptom (e.g., sleep deprivation) may have a strong effect on all other nodes in the network. Recurrent feedback loops may emerge within a network, resulting in an increased activation of different symptoms or even a state of hysteresis, in which a return to a normal resting state is prevented (Cramer et al., 2016). For instance, a patient suffering from major depressive disorder (MDD) may be characterized by a dense network. A temporary improvement in mood, in this patient, may be offset by only one trigger (e.g., a night of bad sleep), that in turn results in a collapse of the complete symptom network to a depressed state. More weakly connected networks instead appear more resilient to changes in one or more symptoms (e.g., Borsboom, 2017; Hebbrecht et al., 2020). In such "healthy networks," if a stressor is applied to the system (e.g., a major life event such as a divorce or the loss of one's job), only local symptoms are affected (e.g., mood), without affecting other nodes in the network.

The use of statistical and mathematical tools allows researchers to quantify different network properties, such as betweenness, centrality, and entropy that are informative, for example with respect to which nodes are most central to the network or how easily information is passed on through the entire network (Epskamp et al., 2018). Partial correlation networks are useful for determining causality between symptoms and for identifying the necessary and sufficient conditions for symptoms to emerge and change. In such a network, the correlation between each pair of symptoms is calculated while controlling for all other correlations in the network. Networks can be modeled at both a between-subject level (i.e., by taking data sampled across many individuals as input) or at an individual-subject level (i.e., by taking data sampled across multiple time points from the same individual as input). Examples of these different approaches and how they apply specifically to modeling the interaction between nodes that characterize ASCs are included below.

A Network Approach for the Study of ASCs

As indicated, we argue that the network approach also provides a fruitful way to conduct research on ASCs, which can be characterized by a multitude of nodes that tend to co-occur in different constellations. For instance, phenomenological nodes of ASCs may include feelings of unity, loss of sense of space and time, visions, auditory hallucinations, synesthetic experiences, feelings of a presence, a changed perception of one's body, meeting with supernatural entities, a sense of awe, sacredness, noetic insight, and ineffability. In addition, genetic (e.g., receptor genetic polymorphisms), pharmacological (e.g., receptor density), neural (e.g., intrinsic network connectivity), psychological (e.g., trait variables), social (e.g., social norms), and cultural (e.g., cultural models of the mind) nodes can be included in the network as well (see Figure 1).

At a group level, some nodes may be more strongly related than others, which can explain the frequent co-occurrence of specific types of experiences (e.g., a feeling of unity is often accompanied by a sense of ineffability and noetic quality; increased brain entropy may make one more likely for having a mystical experience). Configurations of different nodes can also explain our folk-psychological tendency to "label" phenomenological features as representing different experiences, whereas in fact the same nodes may flexibly be clustered differently (see Figure 1C). For instance, one cluster of nodes may be characteristic of psychedelic-induced experiences, while another cluster of nodes (with considerable overlap) may be more related to mystical experiences induced through meditation. There will most likely also be nodes that are less flexible and that will appear in more specific clusters of nodes (e.g., synesthetic experiences might be quite specific to psychedelic-induced experiences and $5HT_{2a}$ receptor density is likely to be strongly associated with the intensity of psychedelic-induced experiences).

The labeling of the different clusters of nodes requires a reiterative process of conceptual refinement, and this process by nature needs an interdisciplinary approach in which experts from different disciplines provide input on the relevance of including different nodes in the network. Initially, such networks are likely to be overinclusive as many nodes are deemed relevant for characterizing ASCs. But over time, the network will be pruned and redundant nodes (e.g., nodes that are strongly correlated) may be merged or left out of the network altogether based on both qualitative and quantitative considerations (e.g., measures of centrality of betweenness). A practical primer for this process of conceptual engineering is provided in A Suitable Approach for an Interdisciplinary Field in its Infancy.

This process can be facilitated by some of the network statistical methods described above. This way it can be empirically determined which nodes are most central to the network, allowing one to identify if experiences caused by different triggers can be characterized in terms of their most prominent nodes. Network statistics also allows identifying how different groups of participants tend to differ in their network structure (e.g., comparing expert meditators to novices), and by using repeated measures and longitudinal networks analyzes how networks change over time. Next to applying these tools at group-level data, network statistics can also be applied at the individual level, for instance to predict the likelihood of having an ASC. This may depend, for instance, on the density of the network, such that a highly connected network (i.e., in specific individuals who are characterized by a high score on the personality trait of "absorption"; cf. Lifshitz et al., 2019) or in a specific context (e.g., a highly suggestible environment) individuals are more likely to have an ASC. Feedback loops within individual networks also account well for the bidirectional relationship between different nodes. For instance, episodes of total attentional engagement can trigger an enhanced perception of reality, which in turn facilitates attention (Lifshitz et al., 2019). Another example may be found in the observation that the feeling of a presence increases the likelihood of having a verbal-auditory hallucination, which may at a neural level be accompanied by prediction error updating deficits (van Elk & Aleman, 2017); these features could be modeled as different strongly interacting nodes in a network. Network approaches also allow inferring evidential relationships between variables, through the inspection of partial correlations. For instance, believing in the possibility of communicating with God necessitates belief in God in the first place, while the belief that one can communicate with God is a sufficient condition for belief in God.

These are just speculative suggestions because as of yet, we don't have the empirical data at hand to propose a fully developed network of the key nodes involved in different ASCs. However, through the process of conceptual engineering ultimately we will be able to (i) determine the key nodes that should be included in the network, (ii) determine how different elicitors of these nodes (e.g., meditation, sensory deprivation, psychedelics) tend to result in different configurations, and (iii) specify the relationships between nodes from different "layers" in the network (e.g., phenomenological, genetic, neural, cultural, etc.). Despite the tremendous amount of work still ahead of us, we suggest our network model of ASCs allows a powerful theoretical and conceptual tool to further research on this topic while meeting the requirements of such a theory, as we outline below.

A Suitable Approach for an Interdisciplinary Field in its Infancy

Our network-based model does not provide a definite characterization but a tool with which such a characterization can be generated. Below, we explain how network approaches foster intelligible, flexible, and open characterizations, easily evaluable for concept utility. We end this section with a few comments on the ontological commitments associated with our view.

A Network-Based Conceptual Framework Is Easily Evaluable for Concept Utility

Developing a network-based model of ASCs means that the (dis)similarity between the cluster of nodes is the basis on which ASCs will be grouped into categories of experiences. Similar clusters will be categorized under the same concept. Clusters of nodes have the advantage of making a conceptual scheme easily assessable in terms of concept utility. Based on Egré and O'Madagain's measures of concept utility, we present here a method to evaluate the epistemic utility of a conceptual scheme of ASCs easily based on a network of nodes. This example will help us to understand how we can avoid the pitfall of developing overly fine-grained categories of experiences (e.g., consisting of single nodes) or categories that are too generic (e.g., that include all nodes in a network).

We explain the method using a toy example in which we compare two conceptual schemes based on networks of nodes (P_1 and P_2) categorizing a sample of five ASCs {e_1, e_2, e_3, e_4, e_5}, where each of these experiences is made up out of different features, represented here as nodes. These experiences are characterized as clusters of nodes in which four different nodes {n_1, n_2, n_3, n_4} may appear. For this toy example, the experiences e_1 to e_5 are characterized as follows (see Figure 2).

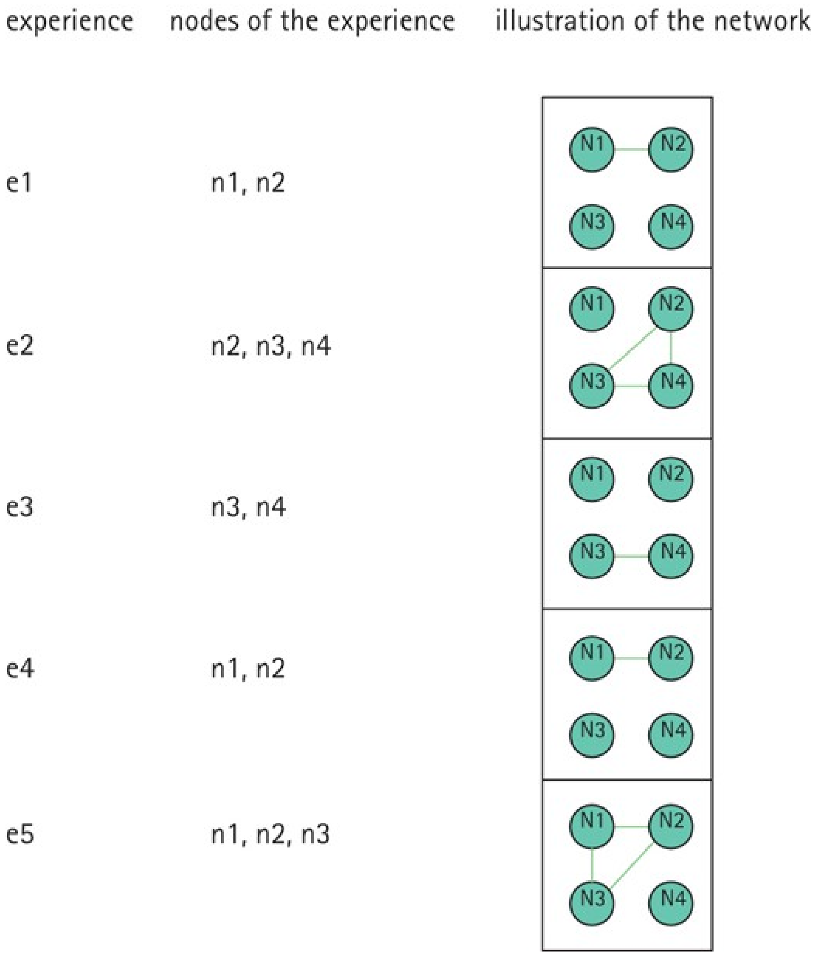

Figure 2 Characterization of experiences e_1 to e_5 in terms of nodes.

The two conceptual schemes evaluated in this toy example are P_1 and P_2, respectively categorizing these five experiences into two categories (C_1 and C_2) and three categories (C_1, C_2, and C_3). Their respective partitions are the following (see Figure 3).

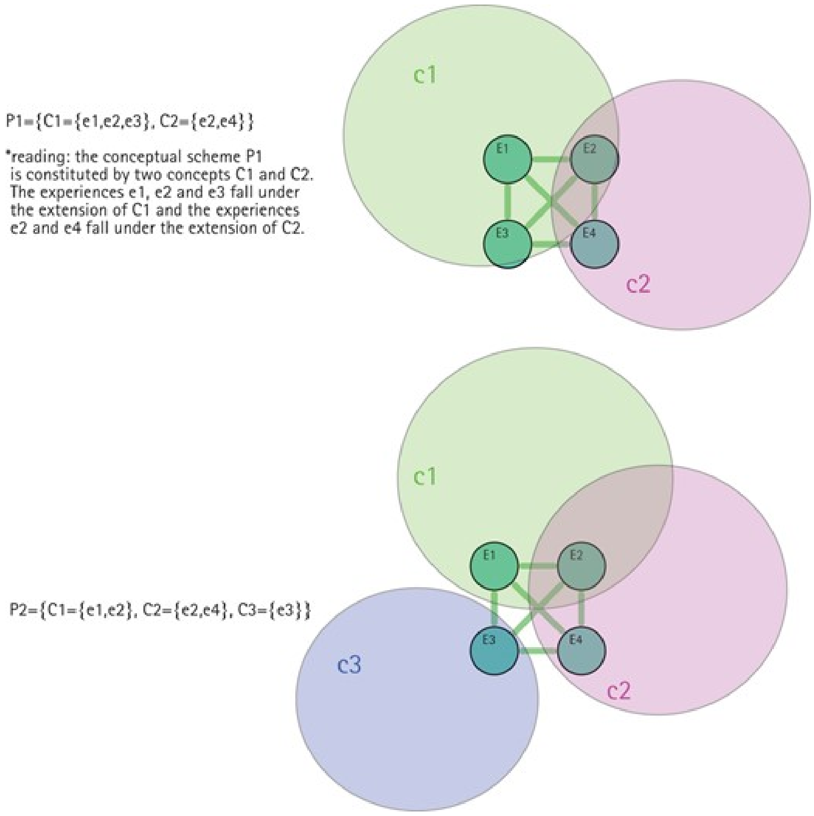

Figure 3 Two competing conceptual schemes P_1 and P_2. The illustration on the right shows how these categories overlap in terms of nodes, as categories of ASCs may probably overlap as well. This visualization is purely conceptual and is meant to illustrate the basic principle of the network approach we propose.

We use Egré and O'Madagain's model of concept utility (2019) in order to measure the homogeneity and inclusiveness of each concept (C_1, C_2, and C_3) composing the conceptual schemes P_1 and P_2. This provides us with scores of epistemic utility for P_1 and P_2 that allow us to compare them. The following calculus has to be understood as a pragmatic tool with which we can compare several conceptual schemes. The scores should not be over-interpreted as reflecting a real and absolute quantity.

In order to measure homogeneity and inclusiveness of each concept, we can create a table of the domain to be classified (here, our five ASCs), in which each item of the domain is described in terms of its nodes. The value "1" means that the experience includes the corresponding node in its cluster of nodes (see Table 2).

Table 2 Table of description of experiences e_1 to e_5 in terms of nodes.

	n1	n2	n3	n4
e1	1	1	0	0
e2	0	1	1	1
e3	0	0	1	1
e4	1	1	0	0
e5	1	1	1	0

A measure of the inclusiveness of a concept is the proportion of items of the domain included into a concept. The more items contained in a concept, the more inclusive. Following this rule, we measure the inclusiveness of concepts of P1:

$$\text{For } \mathrm{C}_1 : \{\mathrm{e}_1, \mathrm{e}_4, \mathrm{e}_5\},\ \mathrm{Incl}\,(\mathrm{C}_1) = 3/5,\ \text{as } \mathrm{C}_1 \text{ includes three items among five.}$$
$$\text{For } \mathrm{C}_2 : \{\mathrm{e}_2, \mathrm{e}_3\}, \mathrm{Incl}\,(\mathrm{C}_2) = 2/5$$

The homogeneity of C_1 and C_2 are calculated with respect to each node. It is measured by the proportion of experiences falling under the extension of the concept having or lacking the node (the highest proportion). The idea is that having a node in common is as informative as lacking a node in common for measuring the similarity between the members of a category. The result is rescaled by multiplying by 2 and subtracting 1, so that the measure will be between 0 and 1, with 0 meaning no similarity at all.

$$\mathrm{Hom}\ \ (\mathrm{C}_1, \mathrm{n}_1) = 1,\ \text{as } \mathrm{e}_1,\ \mathrm{e}_4,\ \text{and } \mathrm{e}_5 \text{ all have node } \mathrm{n}_1.$$
$$\mathrm{Hom}\ \ (\mathrm{C}_1,\ \mathrm{n}_2) = 1; \mathrm{Hom}(\mathrm{C}_1,\ \mathrm{n}_3) = 1/3; \mathrm{Hom}\,(\mathrm{C}_1,\ \mathrm{n}_4) = 1$$

In order to find a value of homogeneity for C_1, we average the scores. We find:

$$\mathrm{Hom}\,(\mathrm{C}_1) = (1 + 1 + 1/3 + 1)/4 = 5/6$$

We then measure the homogeneity of C_2 on the same model:

$$\mathrm{Hom}\,(\mathrm{C}_2) = (1 + 0 + 1 + 1)/4 = 3/4$$

In order to get a measure of concept utility for each concept, we combine the measures of inclusiveness and homogeneity of this concept. We get:

$$\mathrm{u}\,(\mathrm{C}_1) = \mathrm{Incl}\,(\mathrm{C}_1) \times \mathrm{Hom}\,(\mathrm{C}_1) = {}^3\!/_5 \times {}^5\!/_6 = 1/2$$
$$\mathrm{u}\,(\mathrm{C}_2) = \mathrm{Incl}\,(\mathrm{C}_2) \times \mathrm{Hom}\,(\mathrm{C}_2) = {}^2\!/_5 \times {}^3\!/_4 = 3/10$$
$$\text{The average of } \mathrm{u}\,(\mathrm{C}_1) \text{ and } \mathrm{u}\,(\mathrm{C}_2) \text{ gives a score for } \mathrm{P}_1 : u\,(\mathrm{P}_1) = 2/5$$
$$\text{By calculating the same way for } \mathrm{P}_2,\ \text{we get} : u\,(\mathrm{P}_2) = 3/10$$

Following this method, we are able to measure the respective epistemic utility of P_1 and P_2, and we are now able to compare them as $u(P_1) > u(P_2)$. In terms of concept utility, the partition P_1 with two categories is better than the partition P_2 with three categories.

The goal of this toy example is to show that a characterization of ASCs in terms of clusters of nodes will provide a powerful tool for the research area to assess different conceptual schemes. Here, the proposed method is a method of evaluation and not a method of generation. The proposal allows researchers to use insights from different scientific disciplines in building a conceptual scheme, while being able to evaluate them and compare them using a common language.

A Network-Based Model of ASCs Fosters Intelligible Conceptual Schemes

Having categories of phenomena that are epistemically useful means that generalizations made on these categories are plausible and informative. Yet, in order to generalize empirical results, researchers need to be able to empirically identify members of a category. This is the idea behind the notion of intelligibility of a concept.

In our network approach, clusters of nodes constitute yet-to-be-identified categories of ASCs. Salient nodes, or associations of nodes (e.g., which are central in the network), can be considered as a key feature of each category. However, this does not mean that these hallmark nodes are essential properties of the category. Ultimately, the similarity between all experiences subsumed under a category makes each experience part of that category. We suggest thinking of the network categories of ASCs, in terms of a prototypical profile, an abstraction that helps to track similarity. These prototypical profiles can incorporate nodes, and network specifics, such as how strongly nodes are clustered together or how central a node is in the network. Furthermore, prototypical profiles can integrate the temporal evolution of the connectivity between nodes over time, making it a dynamic tool of identification. These prototypical profiles can facilitate the identification of an experience by adding new identifiable properties next to the inclusion of nodes. Based on these prototypical profiles, one can use diagnosis methods, such as tree-based methods, to classify a specific ASC as fitting into a specific category (Banerjee et al., 2019).

The intelligibility of network-based concepts is of course also related to the intelligibility of the nodes itself. If the prototypical profile of a category is only composed of non-identifiable nodes, it will be impossible to compare the cluster of nodes of an experience with a prototypical profile. The intelligibility requirement provides us here with a constraint on relevant nodes for a good conceptual framework: they must be empirically identifiable in one way or another. Yet, the intelligibility of a network of nodes is not the mere aggregation of the intelligibility of its nodes, as we have seen that other properties emerge from the network itself, providing new tools for identification (centrality, relations between nodes). Therefore, a network-based model of ASCs is able to produce a conceptual scheme more intelligible than existing typologies working with only one type of node (phenomenological, neurobiological, psychological, etc.).

The network-based approach of ASCs does not guarantee that a conceptual framework will be intelligible. For instance, a poorly motivated selection of nodes can result in hardly identifiable profiles and inefficient conceptual schemes. However, the network approach provides us with some rules to follow in order to have a powerful tool of identification and classification of ASCs.

The toy example above is abstract and ideally we would give a worked-out example of how this approach might be useful for classifying, for example, experiences triggered by different psychedelic substances. In this case, working through the steps described above with the existing knowledge of the field, we may derive a conceptual scheme in which these corresponding psychedelic experiences are subsumed under the same category or are classified in different categories, based on their unique phenomenological features (e.g., 5-MEO-DMT may trigger stronger feelings of unity and ineffability, while LSD induces more strongly complex visual imagery, and ayahuasca may be more strongly associated with astral travel). We note, however, that applying this method in practice is beyond the aim of this chapter. Here we only want to sketch the boundary conditions for a conceptual engineering approach to take off and we look forward to seeing this being applied to more concrete cases.

A Network-Based Model of ASCs Fosters Flexible Conceptual Schemes

In a research field in which consensus is currently lacking, new empirical discoveries can modify existing categories of phenomena. Here we list some potential scientific achievements that could have an impact on the classification of ASCs: new ASCs may be discovered (or newly described, e.g., through the discovery of new psychoactive substances); some nodes may become more salient or relevant for the field (e.g., cross-cultural studies may show that some phenomenological or behavioral nodes that we may think idiosyncratic are actually cross-culturally pervasive); or the improvement of technological tools may increase the observability of some nodes (i.e., neurobiological traits may become more easily identifiable through the use of new brain imaging technology).

In a network-based approach of ASCs, these discoveries will impact the conceptual framework in a tractable way such that it can be updated with the best current state of the art. This update is not a simple add-on in terms of additional nodes or experiences but requires a reworking of the whole conceptual scheme. Indeed, when a new node or a new group of experiences is added to the whole scheme, the concept utility of previous categories may change, as both homogeneity and inclusiveness of *all* concepts are modified. It is possible then to reassess the whole conceptual scheme with the modified features to ensure that it still has a good conceptual utility, or whether it is better to modify some categories. A network-based approach makes the cost of changing concepts explicit, thereby avoiding accepting concept change without a strong and powerful justification, while still allowing this change and making it tractable.

A Network-Based Model of ASCs Fosters Open Conceptual Schemes

Finally, describing ASCs as networks of nodes allows creating an open conceptual framework. As we have argued earlier, an over-specialized characterization is not adequate for our research field. A classification based on networks of nodes does not make any assumption about the processes underlying these experiences but gathers fine-grained characteristics of the experience in different domains. Furthermore, by taking into account nodes described in different disciplines (e.g., behavioral, social, phenomenological, biological, etc.) without assuming the existence of a hierarchy in terms of importance or fundamentality, these characterizations foster a genuine interdisciplinary approach of ASCs. This conceptual framework will be open to questions with respect to the nature of ASCs, to the factors that influence them, and to their variability. Ultimately such a framework will help to answer questions such as: should ASCs be understood at a psychological/social/biological level(s) (see e.g., Simpson-Kent et al., 2021)? Is there a common core experience with contextual variability or are there several types of radically different experiences? What are the robust patterns of nodes associated with such and such factors?

In other words, networks of nodes are fine-grained descriptions of complex phenomena. They allow researchers to gather a broad range of data on these experiences and build an interdisciplinary profile based on nodes, but also based on the interrelation of nodes. This description is a tool to compare experiences across persons, but also experiences at an individual-person level as they evolve through time. Based on these descriptions, we suggest that we can build robust categories of similar experiences that are open to empirical scrutiny and new discoveries.

Comment on Realism

Until now, we presented network-based frameworks for ASCs as a useful, simple, and elegant tool for research, leaving aside the ontological status of these networks of nodes. We wrap up in this last section with a few comments on the ontological consequences of our method. The central question is the following: what are the implications for the nature of ASCs of the network-based approach? Does the cluster of nodes correspond to a "real" phenomenon in the outside world?

Networks of nodes provide descriptions of experiences. However, these networks should not be understood as a property of the experience but as a methodological marker that helps to identify, track, and study the experience. Furthermore, there is no ontological hierarchy among nodes: no node should be thought of as more essential, more fundamental, or more constitutive than another to an experience (some nodes are said to be more central than others in some networks, but this centrality is related to the structure of the network, without any ontological preponderance).

Likewise, it is not appropriate to distinguish intrinsic versus extrinsic properties among nodes in the network. This kind of distinction is indeed the sign of a preconception of what counts as an experience, ontologically speaking, while the network-based approach is supposed to help in investigating this question. By contrast, in other conceptual frameworks, nodes are often distinguished based on the intrinsic properties of experiences and other extrinsic properties (i.e., consequences of the experience, context of trigger of the experience). The properties that are deemed intrinsic reflect the ontological stance of the theory. For instance, in Taves and Asperem's building block framework (2017), experiences are conceived as mental events. Non-mental context is therefore not related to the experience per se. On the network account instead, the network as a whole—a structured cluster of nodes—counts as an empirical characterization of the experience. This empirical profile is agnostic on any intrinsic characterization of ASCs.

Ultimately, network-based descriptions are compatible with different types of ontological claims concerning ASCs. At a given stage of research:

(1) Some ASCs may be ontologically reducible to one or several nodes (including potentially pharmacological or neurobiological mechanisms).

(2) Some ASCs may be ontologically reducible to one or several underlying mechanisms that are tracked by the nodes but are yet to be discovered.

(3) Some ASCs may be complex phenomena that are not reducible at any level of analysis (neurobiological, psychological, or social) and should be ontologically understood as networks of nodes.

The last proposal can be seen as a realist version of a network-based approach of ASCs. It claims that the network of nodes ontologically constitutes the experience. We do not commit ourselves to this strong version, even if our methodological framework is compatible with it. Our primary goal in this chapter has been to provide a framework for research, that is, a conceptual framework to ask scientific questions. Only empirical findings will ultimately inform which nodes we call ASCs and if they can ultimately be reduced to a neurobiological or psychological mechanism, or if they are intrinsically complex phenomena that can only be understood pluralistically or holistically.

Conclusion

In this chapter, we proposed a conceptual engineering approach to provide a new method for analyzing ASCs as networks of nodes. We argued that this approach will ultimately produce conceptual schemes more suitable to foster scientific research than existing typologies. Network-based conceptual frameworks are easily evaluable for concept utility and can be flexible, open, and intelligible. We hope that they outperform current typologies on epistemic and scientific utility but also allow true interdisciplinarity in this research field. The methodological suggestions we made in this chapter leave open a certain number of problems and challenges that have to be tackled in the future. First, key nodes have to be identified and the hard work of generating a full conceptual scheme still has to be done. Secondly, this conceptual scheme should be tested, both with the methodological tools we presented here but also in the context of experimental research. We are hopeful that our approach can be used as a useful conceptual tool to conduct the hard work of conceptual refinement and theory formation and to foster dialogue between different scientific disciplines.

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