

Natural Kinds of Sleep Experience

A growing literature identifies and debates the ontological nature, neural correlates, and biological functions of dreams. Much of this research proceeds on the assumption that there is a single *kind* of phenomenon — namely, ‘dreaming’ — being investigated here; a state of consciousness obtaining during sleep to which it is appropriate to attribute a single set of neural correlates and biological functions. This paper defends two claims. Firstly, that this ‘natural kind assumption’ plays an active methodological role in the philosophy and science of dreaming which often goes unnoticed, shaping experimental design and orthodox interpretations of data. Second, that contra leading dream researchers, this assumption is empirically unjustified: not only do the empirical arguments commonly appealed to in defense of this assumption fail to justify it, examination of these arguments reveals that the standard methodological framework in dream science is unreceptive to the sorts of empirical evidence which would ground its rejection. I argue that this calls for a revision to the way in which sleep experience is studied in consciousness science. In opposition to the standard approach which proceeds via phenomenological definitions of dreaming, I outline an alternative ‘natural kind’ approach to dream science. This opens up several possibilities— notably, that dreaming or sleep experience may not constitute natural kinds.

1. Introduction

When we are asleep, we are not uniformly unconscious — rather, our sleep is interspersed with bursts of conscious mental activity. This conscious activity takes different forms throughout the night: some experiences are complex, bizarre, and emotionally vivid simulations which appear to have long durations. Others are brief and fleeting; a vague visual image of a face or memory, or lone thoughts. In rarer cases, the state of unconsciousness which accompanies sleep is interrupted by a state in which one comes to have an awareness or insight into the fact that one is not awake, and in rarer cases still, a state in which one is able to partially manipulate and control the content of one’s experience. When we compare these experiences while awake, we tend to refer to these uniformly as ‘dreams’. But are each of these experiences – the lucid dream I had last night, the non-lucid dream you had – experiences of the same neurobiological kind? Do all of the conscious experiences that *I* had last night whilst asleep belong to a common kind, or to several different ones? These questions – which concern the ontological unity, and proper scientific classification of sleep experience – have taken a back seat in consciousness science and philosophy of mind. This paper considers them and argues for their importance.

The past thirty years have seen the emergence of an extensive literature on dreams and dreaming, which now comprises a flourishing area of interdisciplinary research. The issues explored here are vast, but central questions include: what are the phenomenological characteristics of dreams, and how do these differ with sleep stage? What are the neural correlates of dreams and prominent dream behaviours, and what are their biological function(s)? and, in philosophy of mind and epistemology, which, if any, paradigmatic wake-type conscious states – imagination, perception or mind-wandering – can be used to provide an ontological

analysis of dreaming¹. Here, researchers have largely assumed that underlying the phenomenological heterogeneity of dreams there is single *kind* of phenomenon — namely, dreaming — being investigated; a claim which appears to be connected to the dominant practice of specifying and motivating various *definitions* of dreaming from which claims about the unity and taxonomy of dreams follow (Pagel et al. 2001). In contemporary literature, orthodox views tend to fall within two camps: the view that ‘dreaming’ is synonymous with any form of sleep mentation (Cippoli et al. 2016, Siclari et al. 2017, Malinkowski 2019, Zadra and Stickgold 2021, Wamsley and Stickgold 2021, Siclari 2021) and the view that ‘dreaming’ refers to the majority of sleep experiences – but *not all* – viz. those which share a distinctive ‘simulation-like’ phenomenology, or an immersive, vivid ‘here and now’ experience of a self in a world (Revonsuo, Tuominen, & Valli 2015, Revonsuo 2006, Thompson 2015, Windt et al. 2016, Windt 2010, 2016, 2018, 2020, 2021)².

As the science of dreaming begins to mature (Michel et al. 2019), it is time to consider whether the assumption that there is a single kind of conscious state associated with sleep experience is a good assumption to make. This is not necessarily to determine whether this assumption is true, but rather to ascertain *whether* its truth is justified – whether we currently have good reason to assume this from the outset as a guiding methodological claim, or instead, this ought to be left open for empirical investigation to establish or disprove (and moreover, whether the current methods for studying dreaming are well placed to reflect this). This paper argues against the former claim in favour of the latter. This, I shall argue, has far reaching implications. For once it is recognised both that the natural kind assumption (or versions of it) plays a substantive methodological role in consciousness science yet lack the requisite conceptual and empirical justification, we will be forced to reconsider the way in which dreaming and sleep experience are studied in consciousness science and philosophy of mind.

The plan for the paper is as follows. *Section 2* argues the assumption that dreaming is a single kind of state plays an active organizing role in dream science which often goes unnoticed, shaping the way results are interpreted and experimental design. I examine a central debate on the neural correlates of dreaming in order to demonstrate this, showing how orthodox claims and methodological moves made in this debate change if the natural kind assumption is abandoned or left open. I argue the methodological presence of this assumption can also be felt in many other areas of dream science, in particular, recent work on the experimental significance of lucid dreaming.

Given that this natural kind assumption plays a crucial methodological role, it is natural to think that this must be justified — that there must be strong empirical and theoretical reasons for thinking it must be true. Moreover, if there isn’t current empirical justification for this assumption, one might hope that dream science is well placed to recognize this, and thus be receptive to the kinds of evidence which would lead to its rejection; a claim which accords with the gradual convergence on more accurate taxonomies one sees in other scientific domains. Where issues of kinds and classification in dream science are raised, this is precisely what is claimed. The arguments in favour of the natural kind assumption here take the form of offering empirical and conceptual considerations in favour of a particular definition of dreaming (as above), from which claims about the unity and wider classification of sleep experience follow. *Sections 3 and 4* examine this form of argument in detail, focusing on Jennifer Windt’s work (2010, 2015, 2020). I argue this falls short of providing requisite justification for the natural kind assumption. Specifically, it is argued that from the point of view of

¹ Windt (2016, 2020), Ichikawa (2009, 2016), Rosen (2015, 2020), Soteriou (2013, 2017, 2020), Irving (2018), Andriillon et al. (2019).

² For a summary of different definitions of dreaming in dream science see Pagel et al. (2001).

establishing the natural kind assumption, such arguments are question begging – it is the prior acceptance of the definitions themselves, and not, as its proponents claim, the empirical data which motivates these definitions. The issues raised here will be shown to have a broader significance, revealing that the dominant methodological framework to dream science based on these definitions is flawed, insofar as it is unreceptive to the kinds of empirical evidence which would lead to a more accurate taxonomy of sleep experience.

A pressing question for dream science subsequently arises: if the natural kind assumption currently plays a key role in organising research, and yet it is currently unjustified and incapable of being rejected given our methodology, how should dream research proceed? In *Section 5* I put forward a new methodological proposal drawn from recent work in philosophy of science. On this view, dream science ought to be in the business of identifying a series of *global states of consciousness* which habitually or pathologically obtain during sleep which meet robust epistemic criteria for *natural kinds*. The key question for dream science becomes the following: are any of the current definitions of dreaming good - in an *epistemic* sense - scientific categories, or should new and more fine-grained categories be proposed which better accommodate the neural, behavioural and phenomenal diversity of sleep experience? This latter suggestion brings new possibilities - that of scientific eliminativism about dreaming and sleep experience - into view, which I discuss briefly in closing. The central upshot, however, is as follows: the natural kind status of dreaming should be a hypothesis for consciousness science to test and establish, not a foregone conclusion.

2. The Natural Kind Assumption at Work

What are the neural correlates of dreaming? Traditionally, this question has been framed in terms of the sleep-wake cycle: is there a particular sleep stage which is responsible for the occurrence of dreaming?³ Prompted by the discovery of REM (or ‘paradoxical’) sleep — periods of high-frequency, low-voltage activity characterised by rapid eye movements and a near-complete loss of muscle tone (Dement 1999: 27–50; Jouvet 1999)— in the 1950s, an initial hypothesis sought to equate the physiological characteristics of REM sleep with the objective markers for the presence of dreaming (Aserinsky and Kleitman (1953), Moruzzi and Magoun 1949, Steriade et al. (2001) Hobson 1988: 154)). This gained support from the observations that individuals awoken from REM sleep report experiences which fit the traditional phenomenological profile of dreaming: vivid experiences which are narratively complex, bizarre, and hyperemotional (Hobson 2008)⁴.

However, this hypothesis was soon thought to be largely repudiated by a series of findings, most notably, the finding that dream reports can also reliably be elicited outside of REM sleep in stages of N-REM sleep (e.g., Antrobus 1990; Foulkes 1993; Solms 1962, 1997, 2000; Cavallero et al.1990, Hobson et al. 2000, Nielsen 2000, Domhoff 2003; Nemeth & Fazekas 2018)⁵. While there were and continue to be a few dissenters, the

³ Analogous questions can also be, and are more frequently, raised with respect to the sleep stage architecture itself (Nielsen 2000, Dang-vu 2012, Windt 2020). While the discussion in this paper can also be applied to these questions my focus will be exclusively on sleep experience.

⁴ This and other findings depend on the prior acceptance of a number of methodological claims about dreaming which have historically been questioned, yet which I, following others, take for granted – namely, that dream reports in laboratory settings are trustworthy or reliable (c.f. Rosen 2013), and that dreams reports reflect the occurrence of conscious experiences in sleep (Malcom (1956), Dennett (1976), Windt and Metzinger (2007) Windt (2016; Chp2-4).

⁵Awakenings from REM sleep tend to elicit reports around 80-100% of the time, while N-REM awakenings elicit reports of conscious experience around 23-75% of the time (Scilari 2021;2) Other findings that put pressure on this claim include: (i) that pharmacological suppression of REM sleep does not eliminate dreaming (Oudiette et al., 2012), (ii) that in a small number of cases, some REM sleep awakenings illicit no dream reports at all (Pagel 2003, Cipolli et al. 2013, Scilari et al. 2012), and (iii) that specific forebrain lesions (Solms, 1997, 2000) were shown to suppress dreaming without affecting REM sleep.

idea that these findings show that dreaming and REM sleep are dissociable is close to scientific orthodoxy in dream science. One finds it stated uncontroversially, for example, in recent studies (Scilari et al. 2017, Cipolli et al. 2017) and reviews of dream research (Baird et al. 2019, Siclari 2021, Wamsley and Stickgold 2021), as well as in contemporary philosophical literature on sleep and dreaming (Windt 2015, 2019, 2020). For example:

“ There is a persistent and popular myth, even within the scientific community, that dream experience originates exclusively within rapid eye movement (REM) sleep... subsequent studies, however, soon demonstrated that dreaming can occur in any stage of sleep, including even the deepest stages of slow wave sleep” (Wamsley and Stickgold 2021;2).

“The discovery of rapid eye movement (REM) sleep—the ‘third state of being ’besides wake and non-REM (NREM) sleep—led initially to a straightforward view of the neural correlates of dreaming... However, later studies showed that up to 70% of NREM sleep awakenings yield reports of dream experiences” (Siclari et al. 2017;872).

While it is recognised that one could resist this by adopting narrower definitions of dreaming, such as ‘hyper-emotional, and bizarre sleep experiences’ which allow for a closer connection between dreams and REM sleep (Hobson 2008, 2009) or by otherwise positing ‘covert ’REM-sleep mechanisms operating within N-REM sleep (Nielsen 2000), the point I wish to make here is that the orthodox interpretation of the findings is reinforced by a prior commitment to the claim that there is a single *kind* of state being studied in dream science. That is, the very force and significance of the finding that conscious experiences are reported outside of REM sleep depends on acceptance of the claim that the states being reported in both REM and NREM sleep stages are states of the same neurobiological kind. This is particularly salient in light of the finding that, as a general but not exceptionalness trend, REM and N-REM ‘dreams’ do in fact have distinct phenomenological characteristics and profiles: REM dream reports tend to be more elaborate, vivid, and emotionally intense, whereas NREM reports tend to be more thought-like, less emotional, non-progressive, repetitive, and more directly related to current concerns (Hobson et al. 2000, Nielsen 2000, Wamsley et al. 2007, Windt 2019, Mutz and Java 2017, Siclari 2021;2).

Vindication of an alternative pluralistic hypothesis here would, of course, require further explanation of other important findings on the relationship between REM sleep and dreaming which influence the plausibility of this hypothesis. While I think this is certainly possible⁶, the aim here is not to conclusively argue that the natural kind assumption is false. The aim instead is more modest: to show how a prior adherence to the natural kind assumption shapes and alters standard interpretations of findings which serve as the foundation for contemporary research in the philosophy and science of dreaming.

Adherence to the idea that there is a single kind of conscious state targeted and studied by dream science strongly influences not only how key findings are interpreted, but also how new studies to produce further data on the neural basis of dreaming are designed and constructed. The clearest example of this can be found

⁶ For example, the finding that specific forebrain lesions (Solms, 2000) were shown to suppress dreaming without affecting REM sleep, has been criticised, due to worries about whether dreaming itself, as opposed to merely dreaming recall, is suppressed in Solms’ studies (Takeuchi (2005)). Similarly, given the very small number of cases in which REM dreams illicit no dream reports (Siclari et al. 2013), one might explain this by appealing to individual differences in dream recall. This gains support from the recent finding that there is large inter-individual (‘high ’and ‘low recallers’) and intra-individual variability (between stages and nights) in dream recall frequency and in perceptual and formal characteristics of dream experience (Cipolli et al. 2017, Schredl et al. 2003). The finding that pharmacological suppression of REM sleep does not eliminate dreaming (Oudiette et al., 2012), suffers from the same difficulties as the N-REM dream reports: it assumes a broad and unitary definition of dreaming.

in the research programme which aims to identify the neural correlates of dreaming. Here the explicit aim is to look for — and design experimental studies which probe — neural correlates of ‘dreaming’ which are common to *all sleep stages* in which conscious experiences are reported (Scilari et al. 2017, Cipolli et al. 2017, Perogamvros et al. 2017, and discussion in Wamsely and Stickgold 2021). These ‘within-state’ paradigms (in contrast to previous ‘between-state’ studies (Siclari 2021)) are motivated and described as follows:

“Brain correlates of dreaming, then, must include mechanisms active in all sleep stages ”(Wamsely and Stickgold 2020;2).

“Traditionally, dreaming has been identified with rapid eye-movement (REM) sleep, characterized by wake-like, globally ‘activated’, high-frequency electroencephalographic activity. However, dreaming also occurs in non-REM (NREM) sleep, characterised by prominent low-frequency activity. This challenges our understanding of the neural correlates of conscious experiences in sleep. Using high-density electroencephalography, we contrasted the presence and absence of dreaming in NREM and REM sleep” (Siclari et al. 2017;872).

This is doubly significant. First, focus on such a project makes evidence for the neural heterogeneity of sleep experience difficult to come by. Because dream scientists are focusing on and actively searching for

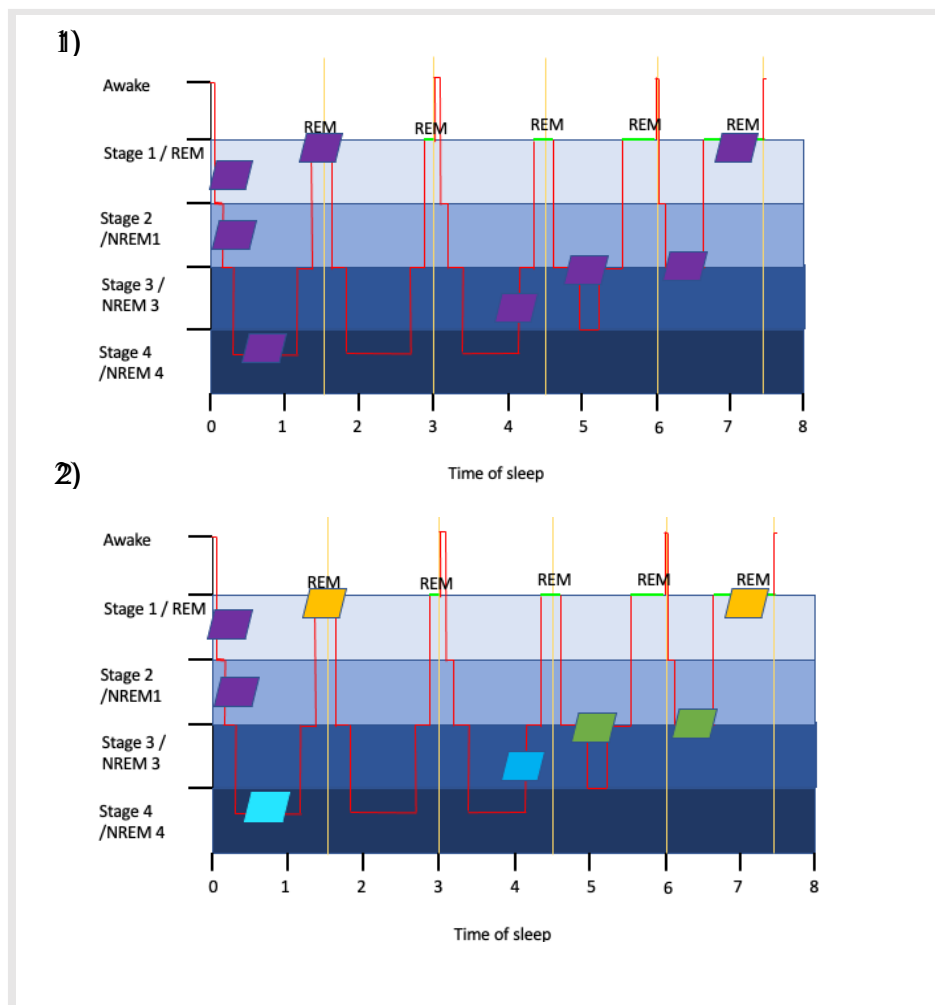


Figure 1: A monistic and pluralistic view of the relationship between dreaming and sleep stages. (1.) represents the standard view that ‘dreams’ form a unified kind common to all sleep stages, in accordance with the ‘within state’ paradigms in contemporary NCC research. (2.) sketches one of several alternative views made possible by the denial of the natural kind assumption. Different colours demote different kinds of conscious sleep states.

homogeneity, this works to hinder examination of the sorts of neural diversity which would ground an empirical reason to reject the natural kind assumption (more on this later). Second and more importantly, if dream scientists are doing so without the right sort of justification for the claim that there is a single phenomenon being studied here (as I shall later argue), there is a risk that dream science has embarked on a project which is flawed from the outset — that is, a project which searches for a unified set of neural correlates common to sleep experiences where there may not be any⁷. Once one brings an alternative pluralistic picture into view – or rather, leaves this open - the mandate for an NCC programme which bases experimental design on the search for a unified sleep-state-non-specific set of NCCs is, if not completely undermined, called into question (Figure 1).

The case just discussed aims to demonstrate that the natural kind assumption plays a crucial methodological role in the science of dreaming which has gone unnoticed. However, one may ask here about the broader methodological role that this assumption plays in consciousness science and philosophy. In closing, I want to mention a further debate whose methodological reliance on a version of the natural kind assumption can be easily demonstrated. This will help strengthen the case for the methodological importance of the natural kind assumption.

Part of what is so puzzling about the widespread acceptance of the natural kind assumption is the growing evidence that sleep experiences are incredibly phenomenologically diverse. A salient example of this is found in the contrast between ‘ordinary’ dreams, and lucid dreams in which subjects become aware they are dreaming and, in some cases, are able to partially control the content of their dream experience (Dresler et al. 2011, Voss et al. 2014, LaBerge 1985, 1990, 2015, La Berge et al. 1981, Windt 2015). Despite not being ubiquitous in the population, lucid dreaming is now a central paradigm and ‘experimental methodology’ for the study of the nature and neural basis of dreaming (Konkoly et al. 2021;1417, Stickgold and Zadra 2021b). The key idea is that recent experimental developments for studying lucid dreaming, such as bi-directional paradigms involving lucid dream signaling through pre-agreed eye movements (or ‘PAEM’ Baird et al. 2019), are able to revolutionise the study of dreaming (Konkoly et al. 2021). This is because they remove the epistemic obstacles – such as reliance on post-hoc verification of dreaming and dream contents -- which have typically plagued dream science, and as such, ought to take centre stage as a model experimental paradigm for dream science.

Similarly within philosophy, lucid dreams have often been cited as providing direct evidence for distinct ontological analyses of dreaming. For example, in his defense of an imagination model, Jonathan Ichikawa cites the prevalence and reality of lucid dreaming as providing direct evidence for the claim that dreams involve imaginative experiences which are products of an agent’s will (Ichikawa (2009; 116))⁸.

⁷ This is receives tentative support from the early observation that studies seeking to replicate Siclari et al.’s results have had limited success (D’Atri et al. 2019, Scarpelli et al. 2019, 2020, Wong et al. 2019, Ruby 2020). However, it is important to note that the claim here isn’t that there would thus not be *any* neural correlates common to these experiences if the natural kind assumption was false - they are both conscious experiences, after all - but rather that this would not be properly considered a hypothesis about the neural correlates of *dreaming as such*, as is typically assumed.

⁸ Interestingly, findings about the nature of lucid dreams have also been utilised to support the alternative perceptual model of dreaming. In their recent paper Baird et al. (2019) present an empirical argument against the view that dreams are imaginative experiences which is centered around the finding subject’s eye movements during lucid REM sleep mirror the patterns of eye movements which occur during tracking of visual motion in waking perception, while diverging from the eye movements accompanying tracking of visual motion during waking imagination (LaBerge et al. 2018). The methodological point below applies also to this argument.

That both arguments – for the experimental promise of lucid dreaming, and their philosophical significance – rely on a version of a natural kind assumption can be easily demonstrated. For example, while the experimental breakthroughs mentioned will no doubt add substantially to our understanding of the nature and neural correlates of lucid dreaming, their advertised potential to revolutionise the study of dreaming *simpliciter* depends upon accepting of a version of the natural kind assumption. The very idea that we can study the nature of dreaming by studying the nature and features of lucid dreaming, relies on an implicit commitment to the claim that lucid and non-lucid dreams belong to a common neurobiological kind. Similarly, in moving from a claim about some observed features of lucid dreams - that they are accompanied by a capacity for mental agency - to a general claim about the nature of dreaming *simpliciter* viz. that all dream states inherit, and are closely tied to, a subject's capacity to exercise mental agency over their dreams Ichikawa is implicitly relying on the claim that lucid and non-lucid dreams belong to the same neurobiological kind. However, when one calls the assumption that every sleep experience belongs to a common neurobiological kind into question, or starts with the view that this is an open empirical question, the validity of this standard argumentative strategy is thrown into doubt.

3. The Phenomenological-Definitional Approach

The natural kind assumption, or versions of it, are widely accepted. What explains this? A natural answer is that this follows from views of what dream scientists take dreams to be - that is, the operationalisation or *definition* of dreaming which guides their research. Such an approach to sleep experience, which proceeds via stipulating a definition of dreaming which forms the explanatory target of experimental research, is standard methodological practice in consciousness science. This was motivated historically by multiple incompatible definitions of dreaming which hindered the comparability of research findings (Pagel et al. 2001, Windt 2010, Revonsuo et al. 2015 Valli 2011;1085)).

As noted, two definitions of dreaming dominate the literature. The first, highlighted earlier, states that 'dreaming' refers to any sort of conscious experience which occurs during sleep. The second, growing in prominence, states that dreams pick out those conscious experiences during sleep which are *simulatory* in nature. According to 'simulation models' of dreaming, a large subset (but not all) of our conscious sleep experiences are unified, and thus warrant classification into a single neurobiological kind 'dreaming', in virtue of sharing a distinctive 'simulation-like' phenomenology (Revonsuo, Tuominen, & Valli 2015, Revonsuo 2006, Thompson 2015, Windt et al. 2016, Windt 2015, 2018, 2020). On this view, the majority of our sleep experiences are unified, and belong to a single neurobiological kind 'dreaming, in virtue of sharing a 'core' of phenomenological properties: they each involve immersive, vivid 'here and now' experiences of a self in a world⁹.

These phenomenological definitions of dreaming have different implications for how one taxonomises the conscious experiences reported in sleep. In doing so, each appear to involve an implicit commitment to different versions of the natural kind assumption. For example, while the view that 'dreams' refers to

⁹ Different simulation views are distinguished by what specific properties are placed at the phenomenological core beyond this immersive "subjective world-for-me" (Revonsuo, 2006, p. 75). For example, one family of views include additional social elements to the simulation in accordance with the idea that the dreaming functions to simulate and strengthen social skills and bonds (Revonsuo et al. 2015). Others emphasise aspects of 'minimal selfhood' and weak phenomenological embodiment which make these immersive dream worlds possible (Windt et al. 2016, 2015a, b; Windt, 2018).

experiences during sleep which are simulational in nature does suggest that there are some sleep experiences - such as non-immersive imagery, sleep thinking, isolated bodily sensations, selfless and contentless experiences - which are 'dreamless' (Windt et al. 2016, Windt 2016, 2018, 2020, Thompson 2016), both this view and the wider definition of dreams as sleep mentation both suggest that the *majority* of sleep experiences belong to a common kind in the sense that would justify the methodological practices discussed above. For example, they both support the practice of searching for an NCC of dreaming which is common to all sleep stages. This is because, according to these definitions, the same *kind* of phenomenon, 'dreaming,' is occurring in all such cases.

This forms the basis of an argumentative strategy for defending the natural kind assumption, which goes as follows. The natural kind assumption (or particular versions of it) is justified on the basis that it follows from conceptually and empirically motivated definitions of dreaming. That is, there are not only conceptual arguments for these definitions, but also that they have strong empirical support. In, to my knowledge, one of the only other explicit discussions of the taxonomic issues raised in this paper, Jennifer Windt makes precisely this argument in her careful defence of the claim that 'dreams' are immersive spatio-temporal hallucinations (from now on, 'ISTH'):

"Given its heterogeneity, it is important to realise, at the outset, that there may turn out to be no invariant and distinctive phenomenal core of dreaming. Dreaming may not turn out to be a natural kind. On pains of committing the armchair fallacy, one should not simply assume that the concept of dreaming picks out a class of experiences characterised by any single, highly invariant, and distinctive phenomenal property.... clearly having a unitary account of dreaming would be preferable, in view of its greater simplicity and parsimony. Such metatheoretical considerations do not, however justify pressing the target phenomenon of dreaming into a conceptual straitjacket.... *fortunately, as I will argue, it is possible to introduce a unified and distinctive account of dreaming that is maximally empirically plausible and minimally legislative, suggesting only slight adjustments to the concept of dreaming*" (Windt 2016;517; emphasis added).

Windt's comments here are indicative of a broader methodological approach which is widely adopted. Detailed most extensively by Windt, this starts by examining the phenomenological features of sleep experiences revealed by an examination of dream reports elicited under ideal conditions (Windt 2016). These features are then examined in order to identify a "phenomenological core" of sleep experience. The idea is to identify a core of phenomenological properties common to sleep experiences which forms the basis of a definition of dreaming in terms of necessary and sufficient conditions. The resulting categories which emerge - viz. 'dreams' which possess this core, and 'dreamless' sleep experiences which lack it - go on to form the primary explanatory targets of dream research. They guide, via providing operationalisations, investigation into the neural correlates and biological functions of dreams. It is from within this broader framework that the argument from definitions in favour of the natural kind assumption is provided (Figure 2).

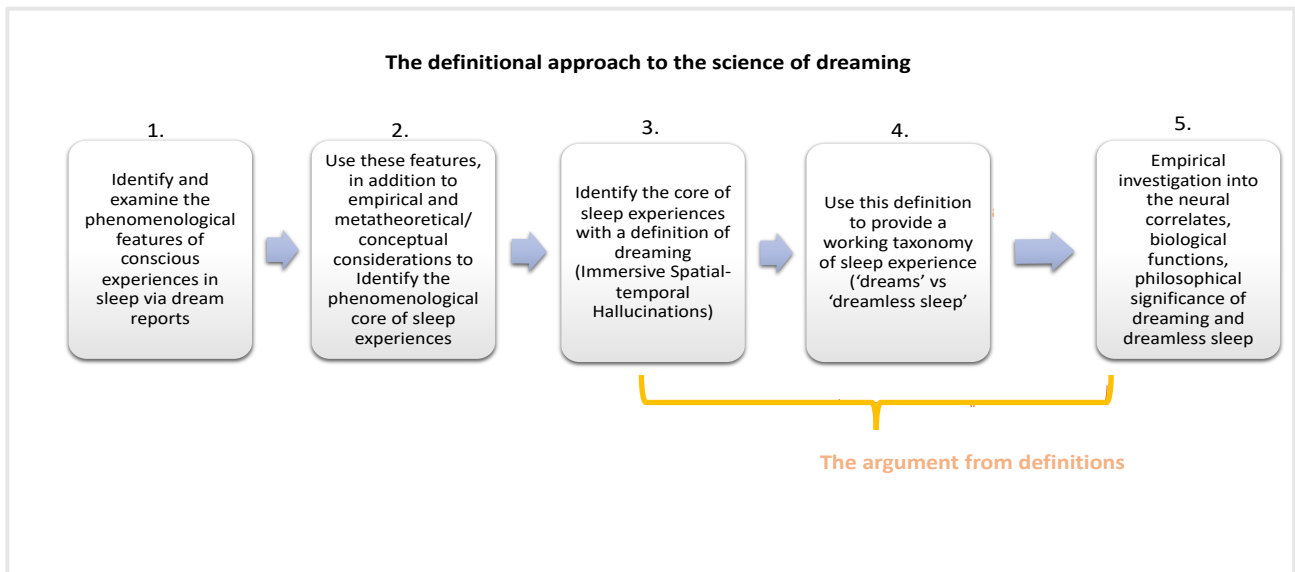


Figure 2: The Phenomenological-Definitional approach to the science of dreaming

If Windt and others are right, then, the natural kind assumption is empirically and theoretically supported. In the next section, I raise two objections to this claim, focusing closely on Windt’s arguments¹⁰.

4. Against the Orthodox Approach

4.1 Circularity in the Argument from Definitions

In order for the argument from definitions to work as an *independent* argument establishing the natural kind assumption — one capable of justifying the substantive methodological role this plays in consciousness science — the arguments provided for accepting a given definition of dreaming must proceed without already assuming the truth of the assumption. For if this were the case, then the appeal to definitions here would not amount to an argument for accepting or relying on the natural kind assumption in consciousness science, so much as a circular argument which examines what follows from it. That the natural kind assumption plays a prior motivating role in the definitional methodological approach can be evidenced clearly in two steps of this approach (Figure 2). The first is in the very idea of a ‘phenomenological core’ of sleep experience. Consider Windt’s remarks:

“Rather than attempting to capture the characteristic phenomenological and profile of dreaming [e.g., Hobson et al. 2000], the goal of this paper is to identify its phenomenological core. *The idea is that the target phenomenon ought to be, first, something that is invariant and stable across different types of dreaming.*” (Windt 2010, emphasis added).

¹⁰ Windt’s defence and discussion of her ISTH definition of dreaming is most careful and extensive and is thus where the motivations for adopting the definitional approach to sleep experience are most clear and explicit. As such, my discussion here will focus mostly on the arguments she provides, on the assumption that the considerations offered in her work reflect the considerations motivating the phenomenological approach more generally.

The explicit aim of Windt’s project is to examine the subjective reports of sleep experience elicited under ideal laboratory conditions to identify a set of phenomenological features that all, or most, of these reports have in common. Yet the following question arises: *but what mandate have we for thinking, assuming such an invariant phenomenological core exists, that this successfully tracks a distinctive neurobiological kind?* That is, what motivates the move from Step 3 to Step 4 in the approach to dreaming in Figure 2? The answer, I think, lies in the prior acceptance of, or sympathy to, the idea that there exists (or is likely to exist) a single kind of conscious state associated with sleep. In other words, whether [as Windt claims] we have good reason to investigate which phenomenological features *unite* the diversity of sleep experience depends on whether there is *already* good reason to think that there is likely to *be*, a deep metaphysical unity to sleep experience (and moreover, that this is likely to be reflected in the phenomenological features of sleep experiences).

The second place where this can be evidenced is in the ‘metatheoretical’ justification provided for the simulation definition of dreaming - the reasons for accepting this definition over others (in Step 2). They argue that the simulational model is attractive insofar as *it alone* can unite many sleep experiences within its purview, and makes room for a definition of dreaming which is independent of sleep stage:

“a proper theory of dreaming *should be simple yet covering so that the same general principles apply to many types of dreams*, including the pathologies of dreaming, animal dreaming, and other special cases” (Revonsuo et al. 2015 in ‘how to make theoretical progress in dream science’; emphasis added).

The reasoning here can, I think, be summarised as follows. What justifies the methodological principle that there is a single kind of state being studied in dream science - one which justifies claims such as the orthodox view that there is a single sleep-stage invariant NCC for dreaming? Well, this claim follows from adopting a definition of dreaming, such as ISTH. What justification do we have for adopting this? Well, these definitions receive justification on the basis that they pick out a phenomenological core of sleep experience which can unite all sleep experiences within a single kind. The assumption that dreaming is a natural kind plays a crucial role in motivating the very methodology that the argument from definitions uses to establish it. This line of argument suggests that there is a circularity in the argument from definitions which gives us reason to doubt whether popular definitions of dreaming should be used to *independently* justify the methodological practices outlined in Section 2.

It might be objected here that this is uncharitable. Is it not stated earlier [and directly above] that these definitions are not *only* supported by theoretical considerations, but also tightly constrained by empirical evidence? If so, then perhaps the circularity just highlighted is not of a problematic, or vicious kind. For, even if there are some concerns about circularity in the way these definitions have been motivated, if there is strong empirical evidence in favour of a definition of dreaming like the simulation view, then the argument from definitions will be capable of providing independent justification for the natural kind assumption. I turn to arguments of this form next.

4.2. The Empirical Insensitivity Objection

What then, is the empirical evidence which is said to support the view that dreams are immersive spatiotemporal hallucinations? The empirical arguments Windt offers come in both a negative and positive

form, with the former drawing on empirical considerations to reject other plausible candidates for a phenomenological core of sleep experience, and the latter using empirical considerations to provide motivation for the ISTH as an invariant phenomenological core of sleep experience (2010; 2016, 2018).

Let's consider the negative arguments first. Before endorsing the ISTH definition, Windt considers several candidates for a phenomenological core of sleep experience drawn from previous literature which could work as definitions of dreams. For example, the view that dreams necessarily involve the integration of multi-modal imagery (Hobson et al. 2000, Solms 2000), that they necessarily involve characteristic cognitive and mnemonic deficiencies, bizarreness etc. (Hobson et al. 2009), and that they necessarily involve emotions. Windt's argument against these views centre around the claim that there are empirical studies of dreams which reveal *counterexamples* to these hypotheses — that is, that there are studies which reveal the existence of dreams which lack these features. Thus, she argues, that (i) a variety of studies show that imagery in non-visual modalities is rarely mentioned in dream reports (Hobson 1988), (ii) that visual imagery can be lost while dreaming remains, as in studies of subjects with congenital blindness (Kerr 1993), suggesting that visual imagery is not necessary for dreaming, (iii) that the existence of lucid dreams suggest that cognitive deficiencies are not necessary for dreaming, and similarly (iv), that small numbers of dream reports contain no mention of emotion, and thus that emotion cannot qualify as a central 'core' of dreaming (Merrit et al. 1994). These arguments all have a similar structure. They work by providing counterexamples to an alternative definition of dreaming revealed by empirical studies of dream reports.

Windt's positive empirical argument for the ISTH view proceeds via the claim that empirical studies of dream reports show that a basic sense of self is invariant amongst distinct kinds of dreaming. This centers on the finding that dream reports consistently involve the presence of the *self*, albeit one which is only weakly embodied, which Windt takes to provide evidence for the claim that the core of dreaming is self-location centered on a hallucinated world (Strauch and Meirer 1996, Occhionero et al. 2015, Speth et al. 2013). Here, she argues that empirical work has shown that underlying the variability of self in dreams (as it relates to embodiment, beliefs about oneself in the dream etc.) is a core of *minimal phenomenal selfhood* — a minimal sense of self which involves the experience of immersion or being present in a world (519-523). This more minimal form of selfhood, she notes, is compatible with the experience of 'selfless' dreams (i.e., the absence of more robust aspects of self), and instead picks out a 'spatiotemporal situatedness' — a 'here and now' experience of being present in a world. There is more to be said about the further conceptual arguments Windt provides for this model, however as far as the empirical considerations go, the argument is a simple one viz. that empirical studies reveal that all dreams (via dream reports) possess phenomenological characteristics of a self in a world.

Both the negative and positive empirical arguments here suffer from the same problem. In short, they are problematic as they require one to already know, or accept, a claim about the *proper extension of the term 'dreams'*. Consider again the negative arguments and reflect on how one might go about critiquing them. An obvious strategy here is to attempt to challenge the idea that the empirical studies mentioned do in fact demonstrate that there are dreams which lack these features. But how does one go about assessing this? To be able to assess whether a given study demonstrates that there are dreams which lack feature X, for example, one must *already* have in mind a particular view of what dreams are — that is, *which* conscious experiences in sleep count as dreams - to be able to determine this. Similarly, to be able to assess whether the view that all dreams have at their core an immersive, spatiotemporal situatedness is in fact common to all dream reports or not, one must already know which reports of consciousness in sleep are *relevant* to such an assessment. But, if the aim

is to motivate a particular definition of dreaming and subsequent taxonomy of sleep experience which can reliably guide empirical research in the way Windt envisions, then one cannot already assume an answer to this question.

The situation gets worse when one considers how Windt and other simulation theorists respond to potential empirical counterexamples - for example, the presence of conscious experiences in sleep which lack this immersive minimal core. Here I have in mind the isolated imagery, hypnagogic imagery, and the 'white dreams' (dreams which potentially lack determinate contents) reported in sleep. For it is open to simulation theorists to simply dismiss such counterexamples, on the basis that these are distinct kinds of 'dreamless' experiences - and this exactly is what they claim (Windt et al. 2016). However, in the context of the negative arguments above, this raises the obvious question: why are we licensed to accept *these* as dreamless experiences, but not the counterexamples raised to other definitions? The answer lies in the idea that these arguments depend on a prior acceptance of a claim about the proper extension of the term 'dreams'; that is, a prior acceptance of a particular definition of dreaming. Thus, on closer inspection we find that these empirical arguments are, in a problematic sense, question-begging. The empirical evidence appealed to in these arguments only supports an ISTH definition of dreaming if a general view of dreaming and broader taxonomy of sleep experience is already accepted. This applies *mutatis mutandis* to other definitions of dreaming.

The problems discussed here are indicative of a wider problem for the definitional approach which go beyond simulation models. The foregoing discussion suggests that popular definitions - and subsequent taxonomies - of dreams which guide research are insensitive to empirical evidence and revision in a way that dream scientists want to avoid. When producing a scientific taxonomy of any phenomenon, we expect our initial taxonomy to be subject to further (and potentially quite radical) revision in light of new evidence and findings. The wider problem for the definitional approach that this highlights is that this is not obviously possible within the existing definitional framework. That is, given the arguments just discussed, it is not clear how a definition like ISTH *could* be revised in light of new evidence about the phenomenological or functional features of dreaming. For example, when faced with a potential new counterexample to this definition of dreaming from recent empirical literature, a proponent of a simulationist view can simply define away these results; they can maintain that this new finding instead reveals features of other, *distinct* kinds of 'dreamless' sleep experience. Similarly, by fixing the extension of dreams in order to determine which evidence is relevant to an assessment of the claim that 'all dreams share a core immersive phenomenology', the proponent of the simulation model of dreaming can continue to maintain that, despite new findings about the phenomenological and neural features of sleep experience, all positive evidence in favour of their view remains the same. There is a broader insensitivity to empirical evidence here which suggests that despite its intuitive appeal, the phenomenological-definitional approach to sleep experience is epistemically risky (given the taxonomies they produce might well turn out to be incorrect) as well as misguided (given its insensitivity to taxonomic revision, it is unable to converge on a refined scientific classification of sleep experience). This calls for an alternative approach.

5. The Natural Kind Approach to Sleep Experience

The question at the heart of our discussion thus far — is there a single kind of conscious state which we surface to while asleep or several — is a question about scientific categorisation. It asks us to reflect on the following: is the correct scientific taxonomy for consciousness science one which posits a single category ‘dreaming’ to capture the nature of sleep experience or one which posits several distinct categories? This question itself invites a host of further questions viz. what does it mean to say that one scientific taxonomy is the ‘correct’ one? and how could we know whether the system of categorisation we have currently in dream science corresponds to this correct classification or not?

These questions are not unique to consciousness science. In the philosophy of science, questions of this sort are said to revolve around and point to a crucial feature of the world, about which there has been much discussion. To ask questions of this sort is to ask about *natural kinds* - those scientific categories which reflect real divisions in nature as opposed to categories (such as ‘red and blue striped objects’) which are arbitrary or gerrymandered. Here, I want to consider how recent research on these questions in philosophy of science can be used to illuminate the issues which have occupied this paper. This will involve combing answers to three questions, which I will now consider: what makes a category or kind natural as opposed to arbitrary? What kind of mental category is dreaming, and can we understand distinct members of this category as forming natural kinds?

5.1 What is a Natural Kind?

When thinking about how best to categorise, and thereby understand, the world, it is natural to start with a distinction between natural and non-categories. When it comes to understanding the world, we typically think that there are some categories better suited to the task than others — and this, we might think, reflects the fact that these categories work to approximate a structure and divisions that are *really present* in the world, and not merely contingent ways of carving up reality. The question of what distinguishes natural from non-natural categories - what distinguishes categories like ‘electron’ and ‘planet’ from ‘libra’ or ‘pixies’- is at the heart of recent research in philosophy of science. Here, one typically finds the claim that genuinely natural categories can be distinguished from non-natural categories on *epistemic* grounds, insofar as the former but not the latter are *projectable* in the sense that they feature in and explain the epistemic reliability of a large class of enumerative inductive inferences (Goodman, Wilkerson 1995, Boyd 1991). The idea is that natural kinds explain and justify forms of inference which generalise from a limited number of observed items (*this F is a G*) to a claim about all unobserved members of the kind to which the items belong (viz. *‘all Fs are likely G’*) (Sankey 1997, 2007, 2001, Kornblith 1993).

This epistemic feature characteristic of natural kinds has been developed into a comprehensive theory by the P.D. Magnus (2012, 2013), who argues that for any given category *k* to be natural, it must satisfy two conditions:

- (1) *The success clause*: *k* is a part of a taxonomy that allows scientific enquiry into *d* to achieve inductive and explanatory success.
- and
- (2) *The restriction clause*: any taxonomy that excluded *k* would not do so.

The thought here is a fairly intuitive one. Natural kinds are those categories which are indispensable for a scientific domain, being those categories which science is forced to posit in order to achieve explanatory success. On this view, what distinguishes natural categories like ‘planet’ or ‘Homo Sapiens’ from non-natural ones like ‘libra’ or ‘pixies’ is that the former are *epistemically fruitful* in the sense that they not only feature in and work a large range of inductive inferences, but are also the categories that *must* be posited, for science to achieve inductive success.

While many philosophers of science take these epistemic features to be definitive to what it is to be a natural kind, many — including Magnus — argue that there are nonetheless specific ontological structures common to natural kinds which work to *explain* how and why natural kinds meet these epistemic conditions. In higher level scientific domains for example, to which the discussion pertains, it is natural to combine the epistemic criteria above with the *Homeostatic Property Cluster* theory of natural kinds made popular by Richard Boyd (1991, 1994, 1999)¹¹. According to this ontological theory of natural kinds, kinds in higher level domains (including neuroscience, psychology and so on) are identical to a cluster or repetitions of properties whose reliable co-occurrence in nature — and thereby, their epistemic *projectability* - is explained and maintained by the operation of a network of historical and constitutive causal mechanisms¹².

While this summary of recent work on natural kinds is inevitably cursory, it is illuminating vis-a-vis the issues thrown up in this paper in several respects. First, it suggests that the question ‘is there a single kind of conscious state associated with sleep, or several?’, and the related debate concerning how to define dreaming is one which can be reframed in terms of *epistemic utility*. That is, it allows for a more precise reformulation of the central question as follows. Are a wider set of inductive inferences in consciousness science underwritten by a taxonomic system which posits a single category of sleep experience, or by an alternative system which posits several categories? In particular, which categories of sleep experience are we *required* to posit in order to achieve explanatory and inductive success?

Second, the discussion here also suggests that in seeking to answer these questions, dream scientists ought to be looking to identify a series of *clusters* of properties associated with consciousness during sleep. These clusters, as above, are those which reliably co-occur among individuals of our species, and whose joint occurrence can be explained reliably by a network of neural mechanisms. This provides a methodology for testing the natural kind assumption as follows. If we find that there is a single cluster of properties - one which functions as a whole to underwrite a reliable set of inductive inferences - underwritten by a single set of neural mechanisms, we would have good grounds for concluding, for example, that the standard monistic definition of dreaming (one which equates dreaming with sleep mentation) is the optimal or ‘correct’ scientific taxonomy. Conversely, if, after rigorous investigation, several *distinct* clusters or groupings of properties were found, clusters which were individually *indispensable* for explanatory success in consciousness science, and underwritten by distinct neural mechanisms, we would be licensed in rejecting the natural kind assumption in favour of a pluralistic thesis¹³.

As it currently stands, this latter suggestion is somewhat vague as it is framed at a high level. In order to make this proposal more precise, more needs to be said about the *sorts* of properties dream scientists ought to be

¹¹ Kornblith (1993); (Griffiths 1997, 1999), and Wilson (1999, 2005).

¹² Boyd (1999, Ereshefsky (2005).

¹³ This is continuous with a recent approach to phenomenal consciousness which advocates a similar cluster-based methodology Shea and Bayne (2010), Shea (2012).

looking for; and in order to determine this, more needs to be said about the *kind* of mental category to which dreaming itself belongs. For knowledge of the kind of mental category to which dreaming belongs will help provide us with knowledge about the sorts of properties which serve to distinguish members of this more general kind.

5.2. A Natural Kind Methodology for Dream Science

Simulation views of dreaming seem to be getting at an important point when they seek to identify dreaming with a core immersive phenomenology. The significant phenomenological feature they track is the idea that to dream in the ordinary sense is in part to be immersed in a simulated dream *world* or reality. Another reason to be partly skeptical of this view as a *definition* of dreaming, however, is that these sorts of phenomenological properties, while distinctive of dreaming, are not unique to it. Very similar sorts of simulative immersion, for example, are also associated with other mental phenomena — most obviously, it is associated with being in a state of *wakefulness*, where one's world is [if one is not an idealist] external reality, but it is also associated with various hallucinatory, psychedelic, and perhaps psychotic states (Windt 2016;chapter 12). In these cases too, it makes sense to talk of finding oneself immersed in a distinctive 'world' of experience, and this immersion seems part of, or at least is characteristic of, what it is to be in such a state. This reflects the fact that these mental phenomena belong to a unique family of mental states known as *global states of consciousness*; so called because the changes implicated in coming to be in one state rather than another (wakefulness to dreaming, dreaming to a psychedelic state and so on) affect the totality or *global* character of a subject's conscious experience as opposed to local, content-related features of experience.

What does being in a particular global state of consciousness consist in? Recent work has sought to provide an answer to this question. The resultant view draws on two key ideas. First, that global states of consciousness like wakefulness and psychedelic states are *multi-dimensional constructs*: they differ from one another not along a single dimension, but several (Bayne et al. 2016, Bayne and Carter 2018) (Figure 3). Second, the dimensions along which these global states differ and can be compared are a set of *conscious-related capacities* (McKillop 2020, Crowther 2018, Soteriou 2017). While research in this area is still ongoing, these are said to correspond to several families of capacities which are framed at both neural, functional, and phenomenological levels¹⁴.

¹⁴ It is worth noting here that it is not just that the proposal here, in contrast to the phenomenological-definitional approach, is to utilise non-phenomenological forms of evidence *in addition* to phenomenological evidence when providing a scientific taxonomy of sleep experience. Rather, the proposal is that we ought to view and treat the recorded phenomenological data with regard to sleep experience *differently*: we ought, on this view not to be looking at the phenomenological properties common to all experiences, but instead be looking for reliably co-occurring phenomenological properties which are not necessarily shared by all sleep experiences; phenomenological clusters which are inductively associated with corresponding functional and neural properties.

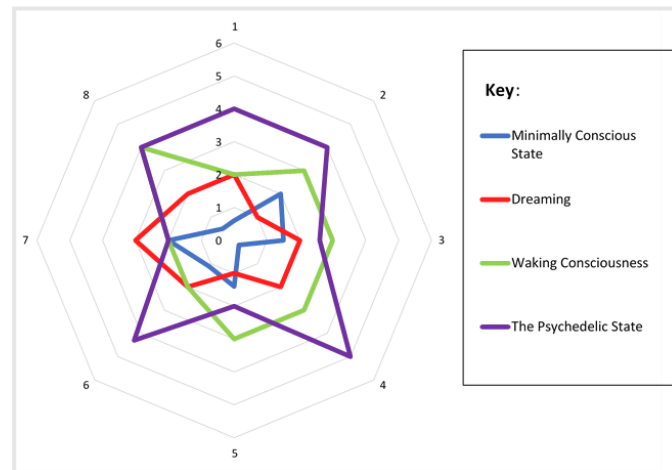


Figure 3 : The Multi-Dimensional View of Global States (adapted from Bayne et al. 2016). Dream science, on the natural kind methodology, ought to be seeking to identify different clusters of capacities which correspond to different global state spaces.

For example, these include (i) *sensory capacities* (corresponding to the intensity and volume of contents experienced (Bayne et al. 2016) and the quality of conscious contents (Fazekas and Overgaard (2016), (ii) *cognitive capacities* (corresponding to mental control and manipulation, attentional capacities and concentration, (enhanced or impaired) capacity to formulate and distinguish novel thoughts (Bayne and Carter 2018), (iii) *subjective capacities* relating to the subject's experience of unity, self and time (corresponding to the experience of time as stopping or slowing, an openness to past and present, altered experiences of self, the boundary between self and environment, the capacity for experiences of 'ego- dissolution 'and experiences of disembodiment (Bayne and Carter 2018) and finally, (iv) *functional capacities* (corresponding to the extent to which information can be globally broadcast, both in terms of the ability to which conscious contents can be broadcast, and the range and number of consumer systems it can be broadcast to (Bayne et al. 2016; McKilliam 2020).

Above, I suggested that recent literature on natural kinds allows for a reframing of the central question structuring this paper. The recent work on global states just sketched helps add more detail to this preliminary proposal. In particular, it suggests that the properties in question that dream scientists should be investigating are those *consciousness-related capacities* which correspond to distinct global states of consciousness. It thus suggests a methodological framework on which the aim is to identify the global states of consciousness which habitually (and, in some cases, pathologically) obtain during sleep. This will involve developing a more fine-grained and comprehensive taxonomy of the capacity-involving dimensions which frame the global state space (by cross examining the neural, functional and subjective dimensions not only of sleep experience, but other global states of consciousness like the psychedelic state) as well as collecting large amounts of data on the subjective and objective properties of conscious sleep experience which can be used as input in causal models to determine how these properties cluster together in such a way as to underwrite the widest set of inductive inferences (that is, from one sub-set of the cluster, to others). This is a new way forward for consciousness science.

Importantly, the new framework that is brought into view is neutral, in the abstract, on the natural kind status of dreaming. That is, unlike the standard methodological paradigms it does not require dream researchers to make ontological assumptions from the outset which have little empirical justification. From a scientific perspective, such a neutral outlook is obviously preferable. Whether there is one cluster to be found or several is not something which can be anticipated prior to the start of investigation — it is simply left open¹⁵.

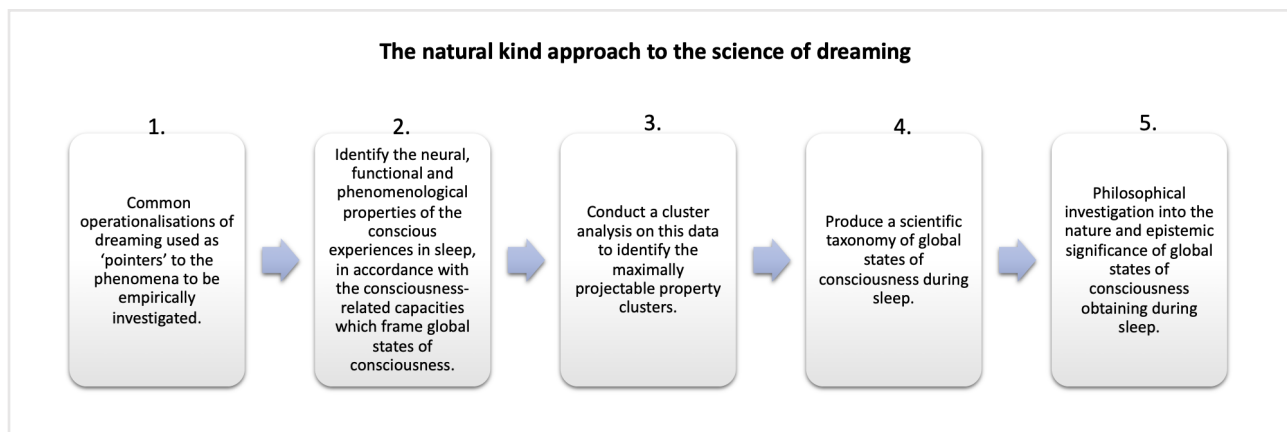


Figure 4: The natural kind approach to the science of dreaming.

6. Conclusion

On this new framework, the answer to the question *is dreaming a natural kind?* cannot be determined prior to empirical investigation. I want to conclude by raising two questions: what would it mean for our ordinary concept of dreaming if the natural kind assumption is false? and, what implications does this framework have for philosophical research on dreaming?

Starting with the first, if pluralism about sleep experience is the outcome of the natural kind methodology, this would support a picture on which our ordinary concept of dreaming *fails to refer scientifically* in the sense that, where we thought there was a unified scientific kind, there isn't one. If such a view was empirically supported, it would - I think - work to ground a form of *scientific eliminativism* about the concept of dreaming, or sleep experience, which mirrors scientific eliminativism about concepts (Machery 2006). These two outcomes are worth discussing briefly. The former suggests that while there may be distinct clusters of experience to be found in sleep, and while they may have some properties in common, they are not unified in the sense of forming a natural kind. At most, they may be said to each belong to a broader sub-kind (for example, 'consciousness during sleep'). This is interesting in several respects. Notably, it suggests that there could be a viable eliminativist position about dreaming grounded in empirical considerations. Unlike current attempts to motivate an eliminativist position which trade on dubious claims about the lack of conscious experience during sleep (Dennett 1979, Malcom 1959), this eliminativist view would be one that is supported by empirical data.

¹⁵ In this sense, it can be said that this methodology is *continuous* with standard operationalisations of dreaming in the literature, but not beholden to them. On the natural kind methodology, these definitions — sleep mentation, or simulation views — can be used to identify, in the first instance, the conscious phenomena to be investigated and analysed in terms of properties (Figure 4). Unlike the current use of these definitions however, this does not build in ontological assumptions from the outset.

The second possibility - that 'sleep experience' fails to refer to a scientific category - is more radical. The idea is that, as part of our natural kind approach to sleep experience (in Step 4) we may find that the global states of consciousness that obtain during sleep have more in common with the global states that obtain whilst waking than they do with each other. On this eventuality, there would be no broader sub-kind of conscious state specific to sleep to which the global states obtaining during sleep belong, related via a genus-species relation. The situation would be analogous to other folk psychological categories which turned out to be scientifically inaccurate— for example, 'aquatic' and 'land' animals. That is, just as whales have more in common with land mammals than with other aquatic animals, so there might be some "dream" states that have more in common with waking experiences than with other kinds of sleep experience¹⁶.

Second, if the natural kind assumption isn't - as I have argued - justified, how should philosophical research which also by and large assumes it, proceed? There is room here for a complementary research programme which develops alongside the empirical one sketched (Figure 4 Step 5). On this view, philosophers ought to refrain from explicit endorsements of the natural kind assumption until this research is carried out, and more evidence in favour of pluralism (or against it) is available. This is the broader lesson. The more specific methodological claim which emerges, however, is that philosophers interested in determining the nature and epistemological consequences of dreaming ought to be engaged in a 'ground up' project which starts from an examination of the ontological constitution and epistemic significance of the consciousness-related capacities which are instantiated during sleep. In relation to dream skepticism, for example, a central question becomes whether the capacities which underwrite the global state(s) that obtain during sleep — those which are empirically and subjectively identified — and their interactions vindicate or otherwise preclude the sorts of epistemic significance philosophers typically attribute to dreams (see, for example, Soteriou 2017, Crowther 2018, O'Shaunessey 2002, whose arguments could be interpreted in this vein). This makes way for a new philosophy, as well as a science, of dreaming; one which is grounded in the idea that conscious sleep experiences form natural kinds.

¹⁶ One might think that this second possibility hinges on the further question of whether sleep itself is a natural kind. I leave this possibility open here.

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