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Spotlight Commentary

The multi-dimensional approach to drug-induced states: A commentary on Bayne and Carter's "dimensions of consciousness and the psychedelic state"

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Abstract

Bayne and Carter argue that the mode of consciousness induced by psychedelic drugs does not fit squarely within the traditional account of modes as levels of consciousness, and favors instead a multi-dimensional account according to which modes of consciousness differ along several dimensions—none of which warrants a linear ordering of modes. We discuss the assumption that psychedelic drugs induce a single or paradigmatic mode of consciousness, as well as conceptual issues related to Bayne and Carter's main argument against the traditional account. Finally, we raise a set of questions about the individuation of dimensions selected to differentiate modes of consciousness that could be addressed in future discussions of the multi-dimensional account.

Key words: states of consciousness; pharmacology; philosophy; contents of consciousness; theories and models

Introduction

In recent years, a debate has emerged regarding the adequate characterization and taxonomy of global states of consciousness, a notion that loosely refers to "ways of being conscious" by contrast with specific conscious contents (Bayne and Hohwy 2016). Examples of global states of consciousness include the ordinary wakeful state, post-comatose disorders of consciousness, and the dreaming state associated with rapid eye movement sleep.

The traditional view in clinical neuropsychology is that global states of consciousness can be ranked on a scale corresponding to levels of consciousness, from the "least conscious" to the "most conscious" state (Laureys 2005). This view has recently been criticized by Bayne *et al.* (2016), on the grounds that global states of consciousness differ from each other in more than one respect, and thus cannot be easily ranked from least to most conscious. Bayne *et al.* argue that consciousness is not a 1D construct measured by levels of consciousness, but a multi-dimensional construct measured across several distinct dimensions.

In a rich and thought-provoking article, Bayne and Carter (2018) propose to extend this analysis to the states of consciousness induced by psychedelic drugs such as psilocybin or lysergic acid diethylamide (LSD). According to Bayne and Carter (henceforth B&C), available evidence from controlled studies does not

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Highlights

- Provides a critical discussion of an influential new model of global states of consciousness such as post-comatose disorders of consciousness and drug-induced states.
- Offers terminological and conceptual distinctions to advance the discussion of multi-dimensional accounts of global states of consciousness.
- Underlines empirical evidence challenging the claim that there is a single paradigmatic global state of consciousness associated with the effects of psychedelic drugs.
- Raises a set of outstanding questions regarding the individuation of dimensions in multi-dimensional accounts of global states of consciousness.

warrant the claim that the kind of global state of consciousness induced by psychedelics might constitute a higher level of consciousness than ordinary waking awareness. Indeed, they argue that the "psychedelic state" differs from ordinary wakefulness in several respects, some of which qualify as "enhancements" and others as "impairments." They conclude that their analysis further undermines the plausibility of a 1D account of global states of consciousness in terms of levels of consciousness.

While we are very sympathetic to B&C's multi-dimensional framework and share the view that the effects of psychoactive drugs challenge the level-based approach to global states of consciousness, we emphasize here some potential limitations of their account and offer some suggestions to address them.

Conceptual Preliminaries

Throughout their article, B&C refer to global states of consciousness as states of consciousness or conscious states. It may be useful to draw an explicit distinction between three notions that this lexical choice might obscure for some readers:

1. Specific experiences individuated by their phenomenal character ("what it is like" to have them), often called "conscious contents" or "local states of consciousness" (Chalmers 2010; Bayne *et al.* 2016). In that sense, the visual experience of a dog and the auditory experience of barking are two distinct local states of consciousness, because what it is like to see a dog differs to what it is like to hear a dog barking.
2. The subject's overall phenomenology at a given time, i.e., the totality of what it is like to be that subject at that time. This notion has been called by different names, such as "total experience" (Dainton 2000), "total phenomenal state" (Gertler 2001; Bayne and Chalmers 2003), and "phenomenal field" (Bayne 2010).
3. The subject's "way of being conscious," individuated by dispositional properties such as the ability to be conscious of certain kinds of contents, and the availability of those contents for the control of cognition and behavior. In previous works, Bayne *et al.* have variously referred to this notion as "background states of consciousness" (Chalmers 2000), "modes of consciousness" (Bayne and Hohwy 2016), and "global states of consciousness" (Bayne *et al.* 2016).

In our opinion, it is better to avoid the expressions "state of consciousness" and "conscious state" altogether, as they might inadvertently prompt readers to conflate these three notions. Furthermore, the expression "global state of consciousness" itself might lead some readers to confuse the second notion and the third notion, insofar as they both refer to global features of conscious subjects. In order to avoid potential confusions, we propose to refer to these three notions as "local phenomenal state", "global phenomenal state", and "global mode of consciousness", respectively. ("Global modes of consciousness" seems more adequate than "modes of consciousness" *simpliciter*, to avoid confusion with modes of presentation or sensory modalities, which both pertain to features of local phenomenal states. We thank the anonymous reviewer for bringing this potential confusion to our attention.) This choice of terminology clearly distinguishes (i) local and global properties of conscious subjects and (ii) categorical and dispositional properties of conscious subjects (phenomenal states vs. modes of consciousness).

The Heterogeneity of Psychedelic Modes of Consciousness

Throughout their article, B&C follow many other authors in referring to the "psychedelic state" as if it were a unified kind. Although they briefly acknowledge that different psychedelic drugs may have different effects on consciousness, they settle on this expression "as a general term to refer to the paradigmatic states of consciousness associated with the consumption of psilocybin and LSD" (Bayne and Carter 2018, p. 2).

For authors who take the uni-dimensional account of global modes of consciousness for granted, it might make sense to refer to a unique global mode of consciousness induced by psychedelic drugs. For example, if putative levels of consciousness are indexed by the Lempel-Ziv complexity of spontaneous neural activity, as has been recently suggested (Schartner *et al.* 2017), then in so far as all psychedelic drugs increase spontaneous signal complexity in a similar way one can meaningfully refer to the single mode of consciousness induced by such drugs. (Let us emphasize again that we side with B&C's criticism of uni-dimensional accounts; we simply want to point out that talking of a single psychedelic mode of consciousness makes sense within such accounts, even if they are inadequate for distinct reasons.)

However, within B&C's multi-dimensional account it might not be helpful to refer to the paradigmatic global mode of consciousness induced by psychedelic drugs in general, or even by psilocybin and LSD in particular. Indeed, the effects of psychedelic drugs can vary dramatically on account of three main variables:

- Dosage: the same substance (e.g. LSD) can induce very different kinds of effects depending on the dose (Shulgin and Shulgin 1997), and the relationship between dosage and subjective effects is not always linear. For example, generally, (i) at a low dose of LSD (between 25 μg and 75 μg), the world feel strange and surprising (Nelson and Sass 2008) but no visual distortion is experienced (no illusions and no hallucinations); (ii) at a medium dose of LSD (between 75 μg and 150 μg), real objects of the world start morphing and illusory properties are projected onto them (illusions with no hallucinations); (iii) at a high dose of LSD (150 μg and higher), genuine hallucinations (seeing objects which are not in the real world) are experienced (Masters and Houston 1966).
- Context and personal predispositions: the same dose and the same compound taken in different settings or with different mindsets can also induce somewhat distinct experiences

(Hartogsohn 2016). Personality traits (such as absorption; Studerus *et al.* 2012) and genetic factors (Ott *et al.* 2005) can also significantly shape the effects of psychedelics.

- Temporal dynamics: the effects of the same dose of the same compound can change considerably across time (Preller and Vollenweider 2018). Furthermore, there is a non-linear relationship between the duration of drug intoxication and the associated subjective effects. For example, a high dose of N,N-Dimethyltryptamine can first induce very salient bodily sensations, immediately followed by an abrupt loss of all bodily sensations (Timmermann *et al.* 2019).

According to B&C, the paradigmatic global mode of consciousness induced by psychedelics is characterized by (i) perceptual enhancements (increased bandwidth and vividness of perceptual experience); (ii) cognitive impairments (impaired decision-making, memory, attention, and abstract thinking); and (iii) alterations of the experience of space, time, and selfhood. (Note that talking of "impairment" and "enhancement" generally makes sense by reference to a baseline performance on a specific task. But, it is unclear whether such reference is available for every dimension discussed by B&C, especially the third one.) However, the evidence reviewed above suggests that (at least) some of these dimensions could be "impaired" in one psychedelic mode of consciousness and "enhanced" in another. For example, psilocybin and LSD might increase the "bandwidth" of sensory experience at low and medium to high doses, thus scoring higher than the ordinary wakeful mode of consciousness on the relevant dimension. However, there is also evidence that high to very high doses of psilocybin and LSD can lead to extremely impoverished sensory experiences. (Consider for example the following anecdotal report describing the effects of around 500 μg of LSD: "everything in my external environment [was] turning black and red. I could barely see anything, my vision was almost completely shot" (retrieved from erowid.org/exp/98623).) As for the dimension related to the sense of self in B&C's account, there is evidence that low doses of psilocybin and LSD can induce introspective moods with an increased frequency of self-related thoughts, while medium to high doses can lead to the temporary cessation of self-related thoughts (Millière *et al.* 2018). Moreover, awareness of one's body can be "enhanced" at one time and "impaired" a few minutes later, for the same subject, with the same drug and dose (Timmermann *et al.* 2019).

This does not merely suggest that psychedelic drugs can induce different global phenomenal states—which is trivially true insofar as what it is like to be intoxicated by some psychedelic drug at one time may differs from what it is like to be intoxicated by some psychedelic drug at another time. Rather, available evidence suggests that conscious subjects intoxicated by psychedelic drugs in general, and psilocybin and LSD in particular, can vary significantly with respect to the dispositional properties (e.g. dimensions) that individuate global modes of consciousness, and that such variation does not always correlate linearly with dosage. (Interestingly, a recent positron-emission tomography imaging study also found that 5-HT2AR occupancy and plasma concentration of psilocin—the active metabolite of psilocybin—correlates non-linearly with the self-reported intensity of subjective effects (Madsen *et al.* 2019).) Consequently, it might be misleading to speak of a paradigmatic global mode of consciousness induced by psychedelic drugs; even at a coarse-grained level of analysis limited to B&C's three dimensions, there is some evidence that psychedelics can yield distinct global modes of consciousness. We note that this is a strength of B&C's account rather than a limitation: unlike uni-dimensional accounts, it allows us to capture the rich diversity of global modes of consciousness that psychedelic drugs can induce.

Dimensions and Levels of Consciousness

In statistics, it is common to distinguish between quantitative and categorical variables; the former can vary on an ordered scale (like height), while the latter corresponds to nominal categories (like blood types). B&C seem to favor the claim that all dimensions of consciousness are quantitative variables that can be gradually "enhanced" or "impaired" compared to the baseline of ordinary wakefulness.

Against the idea that the psychedelics can induce a "higher" level of consciousness, they suggest that the global mode of consciousness induced by psychedelic drugs scores higher than ordinary wakefulness on one dimension and lower on another (Fig. 1A). This argument relies upon the implicit assumption that the global mode of consciousness induced by psychedelic drugs could be considered to be a "higher" level of consciousness than ordinary wakefulness only if it scored higher on all dimensions (Fig. 1B).

It is worth noting that this assumption would be misguided if the notion of levels of consciousness was incoherent anyway as a matter of conceptual analysis—as Bayne *et al.* (2016) previously suggested—because consciousness is not a gradable predicate like height or temperature. (Consider by analogy the predicate being a dog. Either an entity is a dog or it is not; even if a dog scored higher than another on a number of dog-related dimensions—furriness, speed, etc.—it would make little sense to say that such a creature instantiates a higher level of dogginess, as it were.) Thus, we can read Bayne *et al.* (2016) and Bayne and Carter (2018) as providing a two-pronged strategy against levels of consciousness: they offer a conceptual argument according to which the predicate "being conscious" is not gradable, and an empirical argument that comes into play if the conceptual argument is judged unsatisfactory.

However, for the implicit assumption of the empirical argument to be sound, it must be the case that the three dimensions of B&C's account can be meaningfully compared and related; otherwise, the fact that the psychedelic mode of consciousness scores *higher* than ordinary wakefulness on all of these dimensions would not be relevant to the debate on levels of consciousness. Consider by analogy two individuals, Alice and Bob, such that Alice scores higher than Bob on three dimensions respectively related to wealth, height, and blood pressure. These dimensions are not commensurable: there is no meaningful way to aggregate the quantities of wealth, height, and blood pressure instantiated by Alice and Bob in order to claim that Alice scores higher than Bob on some overarching dimension.

If, on the other hand, all the dimensions discussed by B&C can be meaningfully compared and related, then it should be possible to aggregate scores on these dimensions even if—as B&C argue—the psychedelic mode of consciousness scores higher than ordinary wakefulness on a dimension related to perceptual bandwidth, and lower on another dimension related to cognitive function. But the availability of a meaningful aggregation procedure of this kind would ultimately vindicate the notion of degrees of consciousness. (Suppose that you want to compare Alice and Bob on three dimensions related to well-being, corresponding respectively to their happiness, mental health, and sense of meaning—this example is adapted from Alexandrova (2017). Insofar as these dimensions can be quantified and compared, it makes sense to say that if Alice scores

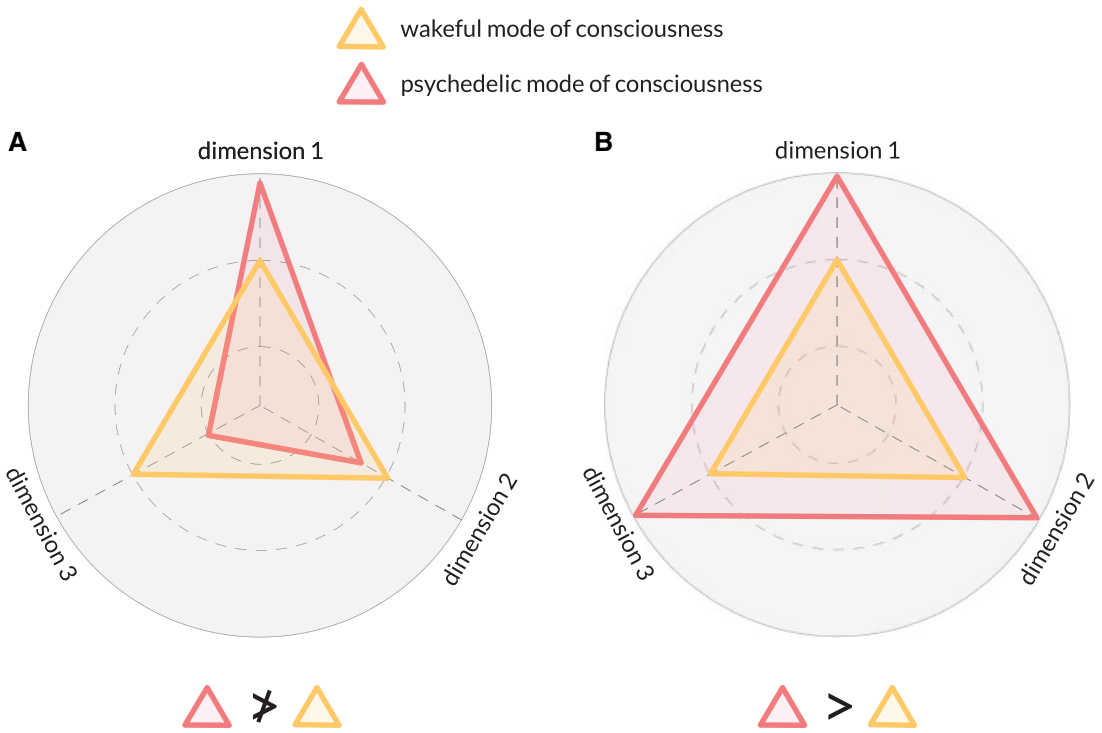

Fig. 1The relationship between dimensions and levels of consciousness.

higher than Bob on all three dimensions, then Alice has a *higher* level of well-being than Bob. But it is also intelligible to say that if Alice scores significantly higher than Bob on the happiness and mental health dimensions, but slightly *lower* than Bob on the sense of meaning dimension, then Alice still has a higher level of well-being than Bob overall.)

Individuating the Dimensions of Psychedelic Modes

Although B&C's model only contains three dimensions, additional variables might be relevant to characterize modes of consciousness induced by psychedelics. For example, it has been argued that the "sense of reality" is a central dimension of altered states of consciousness and can crucially help classifying them (Dokic and Martin 2012; Farkas 2014). In particular, including a dimension related to the sense of reality could be helpful to differentiate modes of consciousness induced by serotonergic drugs from those induced by other hallucinogens—e.g. anticholinergics (Shanon 2002; Fortier 2018).

This final point raises broader questions: what are the individuation criteria of the dimensions of conscious modes? On what grounds should additional dimensions be introduced, or existing dimensions subdivided? Is the dimensionality of the proposed model merely dependent upon the desired fineness of grain of the resulting taxonomy of conscious modes, or is there a optimal number of dimensions that carves out modes of consciousness at their natural joints? Such questions could be addressed in future work building upon B&C's important contribution.

Conflict of interest statement. None declared.

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