The Ritualised Mind Alteration Hypothesis of the Origins and Evolution of the Symbolic Human Mind

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Introduction

This article was originally motivated by a couple of critical commentaries about my work (Helvenston 2014, and above). However, I quickly came to realise that, to be able to adequately respond to the specific concerns that were raised, I would have to present some general considerations. It is only with this context in place that it becomes clear why I think that these details are worth arguing over in the first place. Thus, before anything else, the overarching question is: when it comes to the formidable task of understanding human pre-History, why should we care about altered states of consciousness?

To some extent, intentional alterations of normal waking consciousness are so widely prevalent in today's world that it is difficult to think why they should *not* have previously played a role. Throughout Historic times mind alteration has been achieved by an incredible variety of means, be it with the consumption of coffee, beer, tobacco or some stronger substance, or by practising a specialised mind-body technique of mind alteration such as yoga, meditation or repetitive chanting. At this point the precise method used is not as important as the general insight that every notable culture has its own ways of changing consciousness from the normal waking state, with some methods being more potent in their alterations than others. Surely in itself this seemingly universal phenomenon of mind alteration is in need of a scientific explanation. But, and this is where things get more controversial, how far back into pre-History do such practices go?

Every major ancient culture also seems to have had its preferred substances to alter waking consciousness in one way or another. The variety of psychoactive plants and the diversity of their cultural contexts is truly staggering (Rätsch 2005; Schultes et al. 2001). To cite just a few more recent studies, such practices are known for ancient Eurasia (Guerra-Doce in press; Jiang et al. 2006, 2009; Merlin 2003), Australia (Dobkin de Rios and Stachalek 1999), Mesoamerica (De La Garza 2012; Guzmán 2008; Viesca Treviño et al. 1996), South America (Blanc 2010; Luna 2013; Torres 1996), Africa (Marcus 2009; Sobiecki 2008), and North America (Charlton 2004; Crown et al. 2012; Litzinger 1981; Winter 2000). And with improving methods in archaeochemical and archaeobotanical research we can expect that our knowledge of the list of plants used to modulate the mind and their ancient distribution of usage will increase (e.g. Bawaya 2014; Guerra-Doce in press).

Certainly, the widespread popularity of many substances is explainable in terms of their evident functions in daily life, such as increasing physical energy and wakefulness (coffee, tea, coca, cacao etc.) or decreasing inhibition (e.g. alcohol and aphrodisiacs). But there are several categories of plants, typically used in sacred rituals, which do not fit within this scheme because they interrupt the functions of daily life. Depending on the type of plant, these interruptions can range from mild changes in mentation and enhanced suggestibility, to strong perceptual changes, vivid hallucinations and full-blown deliriums (Díaz 2010). Although care must be taken not to conflate these types of plants, for our current purposes it is sufficient if we group them together as psychedelics.

If we believe our current legislation system, such as the UN Convention on Psychotropic Substances, most psychedelics have no value and substantial potential for harm and abuse. If so, then it becomes difficult to explain their widespread use and it may seem plausible that people only became interested in them in more recent times, perhaps as a negative side-effect of the formation of complex societies.

Yet the idea that use of psychedelics is a maladaptation occasioned by complex society is not consistent with the evidence. The first thing to note is that according to some leading drug experts, the desire to occasionally profoundly modify one's state of mind is deeply inherent in human nature, perhaps even comparable to some of the other basic biological and innate drives (Siegel 2005; Weil 2004). What their assessment suggests is that we are not necessarily dealing with an exclusively cultural phenomenon at all.

Indeed, there is a growing recognition that even a wide variety of nonhuman animals will intentionally and repeatedly intoxicate themselves when given the opportunity to do so (Samorini 2002; Siegel 2005). For one well-accepted example we only need to think of cats' obsession with plants that are commonly known as catnip (e.g. the genus *Nepeta)*, which can temporarily cause profound alterations of their behaviour.

Adaptive benefits of altered states of consciousness

Yet if it turns out that such mind alteration is prevalent in the rest of the animal kingdom, then this presents us with another puzzle. Are we dealing with another unfortunate mismatch between animal brains and their botanical environments that evolution by natural selection has been unable to remove from populations? Or could there even be selective advantages conferred by this seemingly unusual behaviour? The idea of pure coincidence can be ruled out by taking a closer look at the chemical substances and neurotransmitter receptors that are involved in the effects of psychoactive plants. On the contrary, the highly specific ways in which these plant substances interfere with animal neurotransmitters is suggestive of a co-evolutionary relationship that is millions of years old. And while part of the explanation is that plants evolved a defensive reaction against animal predation, there is another side to this story.

Sullivan and Hagen (2002) have argued that consumption of psychedelic plant chemicals could have conferred selective benefits, for example because they could be exploited as externally produced substitutes for metabolically costly endogenous neurotransmitters. Nevertheless, since Sullivan and Hagen's explanation is situated only at the level of metabolism and neurophysiology, it leaves the role of the profound psychological effects rather mysterious. Could mind alteration in itself not also have some selective benefits? At least this is suggested by the positive relationship between altered states of consciousness and

improved health in traditional shamanic contexts (Blanc 2010; Sidky 2009), in modern psychiatry (Kupferschmidt 2014), and perhaps even in modern recreational contexts (Krebs and Johansen 2013).

In order to investigate this intriguing possibility, my colleagues and I devised a highly simplified model of mind alteration by making use of an artificial spiking neural network (Woodward et al. in press). We found that if the model 'brain' is subjected to occasional perturbations that profoundly alter its normal state of activity, in this case via the randomisation of its activity, synaptic plasticity spontaneously starts to reshape the network's connectivity in a way that enhances coordination of neural activity. This result is only based on an artificial model, but it is nevertheless suggestive: neuroscientists investigating the psychedelic state have found it to be associated with a similar disruption of normal activity, including cortical desynchronisation (Muthukumaraswamy et al. 2013) and increased disorder of neural activity (Carhart-Harris et al. 2014).

In addition, the model's finding that such disruption can lead to self-optimised coordination of neural activity fits with current psychiatric theories of health benefits. For example, it has been argued that the experience of altered states of consciousness heals by increasing integration between brain areas (Winkelman 2010). Our finding of self-optimised neural coordination is also consistent with existing theories that view psychedelic drugs as instruments that may provide users with functional adaptation of cognition (Müller and Schumann 2011), and as influencing creativity (Dobkin de Rios and Janiger 2003).

Nevertheless, even if we only focused on the potential benefits of psychedelics in the treatment of mental health problems, such as a variety of mood and affective disorders (e.g. Vollenweider and Kometer 2010), it would still lead us to expect a discovery of remains of psychedelic plants associated with burials of pre-Historic medicine men. If psychoactive plants have medicinal value and if they can be found in the environment, we can be relatively sure that hunter-gatherers would have made use of them. In other words, although we emphasise the temporarily disruptive effects of altered states of consciousness, we do so in the context of long-term improved mental functioning, which makes this proposal immune to criticisms targeted at theories of palaeoart based on mental disorders (Bednarik 2013). We return to the connection between non-pathological altered states of consciousness and enhancement of mental functioning below.

The generality of our model implies that the effects of the psychedelic state are not unique to the modern human brain, which may help to explain why animals are also found to indulge in repeated intoxication with psychedelic plants. For example, wild chimpanzees and wild gorillas are known to engage in consumption of plants that are unrelated to nutrition, including a variety of psychedelic plants. Based on their extensive review of medicinal plants consumed by gorillas, including hallucinogens also employed by local people in ritual contexts, Cousins and Huffman (2002) have suggested that "Africa may not be so impoverished in psychotropic plants as is widely believed," and that "it is a tantalising thought too that gorillas might be directly affected by these same properties" (p. 70). Interestingly, chimpanzees are found to engage in unusual-food consumption twice as frequently as gorillas, which can be interpreted as indicating that self-medication may have become accelerated in our ancestors in association with higher social tolerance and lack of herbivorous gut specialization (Masi et al. 2012). If so, then this too suggests that human practices of psychedelic mind alteration are likely to pre-date the origin of human symbolic culture. But this also means that the practice is so general that it says nothing about whether psychedelic states of consciousness were specifically associated with the origins of symbolic culture. In order to motivate a serious consideration of that connection, I will now turn to arguments that are based on recent developments in the cognitive sciences. And with this we finally start to move into an area of research that is more closely related to the concerns of this journal.

Cognitive benefits of altered states of consciousness

The last couple of decades of interdisciplinary research have profoundly changed the way we think about the mind. The old computational theory of mind is being replaced by an emphasis on biological embodiment, worldly situatedness, and lived experience (Thompson 2007). Mind is conceived of as essentially a living activity of sense-making that constitutes a meaningful point of view, shaped by needs, desires and possibilities of action in the environment, including the social world (Froese and Di Paolo 2009).

One of the main challenges of this new approach is to explain the emergence of abstract 'higher-level' cognition from this concrete 'lower-level' sense-making (Cappuccio and Froese in press). In particular, if mind's default mode of being in the world is to be fully absorbed in coping with whatever is immediately present and meaningful, then how do we account for the origin of cultural signs and symbols, whose meaning is not intrinsic to their appearance while referring to something which is not even immediately present (hence re-presented)? What is needed is a reflective capacity. The beholder of a symbol must be able to step back from her more immediate worldly preoccupations so as to appreciate the communicative role of the physical substrate underlying the symbol, i.e. serving as a neutral medium of representation, while imbuing that medium's specific content with culturally derived meaning. Arguably, it is the difficulty of having to first adopt such a reflective or 'objective' stance that separates human symbolic capacities from those of nonhuman animals (Froese et al. 2012).

I have elsewhere proposed that ritualised altered states of consciousness could have played a crucial role in originally enabling this unusual cognitive stance in pre-Historic times (Froese 2013). To see why, it is helpful to consider under what conditions our modern consciousness spontaneously becomes more detached and reflective. Following Heidegger's *Being and Time*, a foundational work on existential phenomenology, continental philosophers have noted that most of the time we are engaged in situated smooth coping activities in which the distinction between subject and object is not that clear. As Heidegger argued, under these conditions it is more accurate to describe our existence as one distributed and holistic being-in-the-world (*Dasein*). Yet when something unexpectedly goes wrong and smooth coping is disturbed, a subject-object dualism starts to emerge that with further interruption will develop into a full-blown observer attitude whereby situated coping is replaced by detached reflection (see e.g. Dreyfus 1991: 124–5).

What I suggest is that a similar process may have been operative during *Homo*'s transition from a purely animal kind of life (and mind) to what we would consider as a reflective and symbolic mind. This proposal therefore does not depend on the assumption that the modern human mind is already in existence, but rather tries to explain its original emergence. Nevertheless, having something as useful as the capacity to observe and to reflect could not be left to chance occurrences of interruptions and breakdowns of coping activity, but is something that was likely cultivated in a more and more intentional manner. But how?

Altered states and symbolic culture

Here we return to a theme that we have already discussed earlier, namely how consumption of psychedelics profoundly interrupts normal mental functioning. This is not to say that they are the only way to enact such interruptions, but they are certainly a powerful and for most cultures readily available option. Another factor to consider is that reflective consciousness is less needed by young infants, but becomes increasingly useful and, at least in the context of a highly symbolic culture, even necessary as maturation proceeds. On this view, the traditional prevalence of intense rites of passage during puberty, including taboos, extended periods of seclusion, social isolation, physical hardships, and the ingestion of psychedelic substances, i.e., practices which have little to do with the process of sexual maturation as such (van Gennep 1908/1960), is no longer as bizarre as it may otherwise seem. The rites' original purpose could have been related to the facilitation of the ontogenetic development of young initiates' normally fully situated minds into a more stabilised subject-object dualistic form, one which is more suitable for enculturation into a symbolic culture (Froese 2013).

Over time this original purpose of socially enhanced mental development would have become less essential as we and our cultural contexts co-evolved to allow individuals to more easily adapt to and reproduce a variety of highly symbolic practices (Froese and Leavens 2014), a co-evolutionary process that has been nicely illustrated by the co-evolution of the human brain and languages (Deacon 1997). Relatedly, this also explains why we should not expect that all traditional cultures still make use of profound mind alteration, because once our propensity and capacity for highly refined imitation of symbolic practices was already in place, existing symbolic content could be preserved and developed without it.

There is another implication of this hypothesis that relates to the particular form of expression of the first symbolic cultures. Neuroscientists have realized that activity in the visual system is normally inhibited so that it can correlate with the external environment (Butler et al. 2012), since abnormally disinhibited activity leads to internally determined forms, i.e. hallucinations. Mathematical models have shown that under such disinhibited conditions activity in the visual system can develop into self-sustaining geometric patterns, which look similar to some of the ones reported by people with altered states of consciousness (Bressloff et al. 2001). My colleagues and I contributed to this research by highlighting two additional properties of self-sustaining neural dynamics that are relevant for explaining the origins of symbolic culture (Froese et al. 2013).

First, the presence of such dynamics in the sensory cortex would simultaneously have the effect of reducing influences from the external environment to other brain regions, and the absence of tight continuous sensorimotor coupling could simultaneously have facilitated the emergence of more detached and reflective cognitive modes. Second, it has been argued that self-sustaining networks of processes embody an intrinsic value related to sustaining their own viability as dynamic structures (Di Paolo et al. 2010), which may have the effect of enhancing the significance that people associated with the seeing of hallucinations caused by such geometric neural patterns.

Taken together, these considerations lead us to expect that the first expressions of symbolic culture took the form of abstract geometric patterns, and this seems to be confirmed by archaeological findings both in the case of modern humans (Henshilwood et al. 2009) and Neanderthals (Rodríguez-Vidal et al. 2014). But they also lead us to hypothesize that these first expressions were made by populations whose culture included the induction of altered states of consciousness, and who thereby had socially enacted symbolic minds. It matters little if we want to call these practices shamanic or something else[1]. Neither is this hypothesis undermined by indications that Palaeolithic 'art' was mainly produced by children and teenagers (Bednarik 2013). As I have argued, we should expect a ritualised management of the developmental process of mental maturation, so indications of a focus on younger individuals and of puberty rites is supportive of this theoretical framework (Froese 2013).

In response to commentaries by Hodgson (2014) and Lewis-Williams (2014), my colleagues and I have clarified that our proposal differs from both of theirs in one crucial respect: we grant an adaptive value to mind alteration as an enabling role in the original emergence of the symbolic mind (Froese et al. 2014a). Lewis-Williams (2002) assumes that the European cave paintings were made by people who essentially had fully developed consciousness like us, such that the role of altered states is basically reduced to that of providing a collection of experiences whose contents are selectively reproduced artistically according to social norms. But if providing content is all there is to it, then Hodgson is right to wonder if appealing to altered states is really necessary. The neural resonance between geometric patterns and the visual system should naturally enhance the salience of those patterns (Hodgson 2006). But, on our view, that neurovisual resonance is not sufficient to explain the initial appearance of art because it is not limited to the human brain but a general property of animals' visual system. In other words, Hodgson's proposal similarly relies on assuming the existence of a modern human mind to turn neural salience into symbolic representation, and he ignores the essential contributions of cultural context. Our theory, on the other hand, integrates neural, social and phenomenological levels.

In ongoing work I am trying to further demonstrate that the benefits of altered states need not be limited to the self-optimisation of individual brains, but can extend to the spontaneous optimisation of social networks. This is because the general logic of the interruption mechanism we implemented in the model of a neural system (Woodward et al. in press) can in principle be realised by a social system, as long as it has an effective way of temporarily interrupting behaviours associated with normal daily life, such as communal rituals.

In itself this idea of ritualised self-optimisation is not new. In particular, Turner (1977) had already suspected that the liminal phase of rituals benefits societies by increasing the diversity of their behavioural repertoire, thereby making them more adaptable. My colleagues and I have tested this reasoning by implementing a mathematical model of the network of co-rulers of ancient Teotihuacan, central Mexico (Froese et al. 2014). The results show that periodic, widespread and simultaneous ritualised alteration of normal behaviours can implicitly restructure the social connectivity of the network until the most optimal behavioural configurations are spontaneously found in a consistent manner, even though individuals behave selfishly and no single individual

[1] In other words, I am not interested in merely terminological disputes regarding the term 'shaman'. Different definitions are possible. Nevertheless, given that it is reasonable to interpret traditional shamanism as a kind of expertise of managing ritualised interruptions of mundane mental life (González in press), it is indeed a convenient label for the practices I am discussing.

has an explicit intention to adapt their network to the problem domain. Again, the generality of the model should allow us to apply a similar reasoning to other heterarchically organised social groups, such as communities of San hunter-gatherers.[2]

To me these models suggest another intriguing possibility that deserves to be more fully developed: during the initial emergence and development of symbolic culture there may have been a mutually reinforcing feedback cycle of structural self-optimisation spanning both neurobiological and social networks. On the individual level, periodic induction of altered states could have enhanced neural coordination and facilitated abstract cognition, while on the social level that same interruption of normal behaviours could have improved the configuration of relations, leading to more co-ordinated social behaviours, which in turn could have encouraged the development of more complex culture, including more extensive ritual practices of mind alteration. Admittedly, this is a speculative scenario. But it has the virtue of integrating a number of insights into a theoretical framework, which helps us to make sense of the fact that starting from around 300 thousand years ago the pace of cultural development quickened exponentially, suggesting that the changes were increasingly autocatalytic (Ambrose 2001).

Response to criticisms

In response to our article on the implications of self-sustaining neural dynamics in a disinhibited visual system (Froese et al. 2013), Helvenston has above raised several concerns related to our supposedly 'naïve acceptance of the neuropsychological model' (p. ??) of Lewis-Williams and Dowson (1988). By this point I hope it is already clear to the reader that, while we are indeed broadly sympathetic to Lewis-Williams' appeal to the neuroscience of altered states of consciousness, our proposal is not 'based upon the neuropsychological model of Lewis-Williams and Dowson' (p. ??), and neither have we 'uncritically accepted the model as originally proposed' (p. ??).

In brief, that model relates some of the Upper Palaeolithic motifs to different classes of hallucinations. It is assumed that the symbolic mind was already put in place via a fortunate mutation of the brain; altered states of consciousness do not serve as more than a source of motifs; and the selection of specific motifs is made purely contingent on social norms. Conversely, our theory assigns a functional role to altered states in the emergence of the symbolic mind, and it provides neuroscientific arguments for why pre-Historic people should have come to value the contents of hallucinations in the first place (Froese et al. 2014a). In other words, the relationship between our proposal and the neuropsychological model is that we provide independent reasons for hypothesising that some palaeoart was indeed inspired by hallucinations.

Unfortunately, Helvenston decided to ignore these differences and the novelty of our proposal. Instead, she focused her concerns on her and Bahn's interpretation of Lewis-Williams' model, which they have termed the 'three stages of trance' model (e.g. Helvenston and Bahn 2003). It is true that Helvenston was not the first to criticise the neuropsychological model, but Bahn (1988) had certainly raised concerns at the time of its publication. Admittedly, it is sometimes confusing to grasp what the main point of contention is. As Helvenston herself states, in her collaborations with Bahn and Hodgson it was acknowledged that altered states were a theoretical possibility for people of the Upper Palaeolithic. In Helvenston's words: 'I completely agree […] that it is likely ASCs have played a large role in hominin evolution for far longer than 40 000 years' (p. ??). If so, then it would have been useful to know her theory of what that 'large role' was in order to be able to evaluate how it differs from existing proposals.

It seems that the dispute arises over some of the specifics of the 'three stages of trance' (TST) interpretation of the neuropsychological model. To evaluate these details, I have to briefly go over concerns that were already published elsewhere (Helvenston 2014), and to which my colleagues and I had already responded (Froese et al. 2014b), but which Helvenston (above) decided to bring up again.

First, she raises a general objection against 'Lewis-Williams and his acolytes [presumably including my colleagues and I] presenting a theory as if it were established empirical fact' (p. ??). I don't think this is the case. Presumably, it is clear to most readers that what is being proposed are hypotheses, theories and models, such as Lewis-Williams' 'neuropsychological *model*'. Helvenston's own interpretation of that model, i.e. her and Bahn's TST model, boils down to the following: 'The first stage consisted of hallucinations of geometric figures, followed by the second stage which consisted of geometric figures and some 'iconic images'; and the third stage consisted of iconic images such as humans, animals, complex architectural schemes, landscapes and therianthropes' (p. ??). She continues: 'What we have emphasised is that the specific *pattern* of trance described in the neuropsychological model, consisting of three stages, could only be induced by ingestion of psilocybin, mescaline and LSD' (p. ??). According to Helvenston this ignores the variety of possible altered states that are possible, and, more worryingly, threatens to completely disqualify the TST model:

> it is only a matter of time before evidence of plants containing mescaline and psilocybin will be found in Europe *if they ever grew there*. […] there is no evidence that any such plants ever grew in Europe and we have simply pointed this out as a serious problem for the empirical basis of the TST model. In our view, this fact refutes the model (Helvenston and Bahn 2004: 94–95).

To summarise the thrust of the argument: (a) if the TST sequential pattern is a necessary aspect of Lewis-Williams' model, and (b) if that pattern can only be experienced if and only if one of those three substances is consumed, and (c) if it can be demonstrated that none of them ever existed in pre-Historic Europe, then the neuropsychological model is certainly in trouble. But, as will become evident, none of these conditions can be taken seriously. Helvenston's strategy is a classic case of building up a straw man just to knock it down.

Regarding point (a), it is best to let Lewis-Williams speak for himself:

> These three stages of the intensified spectrum of consciousness are not ineluctably sequential. Some subjects report being catapulted directly into the third stage, while others do not progress beyond the first. The three stages should be seen as cumulative rather than sequential (Lewis-Williams 2002: 130).

[2] This is another interesting difference between the ritualised mind alteration hypothesis and the work of Lewis-Williams and colleagues. Whereas the latter have tended to emphasise the role of altered states in producing hierarchical social differentiation (e.g. Lewis-Williams and Pearce 2005), our model suggests that enhanced social co-ordination can also be achieved by ritualised mind alterations in which large parts of the community participate on relatively egalitarian terms.

So while his model does build on a general pattern or sequence of hallucinations, that pattern does not always have to be strictly realised. Accordingly, it is not surprising that Lewis-Williams does not 'stipulate any particular method or methods for the induction of altered states of consciousness' (2002: 134), nor does he focus on a specific form of alteration: 'I wish to emphasize the diversity of altered states of consciousness. […] We must beware of stipulating some naively simple altered state of consciousness as the shamanistic state of mind' (2002: 134–5). This nonexclusive stance makes sense because he is mainly interested in hallucinations as a source of motifs.

Points (b) and (c) are already moot points, given that (a) is not justifiable. But for the sake of argument let us assume we happened to always require a strict three-stage sequence. Then (b) must still be rejected because there are other ways of inducing that pattern than by means of those three chemicals. Helvenston may have already suspected this given her cursory dismissal of ayahuasca, since that brew actually produces a rather fitting escalation of hallucinations:

> As noted by many ethnographers, the effects of taking Ayahuasca follow a fairly stereotypical course. Some time after ingesting the drug, drinkers experience severe auditory and visual disorientation: they hear loud rushing sounds and see patterns of coloured light. […] This phase is often extremely frightening […]. It is, however, followed by more complex hallucinations, which become clearer and clearer: drinkers see distant and exotic landscapes and people (Gow 1988: 26).

Shanon (2002: 59) quoted this description in his comprehensive study of the phenomenology of ayahuasca as one that captures 'succinctly and accurately the overall flavour of the Ayahuasca experience as I myself have come to know it'. To be sure, this is just one additional example to the three acknowledged substances, which is based on a mixture of DMT and other compounds[3]. But there is no reason to assume that there couldn't be other compounds with similar effects, especially given the incredible variety of psychoactive plants that still await detailed phenomenological study (Rätsch 2005).

And then again, it is not even clear why we must restrict ourselves to only a consideration of chemicals. Couldn't sensory deprivation, such as encountered in deep caves or other situations of profound seclusion, have similar effects? According to Helvenston, the speleological literature does not support this possibility. Yet she herself points out precisely why the relative absence of relevant reports is rather meaningless for the discussion at hand: 'speleologists' experiences in caves are not analogous to sensory deprivation since they carry lights' (p. ??). In other words, to reproduce conditions of sensory deprivation in pre-Historic times, it would have been sufficient to remove light sources while in deep caves (or by putting on blindfolds, as Helvenston ironically suggests, which would in fact have allowed the effects of sensory deprivation to be enacted in external environments as well).

Given the inadequacy of a comparison between modern speleology and sensory deprivation, we need to turn to the relevant scientific literature instead. There the situation is unambiguous. There is no doubt that sensory deprivation can lead to a sequence of hallucinations from simple and geometric shapes to more complex and figurative scenes. Moreover, given the right circumstances, such experiences are not uncommon. For example, as Helvenston is forced to admit, in one such study 3 out of 14 participants reported experiencing a sequence of hallucinations consisting of geometric patterns followed by more complex visual imagery (Bexton et al. 1954). Other studies also occasionally found escalations in hallucinations (e.g. Zubek et al. 1961), as we have already discussed in more detail elsewhere (Froese et al. 2014b).

Here I will just briefly comment again on the more recent study by Merabet et al. (2004), because it is still being misrepresented by Helvenston. In contrast to her assertions, multiple geometric figures and animals (including lions!) were in fact reported. The participant who saw a triangle also experienced other patterns: 'images as well as flashes of light within a few hours of being blindfolded. He saw outlines of puzzle pieces that, while moving, "warped into other amorphous shapes" and transformed in colour from white to orange to red.' (p. 110). Subject 8 saw a fluid sequence of imagery: 'she reported seeing a butterfly that became a sunset, an otter, and finally a flower. She also reported seeing cities, skies, kaleidoscopes, lions, and sunsets so bright she could "barely look at them" ' (p. 111). Figurative images, including animals, were seen morphing into each other. Significantly, in 2 of 13 cases the hallucinations developed from simple patterns to iconic figures and complex scenes.

As we have argued previously (Froese et al. 2014b), Helvenston is right that we must distinguish specific hallucinations from altered states of consciousness, but the sensory deprivation experiments also revealed more general mind alteration. For example, Merabet et al. (2004) observed that the reports of subject 8 were evolving 'much as in a dream', and that 'she stressed the intensity of the hallucinations, commenting "sometimes they were much prettier, I think, than anything I have ever seen" ' (p. 111). This enhanced capacity for mental imagery was also found in another sensory deprivation study:

> The majority of the subjects reported that the images which they conjured up were of unusual vividness, were usually characterised by bright colours, and had considerable detail. All these subjects were unanimous in their opinion that their images were more vivid than anything they had previously experienced (Zubek et al. 1961: 89).

The fact that sensory deprivation has temporarily transformed the abilities of many participants, such that they could visualise fantasies and memories 'with almost picture-like clarity' (Zubek et al. 1961: 89), has direct relevance for explaining the savant-like realism of European cave paintings (e.g. Humphrey 2002). In other words, not only do we find several reports of the specific pattern of hallucinations, transforming from simple and geometric patterns to complex and figurative forms, the general capacities of the imagination can also become significantly enhanced. This is good news for the neuropsychological model.

I agree with Helvenston that larger sample sizes would be desirable, but at the same time it has to be recognised that having a dozen or so participants is not unusual for psychological and neuroscientific studies, such that sample size does not undermine these specific studies. And in any case, what is most important is that different hallucinations are reported in all of these studies, including some that can even be interpreted as variations of the TST pattern. Given that Lewis-Williams has never claimed that everyone in a pre-Historic community should be able to experience hallucinations in the same way, rather he assumes that there will be variability with some being more expert than others (2002: 134), even lower percentages of TST patterns would not have

[3] Interestingly, DMT is not exclusive to plants. It is endogenously present in the mammalian nervous system, which means that temporarily elevated levels could have already affected the first humans. It has been suggested that 'naturally occurring altered states of consciousness result from high levels of pineal DMT production' (Strassman 2001: 83). It would be interesting to further investigate under which conditions endogenous levels of DMT can be intentionally manipulated. For example, extreme stress has been put forward as one factor.

been a serious difficulty. Even only one expert in a band of hunter-gatherers would be fine. The more important implication is that even point (b)'s restriction to chemicals, as being the only way to induce the TST pattern, must be rejected.

But this is not all, as I will now show. Even if for some reason we happened to continue to hold on to points (a) and (b), we would still be forced to reject (c). As mentioned, this last point amounts to the claim that no plants containing one of three chemicals, i.e. LSD, mescaline or psilocybin, ever grew in Europe, and that this refutes the TST model (Helvenston and Bahn 2004: 94–5). This is an astonishing claim in several respects. To begin with, it is logically impossible to refute a hypothesis on the basis of absence of evidence (i.e. a lack of evidence for such plants), because that absence could just as well mean that we haven't found that evidence yet (a reasonable assumption, especially due to poor preservation of ancient botanical remains). What would be needed for a refutation is evidence to the contrary (i.e. that such plants could never have existed in principle), and to prove a negative is an extremely difficult undertaking.

What about the positive evidence for such plants? Admittedly, there is currently no reason to assume that mescaline-containing plants ever existed in Europe. In the case of LSD, the situation is a bit more intriguing, since that compound was derived from the ergot fungus, which does exist in Europe and which is known to produce hallucinations, too. But strictly speaking it does not contain LSD, so for the sake of argument we can exclude it as well.

That leaves us with psilocybin, which is known to currently exist in Europe in a variety of psilocybin-containing genus of fungi (Rätsch 2005). In addition to the famous genus *Psilocybe*, discussed by Helvenston, there are other genera of fungi with psilocybin-containing species in Europe, for example the well-known genus *Panaeolus*, whose recreational consumption is prevalent enough to have become a concern for government agencies (Chun-I et al. 2000). But again, for the sake of argument, we will restrict ourselves to a consideration of *Psilocybe* here. Importantly, although recreational usage of at least one such species growing in Europe, *Psilocybe semilanceata*, was already known in the 1970s (e.g. Pollock 1975/76), that important fact was not mentioned in the first critiques by Helvenston and Bahn (2003, 2004). Subsequently, they acknowledged existence of that particular species, but attempted to save their refutation by speculating that 'it may have been imported to the Old World after the conquest of the Americas, […], reaching Spain and Portugal around 1496 at the earliest' (2005: 31)[4]. Helvenston still tries to motivate this same argument: 'By analogy, since horses are now very prevalent in the Americas, it would be easy to suggest that they are indigenous. However, such an assumption would be incorrect since we have historical records documenting their introduction' (p. ??).

Yet the situation is not analogous. Consider the following: if we also knew of several species of horse that were only found in the Americas and nowhere else, then the most reasonable hypothesis is surely not that these species were also introduced but rather that they originated there. And that is precisely the case with the *Psilocybe* genus, of which several species are only known to occur in Europe (Borovička 2008).

But even if some species originated in Europe, what are we to make of the age of that event? Helvenston cites the expert mycologist Guzmán, who theorises that the genus *Psilocybe* may have originated in South America due to that region's greater diversity of species (Guzmán et al. 1998). Yet given that he is talking about an evolutionary timescale, this event is likely to have happened millions of years ago, sufficient time for the new genus to have spontaneously spread around the globe by means of dispersal of spores long before the arrival of humans.[5] This is consistent with the hypothesis that the pre-Historic Selva Pascuala mural, recently discovered in a cave in Spain and dated to about 4000 to 6000 BCE, depicts a species of *Psilocybe* mushroom (Akers et al. 2011).

Finally, if the real problem is just a matter of finding evidence for ancient psilocybin-containing fungi in Europe as such, as originally argued by Helvenston and Bahn (2004: 94–5), then the situation is empirically unambiguous. A genetic study of another family of fungi concluded there were 'a minimum of two independent transitions to a psilocybin-containing state, both of which occurred relatively recently during the Miocene between 10 and 20 million years ago, […]. All of these species are known only from Europe' (Kosentka et al. 2013: 7). We can therefore reject point (c) because psilocybin was present in pre-Historic Europe.

Conclusions

I have argued that there are several interdependent reasons for taking seriously the ritualised mind alteration hypothesis, i.e. the hypothesis that altered states of consciousness, and the hallucinations that can occur during such states, played a variety of specific facilitating roles in the emergence of the symbolic mind in early human pre-History. Importantly, socially orchestrated mind alteration could have supported the ontogenetic development of more detached and reflective cognitive processing, which in turn would have accelerated cultural evolution.

I have also taken a close look at Helvenston's criticisms and found them mostly unconvincing. Even if we give her the benefit of the doubt and entertain her restrictive interpretation of Lewis-Williams' neuropsychological model as the three stages of trance model, under which she has also tried to subsume my research, there is little to be worried about. Psilocybin-containing fungi existed in pre-Historic Europe since millions of years ago, and in any case the three-stage sequence of hallucinations, i.e., a transition from simple geometric to figurative imagery, could also have been ritually induced using only sensory deprivation techniques. That such techniques can enhance visual imagination is a bonus. In sum, although Helvenston has only built a straw man out of Lewis-Williams' model, she has even failed to undermine that impoverished interpretation. Moreover, in combination

[4] Amusingly, Helvenston and Bahn also state that they had been 'unable to find evidence of spoors for this species in data bases of ancient fauna in Europe' (2005: 31). Their likelihood of success would certainly increase if they would search for evidence of *spores* in databases of ancient *fungi*, or at least of *flora*.

[5] To confirm whether this interpretation is correct I contacted Prof. Guzmán. He wrote (pers. comm.) that he believes the genus *Psilocybe* with its hallucinogenic species to have first originated in Gondwana. The genus subsequently evolved new species while it migrated northwards to Pangaea. He wrote that it is difficult to estimate when it arrived in that northern hemisphere, but agreed with me that it may have been during the Miocene epoch. I note that Gondwana was an ancient southerly supercontinent, which included today's South America and which later became part of the supercontinent Pangaea, including what would later become Europe; the Miocene epoch is typically dated to roughly between 23 and 5 million years ago. Prof Guzmán's assessment therefore unambiguously contradicts Helvenston's proposal that the genus *Psilocybe* was only recently introduced into Europe by means of modern human migrations. On the contrary, he is referring to its past in geological time scales.

with the new ritualised mind alteration hypothesis I have outlined in this article, the general hypothesis that altered states of consciousness played a crucial role in the origins of palaeoart is more compelling than ever.

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