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Editor

# Dream Consciousness

Allan Hobson's New Approach to the Brain  
and Its Mind



I also agree with Hobson's defense of the emotional congruence of dreams. In most (if not all) dreams, the signal of the emotion is appropriate to the dreamed events. On the other hand, I do not agree that one's regular waking experience is emotionless. We are fortunately spared large emotional upheavals for long stretches of daily living, but I believe there is a continuously fluctuating state of background emotion and feeling. I regard the complete absence of that emotional background as pathological.

Another suggestion of Hobson's that I especially like is that REM sleep dream states resemble the hallucinatory states of awake individuals in whom consciousness is usually regarded as normal. This has important implications for research on the psychoses.

Let me now turn to Hobson's use of REM sleep dreams as a basis for an account of the origins of consciousness. Here, I agree with the notion that dream consciousness is likely to be a less evolved stage of consciousness than standard wakeful consciousness. However, I resist Hobson's idea that dreams represent the bottom level of the consciousness process, that they are the protoconsciousness, as he calls it. If I understand his idea correctly, the earliest conscious mind states would be dream-like and would mark the very evolutionary beginning of conscious mind processing. My resistance to this comes from the fact that I see the beginning of consciousness as occurring far earlier in biological history and in physiological level. I see protoconsciousness as coinciding with simple events that I describe as primordial feelings. Primordial feelings, in my account, regard the representation of ongoing states of the organism. Such feelings manifest existence, in a powerful way, but they lack the rich imagetic contents of dreams. They are not connected to the representation of external objects and events.

As for the anatomical and physiological level associated with the content of dreams, it is certainly that of the cerebral cortex working in partnership with subcortical structures. This is not so for the primordial feelings that ground my notion of protoconsciousness. They originate at the level of the humble brainstem and hypothalamic nuclei.

In conclusion, I agree with Hobson that dream states probably represent fore-runners of standard conscious mind states. I also agree that they probably stand for a stage in the evolution of conscious processing. But I prefer to think that dreams are not the most primitive of conscious states. I place protoconsciousness at a level far more modest than that of dreams.

## Chapter 11 What Is Dreaming for, If Anything?

Daniel C. Dennett

One of the charges leveled against adaptationism (most famously by Gould and Lewontin 1979, in their attack on "just-so stories") is that we adaptationists jump to our "panglossian" hypotheses without due consideration, let alone testing, of alternative explanations of the phenomena under discussion. The charge is not without merit, but I have always viewed it as pointing to a foible of adaptationists, not a fundamental flaw in adaptationism. So as a devout adaptationist, one of my duties is to police the brethren for just such lapses. Allan Hobson provides a nice instance, since he is cautious and circumspect in his consideration of the claim that dreaming has an important function to perform, and then he *still* overlooks or underplays alternatives. First, I will note what Hobson has to say about the (apparent) function of dreaming. Then, I will list just a few alternative hypotheses, to illustrate my point, and ask whether Hobson has given us any evidence that rules them out. According to Hobson:

It makes good sense to prepare the brain for subsequent waking and the physiology of REM sleep manifests abundant signs of an activation state favoring the massive and parallel connectivity essential to the binding of the multiple cognitive processes that are required to explain the extraordinary unity of waking consciousness. For this reason, I refer to REM sleep dreaming as a proto-conscious state.

It does indeed "make good sense" but that is not enough. We need to see that disrupting/removing REM sleep has a deleterious effect, and even showing that would not be a slam dunk for function, since however we suppress REM, it may be a side-effect of suppression, rather than the lack of REM, that causes whatever decrement in cognitive competence we observe. What we really need is an account of just what REM sleep does to "integrate" the brain, and that could only be speculative at this time. It is certainly tempting to suppose, as Hobson does, that

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REM sleep constitutes an elaborate program for sensorimotor integration, emotion evocation, and scenario construction. It may be hard to prove but it is hard to believe that these features are not in the service of waking consciousness. The fact that this state recurs every night of our lives underscores that assertion.

It underscores the assertion, but leaves plenty of room for alternatives. For instance:

- (a) Dreaming in infancy has a function, but dreaming in adulthood is simply a vestige of a phenomenon that did indeed play a crucial organizing role in the early days of every infant's (or fledgling's) neural development. What function? REM in the womb is (roughly) what Hobson says REM is in the adult: the spontaneous, endogenous activity that shapes functional structures in the absence of current sensory input, a sort of practice perception off-line that helps prepare the neophyte brain for the real world. But once the brain has a regular diet of sensory input to structure it, the off-line activation becomes obsolete but is harmless and so not worth suppressing. It recedes in duration to only 1.5 h a day on average, a fraction of its duration in infancy. On this hypothesis, adult dreaming is rather like adult thumbsucking, a functionless habit that was itself a byproduct of an infantile imperative of considerable functional importance.
- (b) Same as A, except that REM is not in fact so functional during infancy and gestation. It is simply that the brain gets "turned on" in development before it has anything to work with, so it idles vigorously, not doing any harm, but also not doing much if any pre-birth organization, having so little to go on, aside from quite a lot of auditory, tactile and vestibular input.
- (c) REM could also be, as Hobson suggests, a byproduct of some neural process involved in thermoregulation. The fact that it has evolved twice is an important datum, but we should be cautious about leaping beyond "byproduct" to "function." Again, we'd want to know *how* REM supported thermoregulation before taking this giant step.

We also need to be cautious about back-extrapolating our connotations of adult dreaming onto the infant and fetal phenomena—a sort of intraspecific anthropocentric bias! Just because we human adults report dreams that are brimming with fascinating content is not a particularly good reason to infer that infants (or birds) are "enjoying the show" during their REM periods. But on what grounds, other than bloody-minded philosophical skepticism (more on that below), would lead us to reserve judgment about infant *experience* during their REM periods? For one thing, the existence of a feedback loop between (adult) human communication and REM, nicely established by Hobson. As he notes, it is quite possible to train yourself to have lucid dreams, or to wake up and write down dream narratives when they occur. This loop is of course entirely absent in dogs and birds and other languageless REMsters, including pre-linguistic human infants. How could this capacity to be trained have arisen in prehistory and how could it have shaped the phenomenon of dreaming in turn? Here is one way in which dreaming (with content, with narratives, as a proto-conscious experience) could have evolved:

In phase one, there is REM sleep, as described in A or B, and it has some interesting side effects in our ancestors once they begin to develop language: youngsters occasionally blurt out words or longer fragments of speech on awakening (or they talk in their sleep) and their parents respond with interest (curiosity and concern) and this creates the feedback loop that encourages further such blurring, which elaborates and crystallizes over time into dream reportage. There might be a long period (phase two) when only a few people ever exhibit these symptoms even though they all have REM sleep. During this phase there would not be a word for "dream" or a concept of dreaming, and it would be a bit of a stretch to say that dreaming was, already, a phenomenon in this early human world, not just because they didn't have a word for it, but because the feedback loop was not yet well enough elaborated to generate anything worth calling dreams. In a similar spirit, we can envisage a time when our ancestors had not yet managed to invent/discover the phenomena of *homesickness* or *fame* or *war* or *pornography*.

From this perspective, which could be fleshed out in a variety of ways, there is a significant amount of content shaping by the demand characteristics of parental (and then self-) curiosity, not unlike the *folie à deux* elaborations of what used to be called Multiple Personality Disorder but is now officially known as Dissociative Identity Disorder (Humphrey and Dennett 1989). The reward (to put it crudely) of attention can, as Hobson shows, reach down beneath the surface of verbal expression and begin to modulate the processes that feed verbal expression, opening the floodgates to more and more *tellable* dreams. So we would have something of a continuum between REM episodes with no organized content at all, REM episodes that create vague content-laden hunches, emotional squalls of one flavor or another, for instance, and on to fully ripened dream experiences. The capacity to "recollect" dreams would thus be an artifact of cultural conditioning rather than a functional enhancement of an underlying functional process. Dreams wouldn't have to be *for* anything—except for telling, and that activity could be a culturally infectious habit, harmless and even entertaining, and hence hard to extinguish.

It would be true of any of these hypotheses that children in learning to speak also are learning to dream, a process in which the opportunity/task of recalling their dreams when awake plays an encouraging role. Then cultural evolution or contagion could take over, and we're on the yellow brick road to seers and shamans, prophets and interpreters, Jung and Freud.

This brings us close to Hobson's challenge to me to clarify my position on Norman Malcolm's notorious hypothesis about dreams. A re-reading of my 1975 paper "Are Dreams Experiences?" (Dennett 1978) shows that I never defended Norman Malcolm's "hypothesis that dream reports reflect mental activity associated with the awakening process rather than antecedent REM or NREM sleep physiology." (Hobson, personal communication) Rather, I used Malcolm's outrageous but ingenious proposal to expose some of the otherwise tacit and underappreciated assumptions that must be taken on board by dream researchers—assumptions that Hobson and others have indeed committed to, without, perhaps, recognizing that they subtly undermine some "common sense" ideas about dreams and indeed all conscious experience.

Chief among these, no doubt, is the quite standard image of dreams as experiences that occur in strict narrative sequence, quite like a movie running in the head

while the sleeper has REM. The fact that on awakening dreamers *report* such putative episodes is undeniable, but not as conclusive as some would suppose. There are, for instance, temporal anomalies (from the point of view of this standard image), and these appear paradoxical *until* you abandon the standard image and acknowledge that the temporal properties of neural events and the temporal properties *represented* by neural events are entirely independent, in principle, no matter how closely yoked they are *in waking life*—aside from such interesting and telltale cases as *color phi*, *metaccontrast* and the *cutaneous rabbit* (Dennett 1991). The basic physics of living in the world, with events occurring not just in sequence, but continuously, without major hiatuses or leaps in time and space, disciplines our everyday waking perception by imposing deadlines for behavioral control. This is a major feature of conscious experience, and dream processes, occurring under a more relaxed regime, need not obey these constraints. These processes still must reside in the evolved, trained machinery of the perceptual systems of the brain, and here Hobson's model of a partly chaotic, noise-driven (instead of information-driven) elaboration of normal perceptual analysis processes is a nice confirmation and detailed elaboration of my sketchier version, in the prelude, "How are Hallucinations Possible?" to *Consciousness Explained* (Dennett 1991, esp. pp. 10–16.)

Hobson stresses, and I concur, that the line between conscious and proto-conscious or non-conscious is not to be drawn in a principled way. That *in itself* is such a departure from everyday thinking about consciousness and experience that Malcolm stands almost vindicated, if we interpret him as defending the thesis that dreams are not experiences *in the ordinary sense of the term*. (Remember, he was an Ordinary Language philosopher writing in 1959.) I do not want to defend Malcolm's antique view (Malcolm 1959), since the last half century of research, especially by Hobson, has deepened our understanding tremendously, and Malcolm was blinkered by his verificationism. As I noted in 1975, Malcolm hugely underestimated the power of models and theories (Dennett 1975). My brand of verificationism is, I think, more supple, and more attuned to the demands of actual science: we must be cautious when the urge arises to export conclusions *couched in ordinary language* from scientific investigations. Hobson is cautious; he recognizes that he has a considerable diplomatic task confronting him, clearing away the rubbish of several obsolete creeds that still impede communication: the "functional vs. organic" dichotomy, the anti-neurophysiological bias of many psychologists and therapists, and the granddaddy of them all: Freud. I applaud his polemics against all these prejudices, but I do wonder sometimes whether he has outlived his adversaries. Are there really influential Freudians still out there dragging their heels? Since in the field I know from the inside, philosophy of mind, I see Hobson sometimes pounding on an open door, I have some grounds for this suspicion. Brain-mind unification has pretty well gone to fixation among philosophers, with dualism now the renegade position, the outlier—which means, I fear, that a few young philosophers are tempted to endorse it just to be naughty and notorious (such is our field, alas).

In general, Hobson's philosophical views on the nature of the mind and consciousness would be welcomed as reassuringly mainstream by my fellow

philosophers. They ought to be discomfited, however, by a few signs in Hobson's essay of what I think of as overgenerous applications of the principle of charity. In several instances Hobson takes himself to be addressing philosophers' concerns when in fact his comments, sound in themselves, don't reach any targets in philosophy land, only because philosophers are not talking about anything as interesting as the topic he is discussing. They are talking about a trivial artifactual puzzle of their own devising. For instance, Hobson's "Hard Problem" is not the philosophers' Hard Problem, thank goodness. The philosophers' Hard Problem is couched in such a way that no amount of brilliant theory about how the brain accomplishes one cognitive competence or another even *approaches* it. (Roughly, any problem you can solve is, by definition, one of the easy problems! The philosophers' Hard Problem systematically eludes all of cognitive neuroscience. Enough said.) Another instance that makes me cringe is his remark about "Dennett's zombie country." No, philosophers' zombies are *not* like "automatons" as Hobson imagines—those are the zombies of folklore. Philosophers' zombies are a much sillier idea: folks who are excellent company, lively, creative, lovable, as knowledgeable and sensitive as you could want—but *there's nobody home*. (This is well nigh impossible to imagine, but many philosophers have persuaded themselves that they can imagine it, and that their ability to do this feat of imagination is a Major Problem for the sciences of the mind.) When I inveigh against the Zombic Hunch (Dennett 2005), I am not criticizing the idea of automaton-like elements in our brains; I actually support that idea in detail (cf. Christof Koch's proposals on this score). Hobson doesn't in fact have anything to say about philosophers' zombies, I'm happy to report, since the topic is too embarrassing to merit consideration.

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# Chapter 44

## Lecture III: Philosophy

J. Allan Hobson

William James might have been pleased, were he alive, to see so many of his philosophical descendents so vigorously involved in a discussion of dream consciousness – a topic he treated surprisingly little. Taken all in all, I think a good case can be made for a return to the pre-Jamesian spirit of “natural philosophy,” where that term denotes the application of critical thought to the science of phenomena. One does not have to be a professional philosopher to be a natural one and professional philosophers need neither eschew nor ignore the nature that attracts experimental scientists.

Many of the commentaries on my Dream Consciousness lectures reveal a gratifying commitment to the integration sanctified by William James. Mind-brain integration involves an encouraging degree of boundary crossing. Some of the best examples of fearless boundary crossing are given by commentators Allen Braun and Antonio Damasio, both neurologists who are not afraid of psychiatry and philosophers Thomas Metzinger and Jennifer Windt who immerse themselves in ego science – and even collect experimental data about it. Thanks to fearless peers like these, specialist fields are united in what can properly be called natural philosophy. Metzinger and Windt share an interest in the “phenomenological self” and are thus sensitive to my protoconsciousness model’s self-as-agent concept. I have long believed that a more critical look at self-representation in dreams was in order. Perhaps the time for such a study is now.

Contributions to this discussion might have included philosopher Owen Flanagan (who was very enthusiastically engaged in the discussions in Vienna) and the Dean of Neurophilosophy herself, Patricia Churchland. I am confident that this volume will receive their blessings in the sad absence of their written commentary. Other more understandably absent friends include John Locke and Immanuel Kant, whose deaf-because-dead ears might be imagined to burn with

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disdain and pleasure respectively, as we name them. The dreaming brain says that it has *a priori* knowledge and that it is anything but a *tabula rasa*. It would have been nice to have contributions from Karl Popper (Do you still think that psychoanalytic theory is not scientifically testable?) and John Eccles (Do you still believe that dreaming results from a separation of mind from body?). Would Sigmund Freud have accepted an invitation to answer the question? (Is your 1895 Project for a Scientific Psychology now within our grasp?) Such thought experiments are in the tradition of philosophy.

As usual, Dan Dennett gives us the best of philosophical thought itself with his dazzling display of alternative speculations about the mechanism and function of dreaming. He is quite right to mention a myriad of other ways of looking at these data but I have both moral and intellectual discomfort with some of his suggestions: first, I suppose that REM deprivation of infants and fetuses is both impossible and morally reprehensible so that direct test of the protoconsciousness hypothesis is not, unfortunately, available. I argue for the plausibility and explanatory power of my theory. My second concern is with the plausibility of Dennett's own suggestion that the persistence of REM and dreaming in adult life is a functionless appendage (like the appendix in animals that no longer munch grass). The demonstrated utility of the REM sleep enhancement of procedural learning clinches this point empirically. We may no longer munch grass but we must husband energy and body temperature.

These are as strong data as any that Charles Darwin could adduce in direct support of his theory of evolution, a theory that Dennett rightfully admires. I have similar reservations about Flanagan's charming "spandrels of sleep" theory of dreams. While a part of me is sympathetic with the implied epiphenomenalism, I suffer nagging doubts about dismissing the mind's causality, a topic which I treat separately below.

Dennett stops short of engaging in experimentalism himself and wisely sidesteps the blandishment of endorsement and the straightjacket of yes and no answers to questions. The Dennett commentary shows that philosophy is a very free country and I am happy for that.

More narrowly construed, philosophy comprises logic and epistemology. Taking the second component first we can take satisfaction that there is an increasing reliance by epistemologists on experimental evidence (John Searle is a good example) and there is widespread recognition that philosophy of mind cannot advance without neurobiology. I have already asserted that psychology cannot afford, any longer, to go it alone. In the following section I earmark my own scientific logic and strategy for closer attention by philosophers and then close with a discussion of the science of function, an important concern of any natural philosophy.

#### 44.1 The Formal Mental Status Paradigm

It was a great disappointment to me that so few commentators either praised or criticized the formal mental status approach that I have used in my psychophysiological studies of dream consciousness. Thomas Metzinger and Jennifer Windt

seem to understand why I take the formal rather than the content-based approach. Perhaps I should have directed Michael Schredl's critical attention to the formal strategy so widely applied by me in the dream psychology data summarized in Table 1.1. The precedence of form over content in humanistic as well as scientific studies is emphasized by the art historian commentator, Hellmut Wohl, who made this point in his own work long before he collaborated with me. Nor was any comment made by philosophers about my invocation of brain-mind isomorphism. I freely admit that my opening lecture is anecdotal in its formal analysis of a single dream report. It was designed to illustrate rather than convince. I hope that Daniel Dennett and Antti Revonsuo will let me know whether they accept my arguments in favor of the formal treatment of dream reports.

#### 44.2 The Sleep Lab: A Cloudy Lens?

I encourage the development of home-based approaches to dream science because I regard the home as a more commodious and natural place to sleep and because, having slept in the lab as an experimental subject, I know at first hand how difficult it is to wake up on demand and how suggestible are the sleep-fogged minds of even young experimental subjects (and an additional problem is that most experimental subjects *are* young). This means that even the half-baked conclusions of the first half-century of dream science are age biased and heavily so. My reasons for optimism about field work in dream science are given in Fig. 2.3 and Table 2.1. No one commented on this serious issue so I will now state clearly that I believe a new initiative of this kind to be essential. The good news is that such an initiative leads itself to college and even high school student and faculty participation in dream science.

Home-based studies are admittedly invasive but they are inexpensive and interesting to carry out. With funding agencies channeling their resources into high tech studies of everything (including REM) there is little hope for support in a field that has been officially considered to be outside the bounds of science. This is unfortunate because it is now possible to imagine a reconstructed, brain-based approach to psychodynamics making itself useful and self-instructive here. The commentaries of Braun and Damasio make this point indirectly but clearly.

Modern psychotherapists (and there are thousands of them) can join this scientific endeavor by training themselves and their patients to get on board. I hope to live long enough to make my views known to young clinicians. Meanwhile I commend the book, *Night*, by the London-based author, Al Alvarez who slept in a sleep lab and describes his own confusion when experimentally awakened (Alvarez 1995).

### 44.3 Energy and Information Regulation

The old wives' advice about getting a good night of sleep (implying a much needed rest) is pop psychology in search of science. This search was long ago undertaken by the great German scientist, Hermann von Helmholtz. Helmholtz beat Freud to the punch, even in terms of dream theory, by enunciating the doctrine of free energy in the mid-nineteenth century. Part of that theory, the prediction of the sensory effects of movement, is relevant to protoconscious dream theory as Helmholtz makes clear in ten trenchant pages in his masterful book entitled *Physiological Optics* (von Helmholtz 2000).

When Jack Nelson studied the lateral pontine tegmental cluster of PGO burst cells, I recognized the relevance of those findings to Helmholtz' idea of feed-forward excitation from the motor to the sensory side of the visual system. This is where Rodolfo Llinás comes in. His commentary does not do his book (Llinás 2001) justice but Karl Friston honors us with a typically sophisticated commentary about the importance of Helmholtz' free energy theory. Friston and I agree that a surprising possibility is that sleep (and especially REM sleep) helps the organism to regulate brain temperature and, at the same time, allow the brain to predict and correct the errors of visual information acquisition (Hobson and Friston 2012).

Who would ever have guessed that dreaming was our subjective experience of so functionally significant a state? Protoconsciousness theory does its best to show why these disparate parts hang together. It is indeed pleasing to see us moving closer to a view of sleep and dreaming that comprises both energy and information. We cannot say what the mind consists of – is it particles or is it waves or neither – but we are no worse off than physicists who grapple with space, time, and the structure of matter. In fact, we might well echo the *Elegy Written in a Country Churchyard* by Thomas Grey: If ignorance is bliss, tis folly to be wise.

### 44.4 Creativity

Creativity (including artistic, literary, and scientific originality) is at least as functionally adaptive as our tendency to mystical explanations that arise from our religion-minded brains. Allen Braun tells us in his commentary that improvisational jazz musicians deactivate their frontal cortex when they are in a creative zone in waking just as they do when they are dreaming. At the same time that the dorsomedial nucleus goes dark, the nearby mediodorsal nucleus lights up. This finding, however preliminary, is relevant to two aspects of dream science. One is that dreaming itself is creative (as Hellmut Wohl asserts in his commentary); the other is that aspects of dreaming can be enhanced in waking (just as Ursula Voss' commentary on dream lucidity indicates that aspects of waking can be enhanced in dreaming). This double reciprocity affirms a strong claim of protoconsciousness theory: waking and dreaming are both hybrid states and that their hybridicity can be

manipulated to functional advantage. We can condition ourselves to be less fearful in nightmarish sleep and more artful in unimaginative waking. These are both functionally significant possibilities which dispense with alcohol and drugs as they require only autosuggestion.

### 44.5 Cortical Rewiring, Protoconsciousness, and AIM

A mechanism for achieving plastic changes, including the plastic changes needed to condition learning or to create new forms of cognition, is provided by the science described in the commentaries of Braun, Damasio, Dresler and Tononi. Dream science may thus hold the key to understanding these important functional advantages and give sleep research pride of place in this domain. At first counterintuitive, it now seems natural to suppose that clearing the decks for action may well be facilitated by shutting down inputs and outputs (I) and changing the neuromodulatory chemistry (M) while at the same time activating (A) the cortex and thus simulating but not actually instantiating waking. These considerations are relevant to Revonsuo's and Noreika's suggestions about threat avoidance rehearsal and even inform Crick and Mitchison's suggestion (Crick and Mitchison 1983) that we dream in order to forget. David Hartley would sit up in his grave at the sound of such music.

The bottom line is that radical cerebral housekeeping may be going on while we lie, outwardly unconscious, in our beds at night.

### 44.6 Is Consciousness Causal?

Whether subjectivity causes anything physical to occur is obviously the first and last question on all of our minds. We might well say, with William James, that "I will believe in free will by way of showing that my will is free." But this famous tenet of pragmatism is not scientifically satisfying because it is, essentially, a religious belief and today we are not as tolerant of religion as James was in 1890. We have greatly improved our scientific capability to the point where we can reopen Freud's 1895 *Project for a Scientific Psychology*, but the consciousness-as-causal is today much more in doubt than it was at end of the 19th century (Freud 1895).

Commentators wisely skirted this puzzle. I am not entirely happy with acceptance of the implications of the negative experimental data of Libet and Wegner (Libet et al. 1983; Wegner 2004). One way out is to suppose that the physical and psychological domains are separate but equal parts of a unified bi-modal system in which case both domains are causal even though there may be time delays in uniting the psychological domain with the physical. It is very difficult to assume that consciousness has no consequential effect on behavior. This is not only a hope

that conscious will is not a useless subjective illusion. It is also a scientific concern. If consciousness itself is not causal, then what in the world is it for?

Can dream science help us solve this vexing problem? I think so. A robust truth is that the will, be it illusion or reality, is state dependent. In dreams, our will is dramatically weakened along with other executive ego functions. This is one reason for Owen Flanagan's view of dreams as mere spandrels of sleep. A central aspect of lucid dreams is the restoration of will (or the illusion thereof) suggesting that the frontal lobes mediate voluntary decision making as their pre-motor anatomy might suggest. Believe it or not, volition has yet to be operationally defined and systematically investigated in relation to sleep and dreaming. This astonishing oversight must be redressed, and soon! It certainly can be using the concepts and methods of the protoconsciousness paradigm. The way in which the immaterial mind may exert a causal effect upon the material brain has recently been detailed (Hobson and Friston 2014).

The measurement of conscious will in waking and dreaming might help skeptical critics better understand and appreciate the power of the protoconsciousness paradigm. I know from personal conversation that Antti Revonsuo, one of my most outspoken and respected critics, is sure that dreaming of threat avoidance is essential to the efficacy of fight-or-flight dream rehearsals. I was initially skeptical of Revonsuo's assumption about the causality of subjective experience of dreams and only introduce this anecdote to make a final point: we still have much to learn from the study of dream consciousness. I hope that protoconsciousness theory helps that to happen.

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