

Primary and secondary consciousness during dreaming

Commentary on “The neurobiology of consciousness: Lucid dreaming wakes up” by J. Allan Hobson

Don Kuiken

Department of Psychology, University of Alberta, Canada

Summary. Hobson (2009) proposes that lucid dreaming can become simultaneously and separately manifest against a background of non-lucid dreaming. The study of such state conjunctions, he suggests, sets the stage for a revolution in the neuroscience of consciousness. However, while lucid dreaming may indeed represent the emergence of what Edelman (2004) calls secondary consciousness amidst the primary consciousness characteristic of non-lucid dreaming, Hobson does not thoroughly address the form of self-regulative functionality that is already present in non-lucid dreaming. The result is single-minded consideration of rational agency and control (executive functions), rather than consideration also of the self-regulative functionality that is evident in non-lucid dreaming independently of secondary consciousness. Research procedures that reflect self-regulated but fluid openness to “what comes” during non-lucid dreaming are discussed, with particular emphasis on the study of REM sleep carry-over effects and their potential for exploring the metaphoric aspects of non-lucid dreaming.

1. Primary and Secondary Consciousness during Dreaming

For anyone involved in dream studies during the past 30 years, the tone of Allan Hobson's (2009) orientation toward lucid dreaming is familiar. Challenging and even hyperbolic claims are followed by measured and complex proposals—although the latter are sometimes difficult to keep in perspective. It is easy, for example, to recover the complex character of lucid dreaming when it is initially described as “paradoxical” (self-contradictory?), and, immediately after, more carefully described as the partial conjunction of two usually distinct mental states (p. 41). And, it is easy to recover the complexity behind the pre-sleep “autosuggestion” to which lucid dreamers are “susceptible” (p. 41) when that is followed by reference to execution of Arnold-Forster's not-so-hypnotic instructions for attaining lucidity (p. 42). However, while the progression from overstatement to moderation may sometimes serve a rhetorical function, at other times the expected moderation is difficult to discern—or, it seems, not available.

Such overstatement is evident in Hobson's now familiar argument that dreaming provides a “model” for psychopathology (p. 41). On the one hand, his terminology seems innocent enough. Just as it is possible to have an animal

model of anorexia without pretending to explain the full complexity of its human form, so might it be possible to regard REM dreaming as a model for hallucinosis without pretending to explain the full complexity of in vivo hallucinations. But, Hobson seems determined to retain the more strident claim: he argues that “to hallucinate with our eyes open, we have only to run the REM sleep dream image generator during waking” (p. 42). The word “only” shapes the hyperbole; running the REM sleep generator during waking describes precisely what that hallucinatory symptom “is.” There is no suggestion that the model is actually an analogy or that a more complex analysis is required for either waking hallucinations or REM dreaming.

In this rhetorical context, strong claims about lucid dreaming warrant careful scrutiny: Hobson argues that lucid dreaming provides a “model” for the emergence of what Edelman (1992) called secondary consciousness, or, in Hobson's words, “awareness, self-reflection, and decision-making” (p. 43). According to Hobson, primary consciousness, which becomes evident as dreaming, occurs simultaneously but separately from lucidity, which becomes evident on occasion as awareness, self-reflection, and decision-making during dreaming. The isolation of secondary consciousness in studies of lucid dreaming, he argues, may enable a “revolutionary” turn in neuroscientific studies of consciousness. Although the language of revolution seems immoderate, it is appropriate to consider some of the ways in which his vision might be usefully modulated. Whether Hobson would accept the kind of modulation I will propose is difficult to determine from the discussion provided in his brief paper. Hopefully he will consider the following as a convivial elaboration of some selected aspects of his revolutionary venture.

Corresponding address:

Prof. Dr. Don Kuiken, Department of Psychology, P217 Biological Sciences Bldg., University of Alberta, Edmonton, AB T6G 2E9 Canada.

Email: dkuiken@ualberta.ca

2. Functions of Primary and Secondary Consciousness

I have repeated Hobson's phrase "awareness, self-reflection, and decision-making" because, if it expresses his conception of the functions of secondary consciousness in dream lucidity, his analysis remains problematic in some important respects. To begin, his description of the absence or presence of awareness, self-reflection, and decision-making during dreaming is not entirely congruent with Edelman's distinction between primary and secondary consciousness. According to Edelman (2003, 2004), animals with primary consciousness integrate perceptual and motor events with memory to construct a multimodal scene in the present, what he calls the "remembered present." Animals with only primary consciousness can only respond adaptively to scenes constructed within this remembered present. In contrast, animals that possess secondary consciousness can go beyond the limits of the remembered present and reflectively consider past history, future plans, and, importantly for Hobson's purposes, consciousness of being conscious. Thus, among animals with secondary consciousness, the self that emerges becomes "nameable to itself" (Edelman, 2003, p. 5524).

In his adaptation of this theoretical framework, Hobson circumvents Edelman's proposal that language distinctively shapes secondary consciousness. Instead, he acknowledges that linguistic competence is manifest in both lucid and non-lucid dreaming—and, by implication, in both primary and secondary consciousness. Also, Hobson does not address Edelman's proposal that the role of long-term memory in primary consciousness is the "integration of a scene around a small interval of time present" (Edelman, 2004, p. 77). Something less obviously present-centered characterizes dreaming: during the sensory blockade of typical REM dreaming, long-term memory integrates an imagined scene that is largely independent of time present. The imaginative construction of such absent situations might be expected only within the context of secondary consciousness (cf. Foulkes, 1999), although Hobson does not address this possibility. Nonetheless, the preceding issues will not be made focal in the present commentary. Hobson might well discuss them, if he hasn't already, in other contexts. Instead, I will concentrate on what seems a more difficult problem in his understanding of the functions of primary consciousness—because I think it is more important for the future of his proposed neuroscientific revolution.

Because the "rich" subjectivity characteristic of secondary consciousness is the focus of Hobson's concern in his discussion of dream lucidity, he says comparatively little about the functions of the dream self that inhabits primary consciousness. As background, according to Edelman, animals with primary consciousness consistently receive information from the bodily systems concerned with motoric and homeostatic control within the remembered present (Edelman, 2004, p. 133-134). In other words, they have a self that is comparable to the transient, here-and-now, "core self" described by Damasio (1999). Edelman further proposes that animals with secondary consciousness are capable of being conscious of their consciousness; by linguistically representing their memories of such consciousness, they acquire a remembered history, an anticipated future, and an identity. The consciousness of consciousness that is pivotal in these developments is comparable to Damasio's

conception of an "extended self," i.e., a non-transient, autobiographical reflectiveness.

Although Hobson refers summarily to the self of primary consciousness, the language of his description reflects dream content rather than function ("a strong sense of self, of self-as-agent, and movement of that self-agent through a perceptual space"; p. 43). In contrast, when he refers summarily to the self of secondary consciousness, the language of his description indicates how the lucid dream self functions by providing "awareness, self-reflection, and decision-making" (p. 43). Similarly, Hobson leaves unclear in this account the neural networks that support the self of primary consciousness—as though there is no specific neural substrate for the self of non-lucid dreaming (see also Hobson, Pace-Schott, & Stickgold, 2000). In contrast, he clearly specifies the dorsolateral prefrontal cortex (DL-PFC) as the substrate for the self of secondary consciousness. Failure to specify the functions and underlying neural networks for the self of primary consciousness is especially important because of evidence that some aspects of the awareness, self-awareness, and decision-making emphasized by Hobson occur independently of secondary consciousness. Specifically, although it is commonly assumed that the cognitive control functions associated with prefrontal cortices (e.g., self-monitoring, conflict detection, and response inhibition) require secondary consciousness, van Gaal, Ridderinkhof, van den Wildenberg, and Lamme (2009) have found that these self-regulative activities can occur independently of consciousness of consciousness. Because these self-regulative activities can occur independently of consciousness of consciousness, it is important to clarify whether they function differently under those conditions and, then, to determine whether those altered functions also are mediated by activation of the DL-PFC.

3. Cognitive Fluidity and Primary Consciousness

If typical non-lucid REM dreaming reflects primary consciousness, Hobson's argument that typical non-lucid dreaming is accompanied by de-activation of the DL-PFC becomes pivotal. Hobson construes such de-activation as a deficit: de-activation of the DL-PFC is isomorphic with the absence of "self-reflective awareness and volition" (p. 43). However, typical non-lucid REM dreaming may involve another form of self-regulative activity that is not isomorphic with activation of the DL-PFC. There is evidence that the subtle self-regulation characteristic of musical improvisation is supported by the same pattern of activations and de-activations (including de-activation of the DL-PFC) that characterize REM sleep (compare Braun, Balkin, Wesenten, et al., 1997, with Limb and Braun, 2008). It is conceivable that the abandonment of one conscious form of self-regulation during non-lucid dreaming enables the adoption of an unconscious but fluid form of self-regulation that resembles the kind of self-regulation that contributes to musical improvisation. It is possible, for example, that non-lucid dreaming entails self-regulated but fluid openness to "what comes," rather than the direct self-monitoring and response inhibition that enable "rational" planning and decision making. Dreaming may, if we take the Limb and Braun (2008) findings seriously, entail the kind of self-regulated openness to "what comes" that motivated States (1993) to call dreaming "involuntary poetry."

Hobson may well be right that typical non-lucid dreaming contains manifestations of the self that inhabits primary

consciousness—independently of the self of secondary consciousness (i.e., independently of explicit lucidity). However, there has been only limited exploration of the self-regulated openness that seems to characterize what typical non-lucid dreaming “does,” i.e., how it functions. A search for such functionality requires more than evidence of the self of primary consciousness in dream content. It requires more than evidence of the presence of a self figure in dreams (Snyder, 1970), of dream movements correlated with concurrent phasic motor activity (Gardner, Grossman, Roffwarg, & Weiner, 1975), of phasic increases in self-participation in the dream narrative (Weinstein, Schwartz, & Ellman, 1991), and even of explicit intra-dream self-monitoring and internal commentary (Kahan, 2001). To get closer to the fluid form of regulation by which the self of primary consciousness remains open to “what comes,” it may be more useful to examine the carry-over effects of typical REM dreaming. Awakenings from REM and NREM sleep are followed by a brief period (≈ 20 min) during which patterns of thinking and feeling are systematically altered. Observations during this period are often thought to reflect the nature of mental activity during the sleep stage that immediately precedes awakening. If so, the following results from studies of dream carry-over effects may be informative also about the fluid form of self-regulation that characterizes non-lucid REM dreaming:

1. There is evidence that an automatic, stimulus-induced shift of attention toward unexpected stimuli occurs more quickly during the period immediately following awakening from REM sleep than it does following awakenings from NREM sleep (Doricchi, Ippoliti, Braibanti, et al., 1991).
2. Individuals awakened from REM sleep show greater priming by weakly associated words (e.g., thief-wrong) than by strongly associated words (e.g., hot-cold), whereas individuals awakened from NREM sleep show greater priming by strongly associated than by weakly associated words (Stickgold, Scott, Rittenhouse, & Hobson, 1999).

The preceding results suggest openness to the new and unexpected within “what comes” during dreaming.

3. Individuals awakened from REM sleep use strategies that differ from those used during wakefulness to solve simple problems (e.g., anagrams), whereas, after awakening from NREM sleep, strategies for solving these problems resemble those used during wakefulness (Walker, Liston, Hobson, & Stickgold, 2002).
4. After REM deprivation, individuals awakened from REM sleep score higher on fluidity and flexibility in traditional tests of divergent thinking than do those deprived of NREM sleep (Glaubman, Orbach, Aviram, Frieder, et al., 1978; Lewin, & Glaubman, 1973).

The preceding results suggest openness to departures from habit in purposive dream thought.

5. Individuals awakened from REM sleep are more likely than those awakened from NREM sleep to perceive one dot moving between two positions when two stationary dots are alternately presented (the beta phenomenon; Lavie & Sutter, 1975).
6. After awakenings from REM sleep, performance on a

left-handed tactile-kinaesthetic recognition task is better than after NREM awakenings (Bertini, Violani, Zoccolotti, et al., 1984; although see Reinsel & Antrobus, 1992).

The preceding results suggest openness to the emergence of change within the motile and tactile-kinaesthetic dream world.

Taken together, the preceding studies suggest that awakenings from REM sleep are more likely than awakenings from NREM sleep to be followed by a brief period of fluid thinking characterized by openness to novelty within the ongoing motile and tactile-kinaesthetic world. In some instances, such fluidity and responsiveness following REM sleep exceed that of resting wakefulness. By implication, non-lucid dreaming cognition may entail a type of self-regulated openness to “what comes” that occurs even in the absence of activation of the DL-PFC. Examination of the preceding (or similar) carry-over effects in fMRI research paradigms might be especially telling; it should be possible to determine (a) whether de-activation of the DL-PFC persists immediately after awakening from REM sleep, (b) whether the form of fluid thinking characteristic of non-lucid REM dreaming persists despite continued de-activation of the DL-PFC, and (c) whether other neural networks become activated, such as the left thalamus, which is distinctively involved in metaphor comprehension (Stringaris, Medford, Giampietro, et al., 2007) and in other “associative” tasks that involve the activation of objects—but not in tasks that involve the identification of superordinate categories (Kraut, Kremen, Segal, et al., 2002).

I bring up metaphor comprehension in this context because, in his exchange with Bert States in 1998, Hobson (1998, p. 214) challenged investigators to subject hypotheses about the metaphorical function of dreaming to scientific scrutiny. To explore whether non-lucid dreaming may entail the type of self-regulated openness to “what comes” that is characteristic of metaphor production or comprehension, the array of empirical procedures used in studies of metaphor could also be employed in studies of dreaming, perhaps especially in studies of dream carry-over effects. For example, the procedures used to assess the “emergent” properties of metaphoric referents (cf. Glucksberg, 2008; Utsumi, 2005) might reflect quite directly on the present proposal that non-lucid dreaming entails openness to “what comes” within the unfolding dream world. If attentional functions (Doricchi, Ippoliti, Braibanti, et al., 1991), associative functions (Stickgold, Scott, Rittenhouse, & Hobson, 1999), and conceptual strategic functions (Walker, Liston, Hobson, & Stickgold, 2002) can be attributed to the primary consciousness of non-lucid dreaming, perhaps it is time to extend these research paradigms to explore the possibility that non-lucid dreaming also—and possibly fundamentally—has a metaphoric or quasi-metaphoric function. The present discussion of carry-over effects provides just one example of research that could further this objective, although other preliminary efforts to examine the metaphoric function of dreaming have been reported (Kuiken, Bears, Miall, & Smith, 2002; Kuiken, Chudleigh, & Racher, 2010).

4. Executive Functions Revisited

Returning again to Hobson’s characterization of the function of secondary consciousness, he prefers a conception

of lucid dreaming that emphasizes “executive” functions (Voss, Holzmann, Tuin, & Hobson, 2009, p. 1198), despite the widely recognized ambiguity of that class of psychological functions. Thus, he remains committed to a conception of dream lucidity that gives priority to rational agency and conscious control: self-monitoring, conflict detection, response inhibition, and deliberate decision-making. For Hobson, it is these executive functions that are “restored” (p. 43) during lucid dreaming and that, when missing, provide a “model” for psychopathology. However, an unequivocal commitment to such executive functions would put in jeopardy a conception of dreaming that respects its distinctive form of cognitive functionality, i.e., a functionality that may more nearly be a model of musical improvisation or of involuntary poetry than of psychopathology.

Hobson is not alone in his determined support for the rational agency and conscious control that lucid dreaming seems to afford (see also Windt & Metzinger, 2007). Such concern with agency and control is also reflected, in far less carefully considered form, in the widespread but culture-specific fascination with the self-restorative and self-therapeutic effects that lucid dreaming seems to offer. There is no need to deny either the restorative or therapeutic potential of dream lucidity to appreciate also the self-regulated openness that characterizes non-lucid dreaming. Not only is such self-regulated openness and responsiveness a departure from the reasoned regulation of planning and decision-making during waking; it also is a departure from the reasoned regulation of planning and decision-making that is evident during many (although not all) moments of lucid dreaming (for discussion of those important exceptions, see Gackenbach & Bosveld, 1989). So, it may be important to articulate further the openness and responsiveness to “what comes” that characterizes non-lucid dreaming (cf. Fosse & Domhoff) and that is especially evident in some types of impactful dreaming independently of dream lucidity (Kuiken, Lee, Eng, & Singh, 2006).

References

- Bertini, M., Violani, C., Zoccolotti, P., Antonelli, A., & di Stefano, L. (1984). Right cerebral activation in REM sleep: Evidence from a unilateral tactile recognition test. *Psychophysiology*, 21, 418-423.
- Braun, A.R., Balkin, T.J., Wesenten, N.J., Carson, R.E., Varga, M., et al. (1997). Regional cerebral blood flow throughout the sleep-wake cycle. An H2(15)O PET study. *Brain*, 120, 1173-1197.
- Damasio, A.R. (1999). *The feeling of what happens: Body and emotion in the making of consciousness*. New York: Harcourt.
- Doricchi, F., Ippoliti, C., Braibanti, P., Violani, C., Hobson, J.A., & Bertini, M. (1991). Behavioral states and selective attention: Preliminary evidence for a deficit in maintenance of attentional focus upon REM awakenings. *Sleep Research*, 20, 140 (abstract).
- Edelman, G.M. (1992). *Bright air, brilliant fire: On the matter of the mind*. New York: Basic Books.
- Edelman, G.M. (2003). Naturalizing consciousness: A theoretical framework. *Proceedings of the National Academy of Sciences of the United States of America*, 100, 5520-5524.
- Edelman, G.M. (2004). *Wider than the sky: The phenomenal gift of consciousness*. New Haven: Yale University Press.
- Fosse, R., & Domhoff, G.W. (2007). Dreaming as non-executive orienting: A conceptual framework for consciousness during sleep. In D. Barrett & P. McNamara (Eds.), *The new science of dreaming: Content, recall and personality correlates*, Vol. 2 (pp. 49-78). Westport, CT: Praeger.
- Foulkes, D. (1999). *Children’s dreaming and the development of consciousness*. Cambridge, MA: Harvard University Press.
- Gackenbach, J., & Bosveld, J. (1989). *Control your dreams*. New York: Harper & Row.
- Gardner, R., Grossman, W., Roffwarg, H., & Weiner, H. (1975). The relationship of small limb movements during REM sleep to dreamed limb action. *Psychosomatic Medicine*, 37, 147-159.
- Glaubman, H., Orbach, I., Aviram, O., Frieder, I., et al. (1978). REM Deprivation and Divergent Thinking. *Psychophysiology*, 15, 75-79.
- Glucksberg, S. (2008). How metaphors create categories—quickly. In R.W. Gibbs, Jr. (Ed.), *The Cambridge Handbook of Metaphor and Thought* (pp. 67-83). New York: Cambridge University Press.
- Hobson, J.A. (1998). Dreaming as delirium: A reply to Bert States. *Dreaming*, 8, 211-222.
- Hobson, J.A. (2009). The neurobiology of consciousness: Lucid dreaming wakes up. *International Journal of Dream Research*, 2, 41-44.
- Hobson, J.A., Pace-Schott, E.F., & Stickgold, R. (2000). Dreaming and the brain: Toward a cognitive neuroscience of conscious states. *Behavioral and Brain Sciences*, 23, 793-842.
- Kahan, T.L. (2001). Consciousness in dreaming: A metacognitive approach. In K. Bulkeley (Ed.), *Dreams: A reader on the religious, cultural, and psychological dimensions of dreaming* (pp. 333-360). New York: Palgrave.
- Kraut, M. A., Kremen, S., Segal, J. B., Calhoun, V., Moo, L. R., & Hart, J. Jr., (2002). Object activation from features in the semantic system. *Journal of Cognitive Neuroscience*, 14, 24-36.
- Kuiken, D., Bears, M. Miall, D.S., & Smith, L. (2002). Eye movement desensitization reprocessing facilitates attentional orienting. *Imagination, Cognition, and Personality*, 21, 3-20.
- Kuiken, D., Chudleigh, M., & Racher, D. (2010). Bilateral eye movements, attentional flexibility and metaphor comprehension: The substrate of REM dreaming? Manuscript submitted for publication.
- Kuiken, D., Lee, M.N., Eng, T.C., & Singh, T. (2006). The influence of impactful dreams on self-perceptual depth and spiritual transformation. *Dreaming*, 16, 258-279.
- Lavie, P., & Sutter, D. (1975). Differential responding to the beta movement after waking from REM and nonREM sleep. *American Journal of Psychology*, 88, 595-603.
- Lewin, I., & Glaubman, H. (1973). The effect of REM deprivation: Is it detrimental, beneficial, or neutral? *Psychophysiology*, 12, 349-353.
- Limb, C.J., Braun, A.R. (2008) Neural substrates of spontaneous musical performance: An fMRI study of jazz improvisation. *PLoS ONE*, 3(2), e1679.
- Reinsel, R., & Antrobus, J. (1992). Lateralized task performance after awakening from sleep. In J. Antrobus & M. Bertini (Eds.), *The neuropsychology of sleep and dreaming* (pp. 63-85). Hillsdale, NJ: Lawrence Erlbaum.
- States, B.O. (1993). *Dreaming and storytelling*. Ithaca, NY: Cornell University Press.
- Stickgold, R., Scott, L., Rittenhouse, C., & Hobson, J.A. (1999). Sleep-induced changes in associative memory. *Journal of Cognitive Neuroscience*, 11, 182-193.
- Stringaris, A.K., Medford, N.C., Giampietro, V., Brammer, M.J., & David, A.S. (2007). Deriving meaning: Distinct neural mechanisms for metaphoric, literal, and non-meaningful

- sentences. *Brain and Language*, 100, 150-162.
- Utsumi, A. (2005). The role of feature emergence in metaphor appreciation. *Metaphor and Symbol*, 20, 151-172.
- Voss, U., Holzmann, R., Tuin, I., & Hobson, J.A. (2009). Lucid dreaming: A state of consciousness with features of both waking and non-lucid dreaming. *Sleep*, 32, 1191-1200.
- Walker, M.P., Liston, C, Hobson, J.A., & Stickgold, R. (2002). Cognitive flexibility across the sleep-wake cycle: REM-sleep enhancement of anagram problem solving. *Cognitive Brain Research*, 14, 317-324.
- Weinstein, L.N., Schwartz, D.G., & Ellman, S.J. (1991). Sleep mentation as affected by REM deprivation: A new look. In S.J. Ellman, J.S. Antrobus (Eds.), *The mind in sleep: Psychology and physiology*, 2nd edition (pp. 377-395). New York: John Wiley.
- Windt, J.M., & Metzinger, T. (2007). The philosophy of dreaming and self-consciousness: What happens to the experiential subject in dreaming consciousness. In: D. Barrett & P. McNamara (Eds.), *The new science of dreaming: Cultural and theoretical perspectives*, Vol. 3 (pp. 193-247). Westport, CT: Praeger.