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Signal-verfied lucid dreaming proves that REM sleep can support reflective consciousness

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

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Alan Hobson (2009) has recently taken up the call to study lucid dreaming. It is, of course, a call that I (Gackenbach & LaBerge, 1988; LaBerge, 1980, 1985, 2000) and others have been making for decades. So, I say welcome! I hope that Hobson's (re)discovery of lucidity will draw wider attention to the topic.

Hobson's essay represents a personal, even idiosyncratic view of the topic. He calls lucid dreaming a "promising, though problematical, paradigm"; I agree on the promising part, but I find that most of the problematical part derives from Hobson's approach rather than the paradigm itself. There is no question that lucid dreaming appears paradoxical to many. "Being conscious while asleep" seems contradictory until one sharpens the concepts; being asleep means being (reversibly) unconscious of sensory input; being lucid means being (reflectively) conscious of the fact that one is dreaming (and indirectly that one is, presumably, asleep).

A parallel can be drawn (LaBerge, 1990) between the initially anomalous appearance of lucid dreaming (thought impossible by many experts) and that of the state that has been called "paradoxical sleep" (i.e., REM sleep). The discovery of REM sleep, with its many unexpected characteristics (e.g., highly activated brain, autonomic nervous system variability, muscle atonia, etc.) required the expansion of our concept of sleep. The evidence associating lucid dreaming with REM sleep would seem to require a similar expansion of our concept of dreaming, and a clarification of our concept of sleep—lucid dreaming may well prove the most paradoxical feature of paradoxical sleep.

I think that the many studies showing signal-verified lucid dreaming (SVLD) during REM sleep (see LaBerge, 1990 for reviews and references) simply indicate that REM sleep is capable of supporting reflective consciousness. We took enormous care to show these SVLDs occurred during unequivocal REM sleep (cf. Brylowski, Levitan, & LaBerge 1989). Moreover, we have recorded over 100 REM SVLDs and only one of these needs to be REM sleep for our hypothesis to be true. Hobson interprets these results differently. Because he believes reflective consciousness incompatible with REM dreaming, he concludes that lucid dreaming MUST be a dissociated hybrid mixture of waking and dreaming.

I can see how one might draw that conclusion, but I think it nonetheless in error. It's like saying that because most mammals don't fly, bats, if they existed must be hybrid bird-rats. That's not quite what it's like to be a bat.

Hobson cites a recent EEG study of lucid dreaming (Voss, Holzmann, Tuin, & Hobson, 2009), as supporting the idea that lucid dreaming is a "dissociated" or "hybrid" state. However, as far as I can see, the study does no more than assume its conclusion: As the first paragraph of the abstract says "Lucid dreaming is a dissociated state..." (p. 1191)

The assumption is that reflective consciousness indicates the presence of the waking state, and hence, lucid dreaming signals from REM sleep indicates the presence of "waking consciousness". QED? Alternatively, dropping the a priori assumption about REM sleep limitations, the conclusion stands: lucid dreaming shows that REM sleep is capable of supporting reflective consciousness. The essential difference between dreaming and waking is sensory input, not reflective consciousness (Kahan & LaBerge, 1996; Llinas & Pare 1991).

The Voss et al. (2009) study is intriguing, but has several problems that make it difficult to interpret.

1. Incompatible Comparisons. Subjects woke from REM periods after making lucidity signals. "Waking and REM sleep EEG was scored visually according to Rechtschaffen and Kales." (p. 1192). Based on the lucidity signals, some of these REM Sleep epochs were labelled "REM sleep" and others "lucid dreaming". But weren't they all equally validly scored as REM sleep? A less misleading set of labels for the two conditions of interest would be non-lucid REM vs. lucid REM (or, in short: NLD vs. LD). The results (if any) would then take the form: e.g., "REM sleep epochs associated with NLD had less 40Hz power than epochs associated with LD."
2. Frontal lateral gamma artifact due to extra-ocular muscle spikes? Previous studies show that saccadic eye movements give rise to frontal gamma artifact. Although Voss et al. (2009) report correcting the EEG for

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EOG artifact, and mention micro-saccades as a source of artifact, they do not appear to correct for this potentially much more serious source of "40Hz" EEG artifact. "The contraction of the extra-ocular muscles, during the execution of saccades, produces a strong electric potential in the EEG called the saccadic spike potential (SP). ... this SP manifests as a broadband response with most of its power at the gamma-band frequencies." (Yuval-Greenberg & Deouell, 2009, p. 3). Probably the most conservative solution to this potential problem is to delete epochs containing eye movements. Will the 40Hz effect survive this treatment?

3. Need to control for phasic vs. tonic REM density differences. Previous studies have associated phasic REM sleep, compared to tonic REM sleep, with higher levels of 40Hz EEG (Jouny, Chapotot, & Merica, 2000). Moreover, REM lucid dreaming to be associated with phasic REM (LaBerge, Levitan, & Dement, 1986). Thus, putative results could be due to higher levels of REM density in the lucid dreaming sample.
4. Need to control for task and signalling (repeated LR eye-movement signals) during lucid dreaming. Even supposing that the results were not artifactual, how would we know that they show effects of lucid dreaming rather than, for example, the signalling/motor task? (During LDs subjects were executing repeated signal task; during NLDs, not.)
5. Another potential confound: NLD samples were taken from earlier in REM Periods than LD samples. Thus any results could be due to differences in time into REM.
6. Small sample. Comparisons based on only 3 subjects, each with a single LD. A perilously small sample size to expect to replicate. Caution in order?

I apologize in advance for any misreadings on my part; I expect that Dr. Voss and colleagues will have considered some or all of these issues, and I look forward to reading a response. Meanwhile, we should avoid hasty conclusions. Especially if those conclusions assume that if dreams are reflective they cannot be dreams.

Whether awake or asleep, our consciousness functions as a model of the world constructed by the brain from the best available sources of information. During waking conditions, this model is derived primarily from sensory input, which provides the most current information about present circumstances, and secondarily from contextual and motivational information. While we sleep, very little sensory input is available, so the world model we experience is constructed from what remains, contextual information from our lives, that is, expectations derived from past experience, and motivations (e.g., wishes, as Freud observed, but also fears). As a result, the content of our dreams is largely determined by what we fear, hope for, and expect (LaBerge, 1985, 1998; LaBerge & Rheingold, 1990).

From this perspective, dreaming can be viewed as the special case of perception without the constraints of external sensory input. Conversely, perception can be viewed as the special case of dreaming constrained by sensory input (LaBerge, 1985, 1998; LaBerge & Rheingold, 1990; Llinas & Pare 1991). Whichever way one looks at it, and here I am sure Hobson and I agree, understanding dreaming is central to understanding consciousness.

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