

Dreaming and waking: Phenomenological and biological differences

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

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Summary. Varying research perspectives of the conceptual distinction between physiology and subjective experience, and the outside vs. inside perspective on dreaming will be discussed. Whereas the AIM model is helpful in describing the neurobiological differences between states of consciousness, research is needed to test whether specific features of the subjective experience like bizarreness or awareness of the current state of consciousness is related to distinct brain activation patterns. On a phenomenological level, lucid dreaming has more parallels to dreaming and meditation than to the normal waking state. Regarding the conceptualization of dreaming, it seems necessary to conduct sophisticated content analytic studies of normal and lucid dreams to determine what kind of higher-ordered consciousness processes occur regularly within dreams.

Being a dream researcher for 20 years, I can easily agree with Allan Hobson's (2009) claim that lucid dreaming is worth studying to learn more about consciousness processes in general. Lucid dreaming, and dreaming in general, offer a perfect opportunity to study the body-mind-interaction during sleep (Erlacher & Schredl, 2008). In addition, the ability of trained lucid dreamers to carry out pre-arranged tasks during the dream can be used to study one function of dreaming, increasing daytime performance (Erlacher & Schredl, 2010). One wonders why it took Allan Hobson, who experienced lucid dreams himself in 1962, so long to discover the potential of this particular form of dreaming for consciousness research.

I would like to address the conceptual problems that Allan Hobson mentioned in the fourth section of his essay. The concepts of dreaming proposed by the researchers vary a great deal from Hobson's work. Two topics will be discussed, the conceptual distinction between physiology and subjective experience, and the outside vs. inside perspective on dreaming.

1. Conceptual distinction between sleep physiology and dreaming

In the early days of sleep research, dreaming was often confused with REM sleep. For example, the title of William Dement's laboratory study was entitled “The effect of dream deprivation” (Dement, 1960) which is of course misleading

because he carried out REM sleep deprivation. Now we know that dreaming, defined as subjective experiences during sleep, is in some form present during all sleep stages (Wittmann & Schredl, 2004). With this conceptual differentiation in mind, I want to take a look at Allan Hobson's statement “Lucid dreaming is an unusual state characterized by elements of both waking and dreaming” (p. 43). Citing the EEG study of Voss et al. (2009), and the fMRI study of the Munich group (Dresler, et al., 2008), Allan Hobson focuses on the physiological aspects of how lucid dreaming is an intermediate state between normal dreaming and waking, e.g., regarding the 40 Hz frontal activity measured by EEG or the increased activity in frontal and other areas seen in the MRI scans. The AIM model with the three components of activation, input-output gating, and modulation, also focuses on the physiological differences between the waking state, NREM sleep, and REM sleep. This descriptive model is helpful in conceptualizing the differences between distinctive states of consciousness, but it does not allow any conclusions about the subjective level of experience of this state. For example, if the Modulation factor is of importance then an experimental manipulation, such as applying donepezil, an acetylcholinesterase inhibitor, should not only increase the amount of REM sleep (Schredl, et al., 2006), but also increase dream bizarreness, showing effects on the experience level. Systematic studies, however, are lacking in this area, so there should be caution about predictions derived from the AIM model regarding the subjective level in particular states of consciousness. Another line of sleep research clearly demonstrates the difficulty to predict subjective experience from physiological parameters. Amrhein and Schulz (2000) performed awakenings from brief periods of wakefulness, NREM 2 sleep, and REM sleep during the night. Their first question was: “Did you sleep or have been awake before hearing the buzzer?” The participants (N =

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22) stated in about one third of the awakenings from stage awake that they were sleeping, in about 50% of the NREM 2 awakenings, and in over 80% of the REM awakenings. Experiencing and remembering a dream was an important criterion for the evaluation of the state of consciousness. Overall, this study clearly implicates that the physiological measured sleep stage does not allow a very good prediction of the subjective experience of the sleeper. This is even more pronounced in patients with sleep state misperception or paradoxical insomnia (American Academy of Sleep Medicine, 2005). They report severe insomnia which cannot be seen in the polysomnographic recordings, meaning they think they are awake most of the night even if the brain passes through long periods of physiologically measured sleep.

Reevaluating Allan Hobson's statement about lucid dreaming in regard to the relative loose relationship between physiology and subjective experience, the question arises of how lucid dreaming differs from normal dreaming and the waking state on a phenomenological level. Lucid dreamers very often report that perceptions and emotions in lucid dreams are more intense than in normal dreams (LaBerge, 1985), and the most often reported activity in lucid dreams (N = 684 participants) is flying (Johnson, 2007). This indicates that lucid dreams are even more dreamlike than normal dreams and not similar to waking thoughts. Even the defining criteria of lucid dreaming, that one is aware of dreaming while dreaming, is not a typical element of waking thought. How often does a person who is not a dream or consciousness researcher think about the current state of consciousness when s/he is awake? Lucid dreams in that respect do not resemble the normal waking state, but rather other states of consciousness like meditation. The positive correlation between meditation practice and lucid dreaming frequency has been shown in different studies (Gackenbach, 1990; Hunt, 1991; Reed, 1978). On the physiological level, the brain activity during meditation differs considerably compared to the normal waking state (Cahn & Polich, 2006). It has to be tested whether the AIM model that describes different states of consciousness on physiological dimensions is also helpful in explaining the differences regarding the subjective experiences during these states of consciousness. For example, daydreaming (Foulkes & Fleisher, 1975) and experiences during sensory deprivation experiments (Rossi, Furhman, & Solomon, 1964; Zuckerman & Hopkins, 1966) share a lot of features with nocturnal dreaming on a phenomenological level, even though the underlying biological states are quite different, e.g., the cholinergic-aminergic neurotransmission during waking and REM sleep (J. A. Hobson, Pace-Schott, & Stickgold, 2000). Whether there are also similarities (e.g., particular brain activation patterns) that might explain specific characteristics of the subjective experiences like bizarreness and sense of time, self-reflecting thoughts have not yet been shown.

To summarize, the statement that lucid dreaming is characterized by elements both of waking and dreaming is oversimplified. In respect to brain activation, it should be defined in the more detailed way of what distinctive characteristics of what specific waking state are compared to lucid dreaming. On a phenomenological level, lucid dreaming has more parallels to dreaming and meditation than to the normal waking state.

2. Outside vs. inside perspective on dreaming

Using the definition of hallucination for dreaming is clearly an outside perspective on dreaming. One "sees" the sleeping person whose experiences are not based on external stimuli but generated by the brain itself. As stated above, this analogy might not be useful because the brain state during hallucinations and dreaming is very different. Even on a subjective level there are differences. Patients with schizophrenia report auditory hallucinations that are added to their normal functioning perception of the outside world, not creating a complete new world. To describe this, Allan Hobson used the term 'virtual reality experience' (Hobson, 2009, p. 43). However, this term might be misleading because it is used to describe a computer-generated world which has the capacity to be experienced by the person as 'reality', because the person is so immersed in the pictures that thoughts that this is a artificial world occur rather rarely. Dreaming, on the other hand, is generated within the person's consciousness and cannot be perceived by other persons; in that aspect it differs from virtual reality scenarios.

It is more helpful to conceptualize dreaming from an inside perspective. For example, comparing the characteristics of dreaming and waking in respect to the terminology of Edelman (1992): primary and higher-order consciousness. Higher-order consciousness is capable of modeling the past, present, future, a self, and a world (Edelman, 1992). Being an advocate of the continuity hypothesis of dreaming (Schredl, 2003), I wonder what characteristics of higher-order consciousness can actually be found in dreams. As Edelman (1992) states, language is one of the bases for developing a higher-order consciousness, allowing to develop symbolic models of the ongoing experiences. First, social interaction using language is an important ingredient of dreams (Schredl, 2008). Furthermore, dreams are full of thinking about the actual experience (Meier, 1993), reflections about what to do, the consequences of one's actions, and fears about what might happen. Even if distortions regarding time occur in dreaming, there are also scenes with a clear framework of past and future. The dreamer thinks ahead or remembers something that happened earlier in the dream. While dreaming, the dreamer has a self-concept which does not necessarily have to be the same as in waking life (e.g., dreaming that one is younger than their current age), or that can change during the dream. But in most dreams, the dreamer does experience himself/herself in a very similar way to their waking state. From this inside perspective it is difficult to understand why dreaming should lack higher-order consciousness features because planning, insight, and abstraction can all be found. Even the criteria of the awareness of the awareness might not be used to differentiate waking and dreaming because normally we do not reflect about our state of consciousness during waking, except when asked or when we practice specific forms of meditation. Despite the bizarre elements, time shifts, and other dream characteristics, dreaming is comparable to waking experience.

3. Future directions

The major challenge for a "neurobiology of consciousness" is to demonstrate that specific brain activity patterns are related to specific characteristics of the subjective experience. For example, intra- and inter-individual difference in dream bizarreness might be correlated with the degree of

down-regulation of the dorsolateral prefrontal cortex during REM sleep. Or lucid dreaming with the awareness of the own state of consciousness represented in the thoughts of the dreamer should be different from normal dreaming in a similar way as meditation from the normal waking state with thoughts about the current state of consciousness. One might use modern stimulation techniques like transcranial magnetic stimulation (TMS) or transcranial direct current stimulation (tDCS) to test whether activating or deactivating specific brain areas affect the subjective experience in a predictable way. These studies will show whether the factors postulated by AIM model are indeed relevant for the features of consciousness on a subjective level. Regarding the conceptualization of dreaming, it seems necessary to conduct sophisticated content analytic studies of normal and lucid dreams to determine what kind of higher-ordered consciousness processes occur regularly within dreams. As dream reporting focuses most often on the dream action, more subtle dream experiences like thinking, planning, and remembering something of the past might get lost. These kinds of studies will enhance our knowledge about dreaming and would help to correlate specific features of the subjective experience with brain activation patterns.

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