

The Science of Lucid Dreaming

New Evidence of GAMMA Band Activation

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“It’s got a good beat, and I can bug out to it”

Beastie Boys

A small study was published in Germany this month that claims that lucid dreaming should not be considered a REM dreaming phenomenon but rather a unique state of consciousness (Voss, et al., 2009). Poetically, the assertion that lucid dreaming has elements of waking cognition and dreaming has been made for years, but this study, conducted at the Neurological Laboratory in Frankfurt, Germany, backs the assertion with physiological data taken with an EEG machine.

Specifically, lucid dreams are shown to differ from ordinary (REM) dreams by an increased brain frequency in the 40 Hz (or GAMMA) range in the frontal and frontolateral areas of the brain. These areas are considered by many scientists to be the seat of linguistic thought, as well as other higher mental functions associated with self-awareness.

This “hybrid state” of waking and dreaming fits in well with study co-author Allan Hobson’s AIM model for sleep cognition. The AIM model essentially maps and predicts possible kinds of consciousness in sleep based on three different spectra: whether the imagery created is external or internally sourced, the activation levels of the brain, and the modulation of the state by brain chemicals. Lucid dreaming can therefore be mapped separately than ordinary dreams due, in this case, to the unique activation on the gamma level.

The authors say the next step is to test lucid dreaming in the lab with brain imagery devices, such as the fabled-hard-to-schedule-an-appointment-with MRI.

The study in context

Finding the unique physiological markers of consciousness has long been the holy grail of science. We’ve had a few interesting theories along the way. For instance, Rene Descartes put his money on the pineal gland, while today other scientists say consciousness is a byproduct of microtubules in the brain’s neurons. Lucid dreaming research is really an off-shoot of this scientific tradition, especially as it looks for physical markers that coincide with subjective qualities such as self-awareness or free will.

In the 1980s, many psychologists predicted that ALPHA level frequencies (8-12 Hz) would clearly demark lucid dreams from ordinary dreams – but further studies showed that ALPHA levels remain more or less depressed through most of sleep, including even the most lucid of dreams. (Olgvie, Vieri, Small, 1991)

More recently, Holzinger, LaBerge and Levitan published a study (2006) emphasizing how the BETA-1 (13-19 Hz) frequency band is associated with lucid dreams, more so than ordinary dreams. They further isolated this small, but statistically significant, hiccup of activity to the parietal lobe, an area of the brain associated with spatial sense and navigation. Of course, mathematician and neuro-philosopher J.G. Taylor (1999) believes that the parietal region is a seat of consciousness, too. Sigh.....

In any case, wherever consciousness may or may not live, the high levels of gamma range of activation shown in this study need more tests with larger pools of subjects before we can say with any certainty that lucidity has a reproducible physical signature.

40 Hz and Brain Entrainment

Interestingly, the 40 Hz bandwidth of brain activity has a popular following in *brain entrainment*, a theory of neuro-hypnotherapy that supposedly induces brain synchronization by listening to music with frequencies that the brain matches in response. Anecdotally, many lucid dreamers claim to have learned lucid dreaming with the help of brain entrainment tools such as meditation CDs that tease lucidity from the shadows. More reputedly, the gamma band has been associated with high levels of meditation (Lutz, et al 2004) and even the ability to be hypnotized (De Pascalis, 1993). Gamma is clearly the darling brain frequency of the decade.

In closing, this study reminds me that lucid dreaming research is really still in its infancy. Not only does the ability to be self-aware in dreams give us the opportunity to learn more about physical markers of conscious thought in sleep, but it has the potential to revise our understanding about the interaction between mind and matter.

References:

- De Pascalis, V. (1993). EEG spectral analysis during hypnotic induction, hypnotic dream and age reduction. *International journal of psychophysiology*, 15(2), pp.153-166.
- Holzinger, B. Laberge, S., Levitan, L., (2006) Psychophysiological correlates of lucid dreaming. *Dreaming*. 16(2), pp. 88-95.
- Lutz, A., Greishar, L., Rawlings, N., Ricar, M., Davidson, R.J. (2004). Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. *Proceedings National Academy Science, USA* 101(46), pp. 16369-16373.
- Ogilvie, R., Vierna, K., Small, R. (1991). EEG activity during lucid dreaming. *Lucidity* 10 (1&2), pp. 224-226.
- Taylor, J.G. (1999). Neural network of consciousness: the central representation. *The proceedings of the International Conference on Neural Networks*.
- Voss, U., Holzmann, R., Tuin., Hobson, J.A. (2009). Lucid dreaming: a state of consciousness with features of both waking and non-lucid dreaming. Accepted but not published yet in *Sleep*. <http://www.journalsleep.org/Accepted.aspx>

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