Dreaming and the weighted cognitive Rolodex: A review of The Emergence of Dreaming by William G. Domhoff

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Summary. In his new book the eminent dream researcher William G. Domhoff restates the neurocognitive theory of dreams. It provides a lucid overview of decades of empirical research, combining it with recent neuroscientific research to form a theoretical whole. Providing a clear account of his theory Domhoff pivots the science of dreaming onwards, by posing a challenge for competing views.
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Isn't it strange, that during sleep, while mostly disconnected from the external environment, we conjure up a full-fledged phenomenal world, inhabited by friends and strangers, sights and sounds, even odours and bodily sensations? Why would this be the case? What could possibly explain such wasteful use of energy? The nature and function of dreams have gnawed on the minds of great philosophers and scientists at least from the times of the ancient Greeks, including such authorities as Aristotle (350BC/1991), Zuangzhi (~300 B.C/2003), Descartes (1637), Schopenhauer (1896/2007) or Sartre (1934/2010), to name just a few. Following the dominating force of Freud on dream research and the subsequent counterforces, the age of methodological advances in the brain sciences has recently brought about a minor renaissance for the question of dreaming and its purpose.

In his new tome *The Emergence of Dreaming* (2017, Oxford University Press), the eminent dream researcher professor William G. Domhoff takes the reader on a wide-ranging tour, circumnavigating the issue of why, and how, do we dream. He restates the case for a neurocognitive theory of dreaming, resting on five key tenets: 1) Dreams are similar to waking thought; 2) Dreams convey meanings related to the current concerns of the dreamer; 3) Dreaming and cognitive capabilities co-develop; 4) Dreams are instantiated by the same neural substrate, a subsystem of the Default Network, implicated in daydreaming and mind-wandering; and finally, 5) dreams serve no adaptive function in an evolutionary sense. Whilst building a case for each of these statements, professor Domhoff impresses the reader with a large library of wonderful studies conducted especially between the 1950's and the 1970's, and since largely forgotten but for a few scholars. Domhoff is very thorough, as he goes through long series of dreams from single individuals, meticulously tracking their development, and the differences and similarities within- and between individuals. Compared to his previous works, he also concentrates on the most recent neuroimaging findings, with special focus on the activity of the Default Network. These strands alone would make the book a treasure trove for anyone interested in the scientific study of dreams, but as noted, the book is not merely a description, it attempts to build a comprehensive theory of dreaming and relate it to other task-independent states. The ample data are tools towards this end. When considering the tenets for his argument the reader finds himself mostly just nodding easily along. Yes, a consensus is building around the conceptualization of dreams as world-simulations. Yes, dreams are more than passive replays of past experiences or random activation of the ponto-geniculo-occipital waves. The historical analysis on the study of dreams is thorough. Occasionally, however, some cracks appear in the theoretical surface.

After making the case for his theory *The Emergence of Dreaming* continues with an informative chapter on the methodological issues related to content analysis, and the reader is walked through the prominent Hall – Van de Castle method with remarkable specificity. There still remains the ever-present problem, that we only ever get indirect access to the experience via a dream report (here excluding the work of Horikawa, Tamaki, Miyawaki & Kamitani (2013) on fMRI decoding). As this form is cognitive in nature, there is considerable risk of overstating dreaming itself as cognitive as a result (and also downplaying the emotional contents, see e.g. Sikka, Virta, Valli & Revonsuo 2014). Furthermore, even if we were to distinguish dream reports and the emergence of dreaming based on the dream series examples gloriously underlined in the book, we would still have the problem of whether or not it is dreams in *themselves* that emerge, or merely our *cognitive access* for them. Dreaming is foremost a phenomenological, subjective, experience of being-in-the-dream, whereas reporting it is a cognitive task. How these two phenomena co-develop is a question

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of interest, not only for the emergence of dreaming, but for our understanding of dreamless sleep (do we lose both the phenomenal features or only the access features), default mode network and, finally, consciousness itself. Domhoff stakes his claim strongly to the reportability side, and in this case the burden of proof rests clearly on the side of the critics: How to prove (or disprove) for example the existence of phenomenal dreams in children who are not yet able to reliably report them?

Within a field of study with a long historical development, it is essential to position yourself in relation to the rest of the field. Domhoff contextualises his position in two ways: First, by presenting the historical continuum of cognitive theories of dreaming, and, second, by discussing three most prominent competing theoretical frameworks. While this is a good strategy in its own right, it allows for him to build the argument on specific grounds with occasionally invited strawmen. The first to get the treatment is J.Allan Hobson and his AIM model (chapter 6). This discussion is thorough and clearly presented, with a characteristic historical bent. Here, there is, however a curious omission. Given the ample space allocated for Hobson's theoretical development, one is slightly surprised that the most previous iterations that consider the predictive coding view of dreaming (which could be read as an interesting corollary to Domhoff) are nowhere to be found. This discussion would have been of specific interest, as Domhoff already begins to underline the difficulties of reconciling the protoconsciousness view (Hobson 2009) – which is maintained in the predictive coding view – with the delirium views. Next in line to allow for Domhoff's juxtaposition is Mark Solms, and his "Freudian revival". This order is itself informative, for as Domhoff states, the debate between Solms and Hobson gained a lot of interest in the first years of the millennium. Domhoff is then in a position to present the similarities of their argumentation in such a manner you that you can almost hear his smiling through the typeface. He then goes through the arguments placed against Freudian theory of dreams as sentinels of sleep, wish fulfilment, their disguise and the usefulness of free association. Here again, Domhoff gives credit for the Freudian contributions that are salvageable (and which also aid in his theoretical development), while sparing no sympathy for the rest.

The third line of opposed theories is in fact three theories collided into the rubric of adaptive theories. These are the problem solving theory(e.g. Cartwright 1974), threat simulation theory (TST; Revonsuo 2000) and memory consolidation (e.g. Stickgold, James & Hobson 2000). One of the main questions here is contained in the question on why we dream despite its considerable cost energy-wise, posed in the beginning of this review. Evolution should favour energy conservation and select out possible spandrels that are high on cost yet confer no advantage (i.e. fitness benefit). Thus, one can make the case: If dreaming serves no adaptive function it should most likely to have been selected out. Yet, every night it is there, having us climb a never-ending set of stairs or wonder about the intentions and states of minds of the very same dream characters we ourselves have created (Schopenhauer, 1896/2007; Kahn & Hobson 2005). Domhoff rests his anti-adaptationist case on four key points: periodic regularity of REM dreaming; sleep-onset dreaming/ waking dreams/late-NREM dreams; the scarcity of dreams in children, and; the lack of dreams in some neurological patients.

In his refutation of the adaptive function view for dreams, professor Domhoff falls prey to a common misconception. He considers adaptive to mean something beneficial for the individual in the current environment and for resolution of a current problem, i.e. expands the colloquial use of the term to its more specific use in evolution. While there are several pitfalls in so-called adaptationism (Gould & Levontin 1979), this likely is not one of them. There are several instances of traits or behaviours that can be considered evolutionarily adaptive, yet do not fulfil their promise in every instance (consider for example our cognitive heuristics and biases, Gilovich, Griffin & Kahneman 2002). This misconception is present in the way he equates TST with the problem solving view, and how he approaches this conglomerate. To be fair, however, professor Domhoff makes the anti-adaptationist case with a muffled tone, conceiting that the question is both unsolved and debated. As his theory focuses on the (what Tinbergen (1963) titled) proximate causes for dream contents, the question of adaptation is merely left out from the considerations, and the explanatory weight heaved on the current concerns. However, one cannot escape the looming presence of a more general "why" hovering in the background, just out of stage.

In the discussion in relation to TST, Domhoff also makes somewhat sweeping statements on an assumed contradiction in conceptualizing dreaming as world simulation, and then allowing dreams for non-human mammals. However, the contradiction is not as clearly cut (see eg. Templer & Hampton 2013 for episodic memory systems and subsystems in non-human animals). The more specific discussions in relation to the theories critically reviewed in this book will have to be undertaken elsewhere due to limitations of form and length, but at best it will force the opposing theories to further clarify and empirically strengthen their respective cases. The theoretical disputes are, however, not as settled as would appear given the book (for instance, with relation to implicit learning and transfer during dreams).

An interesting point made in passing has to do with the cultural function dreaming serves in various human populations. In a book that marvels at the wonders of the human mind, such flexible capability to hijack phenomena to serve as tools for social and societal functions is a seed worth noting. Related, interestingly missing are references to theories that attempt to explain the social nature of our dreams (McNamara 1996, Brereton 2000, Revonsuo et al. 2016), even though the social aspect is prominently present in his argumentation throughout the book. This discussion is also relevant due to the overlap of the Default Network and the so-called social brain (e.g. Mars, Neubert, Noonan, Sallet, Toni & Rushworth 2012) noted by Domhoff.

In the final section there is a breath of fresh air, as professor Domhoff paints his view on how dream science as such should proceed, ranging from neuroscience and brain stimulation, to studies in specific groups, and finally to a call for an increased collaboration within the dream research field. It is easy to join in this choir. I will here make the case for two further directions to aid us in our work: i) the continued rigorous methodological development, also briefly mentioned in the book, and ii) further development and collaborative testing of competing theories (as argued for in Revonsuo, Tuominen & Valli 2016b).

To conclude, *The Emergence for Dreaming* presents a consistent argument woven from a vast database of previous research. The case it made with caution and meticu-

lousness, with a respect for previous research. Especially laudable is the way Domhoff also presents results that either somewhat water down his own theoretical statements, or dullen his critique against others, yet still follows what he considers to be the best route in formulating his theory. In the section of reviewing the competing theories this candour at times slightly abates, however. Nonetheless, the book as such forwards the debate on how and why we dream by providing a concise presentation of the most up-to-date view on the neurocognitive theory. Even if one were not to accept the specific theory as a whole, it still has to be seriously considered, and thus functions in that ideal way science should proceed; by specifying theories and inviting the opponents to up their game. The next step would be to formulate and operationalize the neurocognitive theory in such a specific way as to provide clear empirically testable hypotheses that can be placed against the competing theories (Revonsuo et al. 2016b). Then, by slowly turning the empirical crank, we will get closer to a grand unified theory of dreaming.

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