

# The continuity and discontinuity between waking and dreaming: A Dialogue between Michael Schredl and Allan Hobson concerning the adequacy and completeness of these notions

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**Summary.** The discussion between J. Allan Hobson and Michael Schredl covers a broad variety of topics that are still “hot” in dream research. The starting point is the continuity hypothesis of dreaming which is complemented by Allan Hobson’s theory of protoconsciousness. Whereas there is no disagreement that waking life is reflected in dreams, the discussion evolves around discontinuity, i.e., how dream activities are explained that the dreamer never experienced in his/her waking life, and possible functions of dreaming. These functions might include preparation for waking life or personal growth. The aim of this paper is to stimulate a discussion among the researchers in the field on these topics which are of fundamental importance for neurophysiological and psychological dream research.

**Keywords:** Continuity hypothesis; Protoconsciousness theory; Functions of dreaming.

## AH. What is the continuity hypothesis?

**MS.** In its general form, the continuity hypothesis (see Box 1) simply says that we dream of our waking life experiences (thoughts, feeling, events etc.). Since Freud’s “Die Traumdeutung” where he coined the term “Tagesreste (day residues)” nobody really doubts this kind of continuity between waking and dreaming. Dreams often contain elements of our recent or more distant waking life, not in terms of exact replay – as the study of Fosse, Fosse, Hobson, and Stickgold (2003) has shown – but on a thematic level, e.g. dreaming of our actual romantic partner, about a work situation and so on. We agree – I think – that the formal characteristics between dreaming and waking life experiencing are different – best explained by the AIM model (see Box 2), different neuromodulators in the brain produce different modes of experiencing. Dreams are more bizarre and emotional, even though – that’s important to keep in mind – the dreamer experiences the dream as real, as real as the waking world (with the exception of lucid dreams which occur quite rarely).

**AH.** I have no doubt that the continuity hypothesis is valid. And, pace Freud, that some recent experience is represented in dreams. The question is: how much? And a related question concerns the source of that content which is *not* an apparent reproduction of prior waking experience. Freud, and you continuity theorists, are obliged to regard these dream elements as distorted or disguised transformations of prior waking experience. I am very skeptical of this explanation.

For me, an alternative hypothesis, perhaps equally valid, posits *discontinuity*. In many ways this “discontinuity” hypothesis is interesting because it distinguishes between waking and dreaming by asserting that dreaming is *not only* the replay of waking experience. This raises the intriguing question: If dreaming is not entirely derived from waking experience, then just what is the source of the anomalous content and what is its function?

**MS.** I would like to know more about your idea of discontinuity, what dream characteristics and/or dream elements might be related to the function of dreaming. I studied, for example, flying dreams, clearly discontinuous to waking life because flying unaided is not possible, on the emotional level (feeling of elation) there might be continuity, which I found to be true, the occurrence of flying dreams was related to lower neuroticism scores – in contrast falling dreams (also discontinuous with waking life) were related to higher neuroticism scores (Schredl, 2008). So, what types of discontinuities would you see to be likely of significance?

**AH.** Discontinuity is defined as misrepresentations of wake state times, places, persons and actions, and the synthesis of completely original dream features. Dreaming is thus much more interesting than continuity theory recog-

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**Box 1 – Continuity hypothesis**

The term „continuity hypothesis” was first used by Calvin S. Hall to describe his findings that dream content reflects the waking life concerns of the dreamer (Hall & Nordby, 1972). Schredl (2003) pointed out that the formulation of this hypothesis is too broad to be of helpful in carrying out empirical dream research. It seems to be important to investigate the factors which might affect the probability of specific life events, activities etc. to occur in a subsequent dream. The continuity hypothesis focuses on the thematic content of the dream and not on dream characteristics like bizarreness.

nizes: it is autocreative and its autocreativity is in no way neurotic, regressive or derivative as Freud and his followers assert. All who try to interpret dreams in psychotherapy miss this important point. Dreaming may not thus be the symptom but rather the cure of such problems as the repetition compulsion. As David Hartlet famously suggested, “We dream in order to forget”.

**MS.** For me, an interesting question is not whether there is continuity or not but what factors affect the incorporation of waking life experiences into subsequent dreams and these factors might tell us something about why it makes sense to have some kind of continuity between waking and dreaming.

**AH.** A function of continuity might be consolidation of memory or the integration of that memory with emotion. But the continuity that interests me the most is what you call thematic but which I call generic, emphasizing the universality of formal features of dreams, like seeing, moving, and feeling. These are universals that I think have little to do with the replay of waking experience. They reflect, rather, the PREPLAY of waking (see Box 3). In that sense, the continuity arrow runs in an exactly opposite direction to the arrow you continuity theorists, again following Freud, choose to emphasize. I fear that you may not only be missing the boat but making an important error in your work.

**MS.** Up to now there are only three studies looking directly into the idea that dreaming as conscious activity during sleep that can remembered upon awaking might be related to memory consolidation which is likely to take place on a cellular level (neurons, synapses). The studies (De Koninck, J., Prevost, F., & Lortie-Lussier, M., 1996; Schredl & Erlacher, 2010; Wamsley, Tucker, Payne, Benavides, & Stickgold, 2010) are far from conclusive. But there is a lot of work to be done. Regarding your idea of PREPLAY, I agree with you about the universality of the formal features of dream like seeing, acting, feeling. As the dream content reflects recent events, emotions of waking life, it seems difficult to understand why you focus only on one side of the coin. In terms of function, it could make sense, that “old” waking life material is put together in a creative way in order to prepare the person for future experiences in waking life, this is similar to the problem-solving function postulated for dreaming (Wright & Koulack, 1987).

**AH.** What might then be the function of discontinuity? I suggest, in my new protoconsciousness hypothesis, that dreaming is a predictor as well as a reflector of waking consciousness. By that I mean that REM Sleep-Dreaming is a virtual reality generator for the conscious brain-mind. It creates an infinitely varied set of possible scenarios at the same time that it processes scenarios that have actually occurred! The advantages of such an autocreative system are obvious. In life, it is important to be prepared for anything. The genetically encoded experience of our biological ancestors is thus made available to us.

**MS.** The idea that dreaming with its creative potential is important for mankind is intriguing and very plausible but as an empirical scientist I think about paradigms to test this theory. Is there any possibility to test the protoconsciousness hypothesis?

**AH.** One of the advantages of a cross-species neurobiological approach like the one I used to study the brain basis of dreaming is the opportunity to explore the implications of theory not just in humans but in animals where certain kinds of experiment can be performed which are not possible in people. For example, it is possible to look for orientation patterns in rat hippocampal neurons before as well as after the animal is exposed to maze-learning. When this is done, it is possible to detect robust evidence that there is PREPLAY (not just replay) of orientational brain activity (Dragoi & Tonegawa, 2011). Thus a sleeping, dreaming animal (like you, Michael, and me), correctly predicts the situation to which he is exposed. This must reflect impressive redundancy to assure some match between expectation and experience and is a finding which confirms an important tenet of protoconsciousness theory. In fact, I long ago predicted that REM sleep provided a redundant set of orientational maps that could be fit to the orientation realities of waking. Such a prediction and such a result could never have emerged from continuity theory unless the continuity arrow

**Box 2 – AIM model**

The AIM model was formulated by J. Allan Hobson and co-workers (J Allan Hobson, Pace-Schott, & Stickgold, 2000) to describe the relationship between neurobiology and consciousness. The three relevant factors are activation (A), input/output (I), and modulation (M). Brain activation is crucial for consciousness processes and differ, for example, between waking, REM and NREM. The major difference between waking and dreaming is the input/output dimension. Whereas in waking life, the brain processes mainly external input, the dreaming brain is processing internal generated information. The modulation factor refers to the reciprocal interaction model of REM sleep regulation, cholinergic cells in the brainstem are active during REM whereas aminergic cells are active in the waking state. These differences in neuromodulatory systems result in an differential activation of the brain, and might explain specific dream features like dream bizarreness or reduced intellectual activities in dreams. I.e., the AIM model and its predecessor, the activation-synthesis theory, aimed at explaining differences in formal aspects of the consciousness based on neurophysiological differences but did not focus on thematic aspects of dreaming.

ran forward from the dream to experience, exactly opposite to the way that psychotherapeutically oriented scientists like yourself would draw it. This finding not only complicates your life by showing that your theory is incomplete, but it also suggests that your theory may be wrong: how could you ever interpret a dream if you thought it was a wide open set of expectations rather than a narrow mirroring of experience?

**MS.** As mentioned before, dreaming must not necessarily play a part in the sleep-dependent memory consolidation which is obviously a function of sleep fulfilling the idea of preparing. How can we tackle the problem to study the effect of dreams on subsequent waking life? One idea is to look what kind of waking-life experiences are incorporated into dreams, does this give us hints about the function of dreams. So, let me elaborate on the factors that may determine incorporation of waking experience into dreams. One factor – emotional intensity – seems very plausible. Emotionally intense waking life experiences are more likely to be incorporated into subsequent dreams. This is not only valid for traumatic experiences but also for everyday events – see my diary study (Schredl, 2006).

**AH.** Emotional salience or emotional intensity may well be a determinant of incorporation and I have already proposed that emotional salience may be used to organize the memories which turn up in dreams. But discontinuity and protoconsciousness theory would insist that there is much more to it than that! I hypothesize that emotion is generated as a primary event in REM and that it then becomes the dreamer's job to associate his or her own memories or predictions on to those emotions. Dreaming is thus regarded as a practice session for a wide range of wake-state challenges (some of which may never actually occur). On this view, dream emotion might be as much a stimulus of dream content as a label, imported from waking, and determining incorporation.

**MS.** A recent study of mine (Schredl & Reinhard, 2009-2010) supports your idea, dreams that were strongly affected by the previous day affected the mood of the subsequent day most likely. In terms of the protoconsciousness hypothesis, it would be helpful if dreams pick up the major

### Box 3 – Protoconsciousness theory

Based on the findings that newborn mammals show high amounts of REM sleep, J. Allan Hobson (2009) formulated his dream protoconsciousness hypothesis which suggests that the development and maintenance of waking consciousness and other high-order brain functions depends on brain activation during sleep. Whereas the benefit of brain processes regarding memory consolidation have been shown in numerous studies, the question of specific function of dreaming as subjective experience during sleep is still not answered. The postulated primary processes in REM sleep (including perception and emotion) are difficult to study because dream reports can only be obtained by infants who succeeded in learning to speak. One claim of the protoconsciousness theory is that some features and even some contents might be inborn and not only reflecting previous waking life experiences.

ongoing problems (or more generally: current concerns) and help the dreamer to be better prepared for the next “round”. Do you have any idea how, for example, flying dreams fit into that picture? These dreams apparently do not prepare for waking life.

**AH.** I have recently revisited the flying dream story in terms of my own doubts that the blind can see, the deaf can hear, and the paralyzed can move in their dreams (Voss, Tuin, Schermelleh-Engel, & Hobson, in press). How can this be true unless dream content is synthetic and not merely reproductive? The fact is that I myself have had perfectly delightful flying dreams without ever having flown in waking. In that state, however, I have seen birds and airplanes flying so I know that it is possible. And when I imitate a bird or an airplane in my dreams I learned to take off. By means of autosuggestion, I was able to fly without imitating birds or airplanes, again confirming the view of dreaming as plastic and pluripotential, a state to be celebrated and used for its own sake, not a means to an end but an end in itself. The blind, the deaf, and the paralyzed enjoy their dream fictions as much, if not more, than I enjoy flying.

**MS.** Another factor which I think may determine incorporation was first stressed by Ernest Hartmann. The title of his article was “We do not dream of the 3 R's: implications for the nature of dream mentation” (Hartmann, 2000). He showed that activities like reading, writing and arithmetic occur – in relation to their frequency in waking life – relatively rarely in dreams. This was replicated by two studies I have carried out. Talking with friends, for example, was found more often in students' dreams than studying – if controlled for the amount of time spent for each activity in waking life (Schredl & Hofmann, 2003).

**AH.** The absence of Hartmann's 3 R's from dream content is important evidence in favor of discontinuity. Some frequent and common experiences of waking (like reading, writing and mathematics) are markedly underrepresented in dream content. Why? Certainly not because those activities are not emotionally salient. It is difficult to imagine waking experience more stressful to students than scholastic challenges. No, I propose that the 3 R's are not there because they are secondary consciousness dependent cognitions that cannot occur in REM Sleep dreaming. This is because the brain is defrontalized and aminergically demodulated. We don't do math in our dreams because we can't do math in our dreams! It's as simple as that. This point exposes a glaring weakness of continuity theory and, again, indicates a major difference between waking and dreaming.

**MS.** I agree with you that the continuity hypothesis can not explain everything – see for example flying dreams. The underrepresentation of the 3 R's does also not favor a simple relationship between dreaming and memory consolidation either. As we are not talking about exact replay which might be necessary for memory consolidation which takes place in sleep but about content, it might be interesting to speculate why studying is underrepresented and social interactions are overrepresented compared to waking life. Why is there a thematic continuity between waking and dreaming. As I said above, I found a “second-order” continuity, those dreams which have been most strongly affected by waking life experiences of the previous day are those

**Box 4 – Continuity vs. Discontinuity**

Whereas the continuity between waking and dreaming is easily defined in terms of thematic similarities, e.g., dreaming of the romantic partner because she/he is salient in the waking life of the dreamer, the definition of discontinuity is more complex. One aspect addressed in the discussion is the aspect that dreams included elements that the dreamer has never experienced in his waking life, e.g., flying, pain experiences, hearing in congenitally deaf person etc. It seems a very interesting topic to speculate about the origin of these dream experiences. It also seems to be related to bizarreness (see page 4).

that affected the mood of the following day the most. This led me to hypothesize that thematically important issues will be processed in waking life as well as in dreams, and this is continuity and protoconsciousness theory (see Box 4).

**AH.** Michael, you are struggling to defend your theory against all evidence. Maybe you would tell us what evidence would convince you that continuity theory is either wrong or incomplete.

**MS.** I do not have any problems to admit that the continuity hypothesis is incomplete. First of all, it is a descriptive model to show that some waking life experiences (not all) can be found in some form in dreams. Here is the evidence clear. The major – and yet unanswered – question is: Does continuity or discontinuity – as you define it – makes any sense in regard to a possible function of dreaming?

**AH.** From my perspective, the evidence that incorporation of waking experience into dreams is determined by emotional salience is unconvincing. All my life I have heard similar arguments made by clinicians whose bias in this matter is obvious. They are selling a product and can't be expected to warn potential customers of their product's deficiencies! Look, Michael, there are numerous emotionally salient experiences which are never incorporated into dreams and many emotion-rich dream experiences which never occur in waking. My personal and scientific reaction to these facts is that there is a redundant mix and match process going on in REM sleep dreams which associates emotion and mental content, real or imagined, experienced or merely anticipated. Such a system is far less constrained than continuity theory would predict but one which is far more effective because of its scope, generality and redundancy.

**MS.** My definition of continuity might be different from what you have in mind. I am not associating replay of waking life experiences but continuity of topics that are important to the dreaming and waking ego. I would like now to refer to psychological theories about personal growth or self-actualization as Carl Rogers called it. In addition to the "normal" problem solving skills (inventions, daily work) in order to cope better with the physical surrounding, the need for personal growth seems inherent to human nature, maybe in order to better cope with social situations. That makes sense for the human species as they live together in groups. So, my idea is that dreams, especially dreams that show thematic continuity to waking life, help the dreamer to mature in this psychological sense (see Box 5).

**AH.** Whether dreaming is correlated with adaptation in the narrow clinical sense of the theorists like Sigmund Freud, Carl Rogers or Rosalyn Cartwright is dubious, I believe. But the idea that dreaming is a prelude to, and predictor of, waking consciousness is a clinically significant and powerful adaptive notion. I submit that continuity theory espoused by you and many other clinically oriented psychologists puts the cart before the horse. In my view, REM sleep dreaming subserves all conscious state functions and not just those which are narrowly relevant.

**MS.** I wouldn't call the idea of personal growth aimed at increasing pleasant experiences and decrease the frequency of negative ones "a narrow clinical sense of adaption". If I understand your protoconsciousness theory correctly, this would fit in perfectly.

**AH.** For what is worth, in my forty years' experience as a psychotherapist, I can honestly state that I never learned anything from a client's dreams that I did not already know. Since I was trained by Freudians, I listened long and hard for the penny to drop. It never did and my patients have done at least as well as those that are still waiting for messages from their dreams and the unconscious.

**MS.** My over 20 years' experience in working with dreams gave me a quite different picture but, of course, my aim was different. My approach to working with dreams is different from classical psychoanalytic approaches (maybe not so different from modern psychoanalysis) and aims helping the dreamer to understand himself or herself better. And this I have seen a hundred times, talking about the dream, its relationship to current issues helped the dreamer to understand the situation more clearly and even provided some ideas for change – especially if the dreamer was asked what he or she would have liked to do in the dream differently. That dreamwork in psychotherapy is effective have been shown by Clara Hill and coworkers (Hill & Goates, 2004). I admit that this evidence is not conclusive because talking about other issues might be as helpful as well, even if the Hill studies suggest that there might be a slight advantage for dreams.

A brief comment on Ursula Voss' finding that the dreams of paraplegics, and deaf-mute people do not dream of their disability and that they do dream of themselves as without their wake state limitations (Voss, Tuin, Schermelleh-Engel, & Hobson, in press). Even if she demonstrated that their dis-

**Box 5 – Psychological functions of dreaming**

The question whether dreaming has a function on its own – in addition to REM sleep or sleep in general is still debated. The assumption, for example, that dreaming is necessary for memory consolidation processes taking place during sleep have not empirically studied in depth. Overall, it is difficult to study the function of dreaming because dreams can only be obtained by asking the dreamer after he or she woke up and, therefore, possible beneficial effects can not be separated from thinking about the dream during or after telling the dream. I.e., one cannot study the function of unremembered dreams. One possible function of dreaming because of its focus on social interactions might be personal growth.

ability shows up very rarely in their dreams this does not falsify the continuity hypothesis. It only says that the life-long disability does not have a strong effect on the dreams during the study period. Maybe current interpersonal conflicts are more important to be incorporated but this hypothesis can only be studied if the waking life of the participants will also be measured in some way in order to correlate waking life with dream content. So the Voss results might also point in the direction to look more closely what kind of waking life experience is likely to be incorporated into dreams.

**AH.** This surprising finding clinches the case for me. Although I am skeptical of the claim that these subjects have sensory experiences in their dreams which they never had in waking, the study strongly supports the idea that conscious experience depends upon built-in processes that arise independently of waking. In other words, continuity theory is, at best, incomplete and must be complimented by a theory of discontinuity like that of protoconsciousness. It is not so much a question of either/or as it is a question of both/and.

**MS.** I agree. This finding – which is, however, not supported by other empirical studies in the field – suggest that some features like body image or verbal interaction might have some basis in the hard-wire of the brain. In my opinion, the continuity hypothesis and the protoconsciousness theory fit together well.

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