Evolutionary Psychology
www.epjournal.net – 2007. 5(1): 28-44

Original Article

# Costly Signaling Theory of REM Sleep and Dreams

Patrick McNamara, Department of Neurology (127), Boston University School of Medicine, Boston, MA, and VA Boston Healthcare System, 150 South Huntington Avenue, Boston, MA 02130, Email: mcnamar@bu.edu

Reka Szent-Imrey, Károli Gáspár University, Psychological Institute, 324. Bécsi Street, H-1037, Hungary

**Abstract:** The function of REM sleep dreaming is still unknown. We situate our approach to understanding dream phenomenology and dream function within that part of evolutionary theory known as Costly Signaling Theory (CST). We contend that many of the signals produced by the dreaming brain can be and should be construed as "costly signals"—emotions or mental simulations that produce daytime behavioral dispositions that are costly to the dreamer. For example, often the dreamer will appear in the dream as handicapped in some way (i.e., no clothes, no ID, no money, is under attack, being chased etc.). The dreamer, during waking life, is then influenced by the carry-over effect of the unpleasant dream content. The informational and affective content of the dream creates a mental set in the dreamer that operates during the daytime to facilitate the signaling of a "handicapped" Self. The subtle signaling effect might be via display of the intense emotions or physical demeanor that had first appeared in the dream. When the dreamer shares his dream with others the dream has a more direct impact on waking life and social interactions. In effect, the dreamer uses his or her dreams to adopt a self-handicapping strategy when dealing with significant others. The increased use of costly signals (the self-handicapping strategy) during the daytime then facilitates some vital communicative goal of the dreamer.

**Keywords**: REM Sleep, Dreaming, Costly Signaling Theory, Handicap, Emotions

## Introduction

The function of REM sleep and dreaming is still unknown. To the extent that some forms of sleep mentation depend on REM sleep physiology it can be said that this mentation is part of that physiology. In this paper we treat dreams that occur in temporal relation to REM sleep episodes as part of the physiology of REM sleep. Not all dreams and not all of the content of REM-related dreams are due to REM physiology alone (see Nielsen, 2000; Solms, 2000). Nevertheless, it is very likely that a significant portion of the content of REM related dreams is related to and even a direct result of various components of REM physiology (Dement and Kleitman, 1957; Goodenough, 1991; Hobson, Pace-Schott, and Stickgold, 2000; Schonbar, 1961). For example, when ponto-geniculo-occipital (PGO) spikes occur during a REM episode one is more likely to get dream reports that contain rapid plot shifts and greater amounts of bizarre imagery. In addition, the limbic brain activation patterns that occur during REM very likely accounts for dreams containing emotionally charged social interactions (Maquet and Phillips, 1999; McNamara, McLaren, Smith, Brown and Stickgold., 2005). In short, it is not

unreasonable to treat dream reports that occur in temporal relation with REM episodes as part and parcel of REM physiology itself. To construct a theory of dream function it is reasonable to bring in an account of REM physiology.

Some progress has been made in our understanding of REM physiology including REM dream content by adopting evolutionary approaches to dream function. For example, the so-called "threat simulation theory" (Revonsuo, 2000) of dream function can claim some empirical support given that some studies of dream content are consistent with the theory. In addition, unlike classical Freudian or Jungian theory, threat simulation theory is consistent with a broad range of data from the evolutionary sciences and theory. No elaborate interpretation of dream content is needed to square the dream content data with the (evolutionary) theory. The data or at least some portion of the available data on dream content is nicely predicted by the threat simulation theory. Evolutionary approaches to dream function have the advantage of putting severe constraints on the scope of the theory proposed – namely that the theory be consistent with both the facts concerning dream phenomenology and the rest of the evolutionary sciences. It is not enough to speculate about what dreams might do for the organism – one must propose a function that is consistent with some part of evolutionary theory. If dreams are good for something, that something must be with reference to some part of evolutionary theory.

We situate our approach to understanding dream phenomenology and dream function within that part of evolutionary theory known as Costly Signaling Theory (CST; Bliege Bird and Smith, 2005; Bradbury and Vehrencamp, 1998; Grafen 1990; Johnstone 1997; Maynard-Smith and Harper, 2003; Zahavi, 1975; Zahavi and Zahavi 1997). CST is concerned primarily with understanding animal signaling behaviors. The basic idea is simple: for signals between two parties to be workable or believable by both parties they must be reliably unfake-able. Only signals that can't be faked can be trusted to carry honest information. Un-fakeable signals are those signals that are metabolically, motorically, or behaviorally difficult to produce (costly). Their production costs or "costliness" is their certification of honesty. Costly signals are preferred by animals under conditions where the animals are capable of deception but require reliable and honest signaling between the parties (e.g., between the two sexes during mating season). . For a signal to classify as a handicap, the net benefits for displaying the signal (REM sleep intensity in our case) must be higher for a high-quality individual than a low-quality individual (or the costs of high REM intensity must be higher for low-quality individuals). Thus a low-quality signaler must be able to send a signal suggesting high quality; i.e. must be able to fake "high REM". The signal must be costly to fake but not impossible to fake. The handicap principle asserts that low-quality signalers generally don't send false signals because it simply does not pay; the net costs are too high.

Humans, of course, engage in a range of signaling behaviors, but can REM sleep and dreams plausibly be considered one of them? Human signaling behaviors include everything from speech and language exchanges to emotional displays, "body-language" (e.g. clothes, postures, tattoos etc) and other non-verbal behaviors. Our basic claim in this paper is that dreams associated with so-called rapid eye movement or REM sleep can function as signals. Dreams can also function to facilitate production of signals when they produce some daytime effect such as a memory or a mood (or both) or a behavior that communicates a message to an observer. A person, for example, who awakens from a disturbing dream may behave differently during the day from a person who awakens from, for example, an erotic dream or a bizarre dream and so on. Many dreams, even un-remembered dreams create background moods and behavioral dispositions that linger through much of the subsequent daytime period (Kramer, 1993). While it

is difficult to demonstrate that un-recalled dreams can influence daytime mood and behavior, we know that depriving a person of his or her REM/dream sleep can significantly alter daytime mood states –at least in some vulnerable individuals (for reviews see Bonnet, 2005; Dinges, Rogers and Baynard, 2005; Moorcroft, 2003; Vogel, 1999).

It is much easier to demonstrate that recalled dreams can influence daytime mood and behavior. We know from personal experience that this is the case. A bad dream can color one's mood throughout the day. Most people have had such experiences fairly frequently it seems. Kuiken and Sikora (1993) for example, found that 13% of 168 respondents to a questionnaire on dream recall reported that they, at least 12 times in the past year, had had dreams that significantly influenced their daytime mood; 25% of respondents indicated that they had had such dreams at least 4 times in the past year and 44% at least twice in the past year. Like any other mood state, these dream-related dispositional and mood states, we claim, can be "read" by observers as informational about the internal states and quality of the dreamer.

Dreams can also affect daytime mood and behavior by being shared with others. Given what we know concerning the centrality of group dream sharing in pre-modern tribal groups (Gregor, 1981; 2001; Schneider and Sharp, 1969; Tedlock, 1992), we can assume that dream sharing was a common practice in early human groups in the "environment of evolutionary adaptation" (EEA). Even today young adults recall one to two dreams per week with 37% of these reporting that they recall a dream "every night" or "very frequently" (Belicki, 1986; Goodenough, 1991; Strauch and Meir, 1996). In representative samples of the general population between 40 and 75% recall between one to five intense and "impactful" dreams per month (Borbeley, 1984; Kuiken and Sikora, 1993; Stepansky et al., 1998). Once recalled a dream is typically shared with another person (Stefanakis, 1995; Vann and Alperstein, 2000). Once shared it has the potential to go on influencing daytime mood and behavior.

Like many other costly signals, dreams are considered to be involuntary cognitive and emotional experiences and thus less fake-able. Sharing a dream with another gives the "other" a direct window into recent brain/mind REM activity and thus a direct window into the quality of the individual sharing the dream.

We contend that many of the signals produced by the dreaming brain can be and should be construed as "costly signals"—emotions or mental simulations that produce daytime behavioral dispositions that are costly to the dreamer. For example, often the dreamer will appear in the dream as handicapped in some way (i.e., no clothes, no ID, no money, is under attack, being chased etc.) The dreamer, during waking life, is then influenced by the carry-over effect of the unpleasant dream content. The informational and affective content of the dream creates a mental set in the dreamer that operates during the daytime to facilitate the signaling of a "handicapped" Self. The subtle signaling effect might be via display of the intense emotions or physical demeanor that had first appeared in the dream. In effect, the dreamer uses his or her dreams to adopt a self-handicapping strategy when dealing with significant others. The increased use of costly signals (the self-handicapping strategy) during the daytime then facilitates some vital communicative goal of the dreamer.

We realize that this theory is at this point purely speculative. We nevertheless contend that there is a great deal of evidence that supports it basic suppositions. In what follows, we summarize the main arguments for our CST approach to REM sleep and dreams and then provide some preliminary suggestions as to what CST theory would predict concerning dream content.