

Introduction: Establishing a Context, Providing an Overview

This book presents a detailed statement of the neurocognitive theory of dreaming, along with the empirical findings that support it. The theory has three levels. It begins with the neural substrate that subserves dreaming. Next, the specific cognitive processes supported by this neural substrate are outlined. Finally, the dream reports that research participants provide, either verbally or in writing, are used to carry out quantitative studies of dream content.

The neurocognitive theory of dreaming is therefore based on “three distinct, but fundamentally interrelated, levels of analysis,” which are generally considered to be the hallmarks of much current theorizing in cognitive neuroscience (Ochsner & Kosslyn, 2014b, p. 2). There is an underlying neural substrate, along with the cognitive processes that the underlying substrate supports. Finally, a neurocognitive theory has a behavioral level, which in the case of dreaming can only mean verbal and written dream reports. There are numerous links between levels, and more links are likely to be discovered (Ochsner & Kosslyn, 2014a, pp. 478–479, 481).

The theory also has a developmental dimension. The neural substrate that supports dreaming matures only gradually during childhood and early adolescence. The cognitive skills necessary for dreaming also develop very gradually. As a result, the dreams reported by children and adolescents in controlled laboratory settings change in frequency, complexity, and content until the participants reach middle adolescence.

Different groups of researchers in different disciplines carried out the studies that are the basis for the neurocognitive theory of dreaming. Since the theory draws upon a multiplicity of sources, it is first and foremost a synthesis. It is therefore useful to proceed in a step-by-step fashion.

Although each of these research literatures is considered to be solid and well-grounded by the specialists in them, there may be differences among both cognitive neuroscientists and psychological scientists as to the degree of their relevance and importance in understanding dreaming and dream content. In addition, some of the findings that emerge from these research fields lead to counterintuitive conclusions. For these reasons, the theory may be perceived as controversial to varying degrees on some issues.

Due to the focus on explaining a theory and presenting the evidence for it, the book does not draw upon all aspects of the research literature on dreaming. It therefore does not provide a comprehensive account of everything that has been written about dreams, nor a historical overview of the development of this large literature. The primary focus is on replicated findings that are based on large sample sizes and make use of reliable and validated methodologies. In addition, there is an emphasis on the use of statistical analyses that are appropriate to the level of measurement used in the various studies.

Within the context provided by the previous five paragraphs, the remainder of this brief introduction presents an overview of the where, how, when, what, and why of dreams. The “where” of dreaming is located in a relatively small portion of the human brain. During dreaming, the neural substrates that support waking sensory input, task-oriented thinking, and movement are relatively deactivated. This discovery in the mid-1990s, based on new neuroimaging technologies, was not anticipated on the basis of the many earlier electroencephalogram (EEG) studies of the brain during waking and sleeping. Any hesitancy about accepting the accuracy of these unexpected results with regard to dreaming was soon abandoned on the basis of the findings in systematic studies of the effects of brain lesions on dreaming.

These lesion studies, which were carried out by a neuropsychologist shortly before the neuroimaging studies were undertaken by other researchers but published at the same time as the neuroimaging studies were first being reported, pointed to the same neural substrates as necessary or not necessary for dreaming (Solms, 1997). The convergent findings from neuroimaging and lesion studies took on even greater significance on the basis of a further discovery by still other researchers, which occurred shortly thereafter. The neural network that subserves dreaming is part of a larger neural substrate, called the “default network.” During waking, this network enables the cognitive processes that have a large role in supporting

memory, imagination, and other forms of internally generated thought, including mind-wandering and daydreaming (Gusnard, Akbudak, Shulman, & Raichle, 2001; Gusnard & Raichle, 2001; Raichle et al., 2001).

As to the “how” of dreaming, the primary cognitive process that produces dreaming is “simulation.” Simulation is a type of thinking that places a person in imagined hypothetical situations. These imagined situations are often used to compare various possible alternative outcomes. Still other studies suggest that the simulation process is sometimes enhanced to the point that it can be characterized as “embodied simulation.” Embodied simulation not only involves imagination and narrative flow; it also includes a greater activation of secondary sensory and sensorimotor areas, which support both vivid mental imagery, such as visual and auditory imagery, as well as imagined movements. During dreaming, the mental imagery involved in embodied simulation is usually so vivid that dreaming is subjectively experienced as the person in action within a real environment.

Turning to the “when” of dreaming, dreaming occurs spontaneously whenever six specific conditions are met. These six conditions, which are stated very generally here, primarily concern the maturity of the neural substrate that supports dreaming, the absence of external demands on the brain, and an adequate level of cortical activation. As a final condition, there has to be a loss of conscious self-control, which involves the relative deactivation of the neural substrates that are involved in supporting focused attention. The six necessary conditions for dreaming are explained in detail as the analysis unfolds.

The “what” of dreaming is called “dream content.” It is analyzed quantitatively by placing all aspects of dream reports into a wide range of carefully defined categories. The ensuing statistical analyses reveal that dreams in large part enact personal concerns. These personal concerns usually relate to important people and avocations in the dreamers’ lives. Dreams thereby dramatize the dreamers’ conceptions of themselves and their relationships with other people. There are large individual differences in people’s conceptions and concerns. For example, an individual dreamer’s social interactions with the people she or he dreams about may portray the dreamer as generally friendly with people or as being hostile and aggressive. Then, too, a dreamer may frequently initiate friendly interactions with one dream “character,” as the people and animals in dreams are called, but not with another. A person’s dreams may show her or him engaging in supportive

interactions with one character but ignoring attempts by another character to initiate friendly interactions. When the frequency and nature of a dreamer's interactions with each specific character are precisely quantified and then turned into percentages or ratios to correct for the varying lengths of dream reports, the dream content in 125 or more dream reports from a group or individual can provide a reasonably precise portrait of the dreamers' conceptions and personal concerns.

The "why" of dreaming may be the most counterintuitive outcome of empirical dream research. Numerous systematic studies inadvertently cast doubt on all adaptive theories of dreaming. Nor is there any positive evidence for any adaptive theory of dreaming. These various studies lead to the hypothesis that dreaming may be a by-product of the selection for waking imaginative cognitive capacities. Waking imagination has reproductive and survival value because it allows humans to rethink the past, bring together the past and the future in their present thinking, and to plan and prepare for the future (Spreng, Madore, & Schacter, 2018).

Although dreaming may not have any adaptive functions, research by anthropologists, historians, and comparative religion scholars demonstrates that dreaming has psychological and cultural uses, which were invented in the course of human history. The most important of these uses are found in religious ceremonies and in healing practices. In order to develop a complete theory of dreaming, it is therefore essential to distinguish five separate issues from each other: neural substrates, cognitive processes, the psychological meaning contained in dream content, evolutionarily adaptive functions, and historically invented cultural uses. It is then possible to explore how these different issues are intertwined.

In addition to explaining the where, how, when, what, and why of dreaming, the book includes chapters on the degree to which there is "symbolism" in dreams, the development of dreaming in children, and the relative frequency of emotions in the dreams of both children and adults. Following those chapters, there is a chapter that discusses the two main traditional and comprehensive theories of dreaming, as well as a chapter on the several theories concerning the possible adaptive functions of dreaming. A brief concluding chapter then highlights the differences between the neurocognitive theory of dreaming and other theories of dreaming.

Chapter 1, to which the book now turns, discusses the definitions, distinctions, and limitations that should be kept in mind while reading through the step-by-step theoretical chapters that follow it.

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The Where, How, When, What, and Why of Dreams

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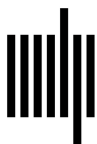
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