

10 Dreaming, Adaptive Functions, and Cultural Uses

Based in large part on four different types of descriptive empirical findings, which are inconsistent to varying degrees with every theory of dream function that has been proposed, this chapter argues that dreaming has no adaptive function. In addition, still other empirical findings refute specific aspects of one or another adaptive theory. The four general findings are already familiar to readers because they were discussed in previous chapters, so they can be briefly summarized for the purposes of this chapter's introductory section.

First, the extremely infrequent recall of the several dreams during sleep onset and at night seems to be much lower than would be expected if dream content contains useful information people need to consciously know in waking life. This result alone has contributed strongly to the promulgation of new adaptive theories since the late 1990s, which claim that dreaming has an impact on neurocognitive processes and/or waking behavior without any need for recall. Second, the likely absence of dreaming during the preschool years, and its infrequency and lack of complexity until ages 9–11, seem to limit any adaptive function to the adolescent and adult years. However, most adaptive theories, including those not requiring recall, currently assume there is dreaming at an early age, or by age 6 at the latest.

Third, the lesion studies, which show that people can lose dreaming without losing necessary cognitive functions, provide a strong challenge to most adaptational theories. Fourth, the consistency of dream content over months, years, and decades, and the fact that dream content changes only gradually when it does change, calls into question any adaptive theory claiming that dreams deal with new problems as they arise or help people to prepare for the future.

These numerous empirical findings provide the main basis for assessing the three most widely discussed general types of theories of dream function. These three general types of theories focus on (1) solving specific problems, (2) helping with the regulation or assimilation of emotions in waking life, and (3) mastering waking situations. The third of those categories, “mastery,” is a very general one. It encompasses Freudian-derived theories, social-rehearsal theories not involving waking recall, and assertions about dreaming during REM sleep having a role in consolidating the brain’s predictive-coding capabilities.

Although there are many reasons to reject all of the adaptive theories, there are good reasons to suggest dreaming is a type of “nonadaptation.” According to evolutionary biologists, nonadaptations include genetic drift and preadaptations, which persist because they do not interfere with reproductive success. In the case of dreaming, it is more specifically a “by-product,” which is a type of nonadaptation that is an unintended outcome of one or more adaptations. From a neurocognitive point of view, dreaming is a by-product of the evolutionary selection for the default network, which supports the imaginative capacities making it possible to rethink the past, imagine possible alternatives in new situations as they arise, and plan for the future.

Even though dreaming is most likely a by-product, there is an abundance of evidence showing human beings in virtually all cultures have used their waking imaginations to invent uses for dreams (Benjamin, 2014; D’Andrade, 1961; Gregor, 1981). Dreaming thereby has emergent cultural uses in a variety of contexts. Due to age-old beliefs about a link between dreams and the world of spirits, the most important of these invented functions involve religious and healing ceremonies (Bulkeley, 2008; Tylor, 1871/1958). In particular, dreams may become extremely important in times of cultural crisis, when cultural heroes claim that a dream or a dreamlike state was an important basis for the new religious beliefs they propound (LaBarre, 1972). In this way, the private world of an individual’s dreams may lead to new cultural practices. These new practices may help to bring about group solidarity and also may aid individuals in coping with anxiety and other negative emotions. The uses of dreams are explored further after the several theories of dream function are discussed in detail.

The Problem-Solving Theory of Dream Function

The general idea that dreams sometimes provide solutions to unresolved problems was put forth by several early advocates of Freudian dream theory, who had come to believe the adaptive dimension of the theory is too narrow (Dallett, 1973, p. 409). In their view, dreams help people to cope with their personal problems. This idea was developed and elaborated upon by a psychoanalyst who was also a sleep-laboratory dream researcher (Ullman, 1959). Problem-solving theories were carried forward in slightly different forms by non-Freudian dream researchers through experimental studies (e.g., Cartwright, 1977, 1996; Cartwright, Agargun, Kirkby, & Friedman, 2006).

All versions of the problem-solving theory are called into question by several different empirical findings. First, the truncated neural substrate underlying dreaming may be limited in its ability to support many forms of waking thought, as discussed in chapter 2 and as demonstrated in the case of figurative thinking in chapter 5. Second, most people recall only a very small percentage of their dreams, which seemingly would be recalled more frequently if they were important in dealing with waking-life problems. Third, the small percentage of recalled dreams rarely contain even a hint of a solution to a problem, so the theory in effect ignores the extremely large number of instances it cannot explain.

In one of the largest and most carefully done studies, 76 college students were asked to choose a problem they hoped to resolve and then to write down any dreams they had about the problem within the next week or longer if necessary (D. Barrett, 1993). Only half of the participants recalled a dream they felt related to the problem, most of which simply enacted relationship dilemmas or educational/vocational decisions and did not seem to offer any solutions. There were only two instances in which both the dreamer and two independent judges agreed the dream reports contained the problem and offered a plausible solution. The language used in the written reports about those two dreams strongly suggests the possible solutions to their problems dawned on the participants as they were writing down and reflecting upon their dreams (Domhoff, 2003, pp. 160–161). Since conscious attention is usually if not always needed for problem solving, it is more likely that any realizations about a possible solution to a problem emerge while a person is thinking about the dream in the waking state. This point has been convincingly argued and demonstrated in an insightful

critique of problem-solving theory by a cognitively trained research psychologist, who focuses on dreams (Blagrove, 1992, 1996, 2000; Blagrove, Edwards, van Rijn, Reid, & Malinowski, 2019).

The findings from studies of dream series, as overviewed in chapter 4, also present major problems for the problem-solving theories of dreams. As these studies demonstrate, most of the dream reports in the most recent years of a dream series dwell upon the same personal concerns appearing earlier in the series. Changes in dream content happen only gradually over time in a dream series, if they occur at all. This point is perhaps best made as far as problem-solving theories through the results at the end of chapter 7 regarding the Izzy and Jasmine dream series. Readers may recall those two dream series begin in the teenage years and stretch into early adulthood, a time period when individuals are facing new problems and undergoing many changes. Both series reveal the continuing appearance of the same people and avocations throughout. The findings with dream series also reinforce another conclusion, based on studies of individuals who are participants in sleep-dream lab studies or who make daily reports: dreams only rarely deal with actual daily waking events of any type (Domhoff, 2017, pp. 25–33; Foulkes, 1996a). This issue is also briefly overviewed in the critique of Freudian dream theory in chapter 9.

As a result of the doubts about the systematic studies relating to the problem-solving theory of dreams, the best evidence for it consists primarily of anecdotal examples concerning the writing of new poems, the creation of new story plots, and the emergence of new scientific insights. However, it is one thing for dreams to provide inspiration for poetry, stories, films, or musical creations, but it is another for dreams to contain solutions to problems confronting the dreamers. Even while acknowledging that recalled dreams may inspire waking creativity, the alleged dream may not have been a dream in some of the best-known examples. In one such instance, the new ideas also involved using opium before taking a nap, which led one wary investigator to do a detailed historical study that caused her to doubt every aspect of the story (E. Schneider, 1953). Another instance, based on a drug-induced state, may not have involved much sleep (I. Bell, 1992). In another, the creative thoughts were reveries while nodding off to sleep in front of the fireplace in the early evening. Moreover, the dreamer had been thinking intensely during the day about the theoretical problem in chemistry he had been trying to solve for at least a few weeks (Rudofsky & Wotiz, 1988). In examples such as

that one, the drifting waking thought during the sleep-onset process may or may not have reached the point at which it could be considered “dreaming,” as shown in detailed studies of the sleep-onset process that are discussed in chapter 2 (Foulkes et al., 1966; Foulkes & Vogel, 1965). Still other anecdotal examples are secondhand accounts from decades after the time of the alleged dream. They turned out to be inaccurate or else the reports are of dubious validity because no text of the alleged dream from many years earlier can be found (Baylor, 2001, pp. 89–90).

Beyond these famous instances, though, there are more recent examples of dreams providing intellectual and artistic inspiration (D. Barrett, 2001, 2017). In an interview study of several present-day computer programmers and physicists, they reported that they gained new insights from dreams while working intensely on their projects (D. Barrett, 2001, pp. 102–103, 107–109). However, it cannot be ruled out that the insights might have arisen in a drowsy state, mind-wandering during NREM 2 late in the sleep period, or transitioning into waking. It would therefore be necessary to carry out well-controlled studies and replicate them. Replication studies are especially necessary in these cases because any problem solving relating to dreams may occur while the person is thinking about the dream (Blagrove, 1992, 1996).

Emotions-Related Theories of the Adaptive Function of Dreaming

In still another variant to Freud’s (1900) conclusion about the adaptive function of dreaming, a clinical psychologist suggested the dream state has a number of advantages over waking consciousness for dealing with emotional material (Breger, 1969, pp. 409–410). Based in part on his work with children, this theorist claimed that associational processes may be more fluid and that stored information may be more readily available during dreaming. Moreover, the pressures toward social acceptability may be at a minimum, so the overall context of dreaming may creatively open up memory systems. Finally, emotionally arousing situations during the day might be more readily compared during dreaming with strategies used previously in such situations (Breger, 1967, 1969). In a similar fashion, two psychoanalysts suggested that REM dreaming may provide the context for emotion regulation, by bringing together new and past experiences in order to facilitate new adaptive solutions (Greenberg, Katz, Schwartz, & Pearlman, 1992; Greenberg

& Pearlman, 1993; Greenberg, Pearlman, & Gampel, 1972). As part of their effort, they did experimental studies with rodents, which suggested that REM sleep facilitated information processing and memory consolidation (Pearlman & Becker, 1974; Pearlman & Greenberg, 1973).

The Memory-Consolidation Theory of Emotional Regulation

Although the Freudian-derived theories were largely abandoned, a new version of an emotions-regulation theory of dreaming was created at the turn of the twenty-first century by activation-synthesis theorists (Stickgold, 1998; Stickgold, James, & Hobson, 2000; Stickgold, Scott, Rittenhouse, & Hobson, 1999). This theory claims memory consolidation includes the regulation of emotions in the context of dreaming during REM periods. As with the Freudian-oriented emotions-regulation theorists, the new version built in part on studies of rodents. Some of the animal studies involved depriving rodents of REM sleep. The deprivation of REM sleep in these studies was accomplished by placing the rodents on a small pedestal, from which they would fall into water if they went into REM sleep (due to the muscle atonia accompanying REM sleep) (Carlyle Smith, 1985). These studies were heavily criticized because the stress caused by this procedure very likely confounded the results in a major way (Horne & McGrath, 1984; Vertes, 1995; Vertes & Eastman, 2000). The other and more lasting animal basis for this line of theorizing focused on the tracing of hippocampal brain patterns in rodents during NREM slow-wave sleep. Several studies found these brain patterns to be similar to the brain waves recorded during an earlier spatial behavioral task in the waking state (Wilson & McNaughton, 1994).

At the human level, this new version of the emotions-regulation theory claims that memories of daytime experiences are reprocessed and consolidated during dreams in REM. This assumption is supported by evidence of various changes in REM dream reports after participants view either an emotionally arousing picture, such as one of a wrecked automobile, or a more neutral picture. Dreaming is said to be “simply the conscious perception of the stream of images, thoughts, and feelings evoked in the brain by one or more of the many forms of off-line learning and memory processing that occur during sleep” (Stickgold & Wamsley, 2017, p. 514). This conclusion provides the basis for a further conclusion: “the function of dreaming may be reducible to a question of the function of the sleep-dependent

memory processes that result in the conscious experience of dreaming,” with an emphasis on REM dreams as aiding in emotional regulation (Stickgold & Wamsley, 2017, p. 513).

The emphasis on emotional memory processing during REM is first of all doubtful due to the continuing lack of convincing evidence for any type of memory consolidation during REM sleep in rodents. For example, one independent research team concluded, on the basis of its own research: “Altogether, these findings indicate an importance of NonREM rather than REM sleep for the encoding of information that is independent of the emotionality of the materials” (Kaida, Niki, & Born, 2015, p. 72). These conclusions are similar to those in other research studies by the same core research group (Born & Wilhelm, 2012; Rasch & Born, 2015; Rasch, Pommer, Diekelmann, & Born, 2009). Their analysis is supported by a study showing that “sleep did not stabilize memory” for a word list learned earlier in the day and then followed by another learning task. The study led to the conclusion that “the stabilizing effect of sleep against interference” by subsequent new learning “has been overestimated” (Pohlchen, Pawlizki, Gais, & Schönauer, 2020, p. 1).

In a review of the two decades of work on the replay during sleep of the waking brain-wave patterns accompanying memory consolidation in rodents in experimental settings, the researchers did not find evidence for memory consolidation during REM sleep (Z. Chen & Wilson, 2017). The sharp-wave ripples in the hippocampal region, which are the brain waves used to indicate memory consolidation, seem to behave differently in REM than at other times. Sharp-wave ripples are frequent in slow-wave sleep and quiet wakefulness, but in REM sleep the “firing-rate correlation was not related” to the relevant learning experience during the experiment (Z. Chen & Wilson, 2017, p. 3). Adding further complexity to the research literature on this topic, some of the neurons in the hippocampus active during REM sleep may play a role in forgetting (Izawa et al., 2019). At the least, then, the role of REM in memory consolidation remains uncertain in animal models.

The emphasis on emotional memory consolidation during REM in humans is first of all doubtful on the basis of studies of the many thousands of people who unexpectedly lost most of their REM sleep in the 1950s and 1960s, due to their use of the first generation of antidepressant medications. Despite the relative absence of REM sleep, they did not report any memory

difficulties or other cognition issues. This finding is particularly striking in the case of those who took monoamine oxidase inhibitors, which all but abolish REM sleep (Schweitzer & Randgazzo, 2017; J. Siegel, 2021; Vertes & Eastman, 2000; Wyatt, Fram, Kupfer, & Snyder, 1971).

Similar results are reported in a study using antidepressants developed a few decades later, which reduce REM sleep by as much as 30%. In this well-controlled experimental study, the moderately depressed patients first took several cognitive tests. Then they were placed on one or the other of two medications. After a one-week trial, there was “no association of REM sleep diminution with decreases in memory performance or cognitive flexibility” (Göder et al., 2011, p. 544).

In addition, there is the case of a young man who lost all but a very few percent of his REM sleep due to shrapnel wounds during routine military training. This accident permanently damaged the lateral pontine region of the brainstem, as discovered by means of CT scans after he complained of headaches (Lavie, Pratt, Scharf, Peled, & Brown, 1984). Even without REM sleep, he earned a B.A. and a law degree, practiced law, prepared a new crossword puzzle each week for a major newspaper, and in general led a normal life. He was examined again in greater detail 34 years later at age 68. A full daytime neuropsychological assessment was made. He spent four nights in a laboratory setting while being studied with EEG recordings and a CT scan. He was found to be cognitively normal. He still was almost devoid of REM sleep. He also lacked the REM sleep concomitants that could be assessed, such as increased heart rate and muscle atonia (Efrat et al., 2018).

The neuroimaging studies of the neural substrates supporting emotions during the waking state, which are discussed in chapter 8, are also relevant to this discussion of emotions during REM dreaming. This is because the dorsolateral prefrontal cortex, which is a necessary part of the neural systems subserving the experiencing of emotions in waking (LeDoux, 2012, 2015; Lindquist et al., 2012), is deactivated during both REM and NREM sleep (Fox, Nijeboer, Solomonova, Domhoff, & Christoff, 2013; Uitermarkt, Bruss, Hwang, & Boes, 2020). Then, too, the emotions-regulation theory of REM is called into question by neuroimaging studies of emotion states. Four of the five association networks known to be the basis for emotion states during waking are relatively deactivated during all stages of sleep, as overviewed in chapter 8 (Polner-Clark, Wager, Satpute, & Barrett, 2016; Touroutoglou, Lindquist, Dickerson, & Barrett, 2015).

The low levels of emotions in dream reports collected from children, adolescents, and adults, inside and outside of laboratory settings, are consistent with these neuroimaging results. The findings from studies of dream content also cast doubt on the emotions-regulation theory in their own right. First, as discussed in chapter 8, there is a relative absence of emotions in the dreams of children and preadolescents, which means the theory could not likely be relevant until early adolescence (Foulkes, 1982; Strauch, 2005). Even during adulthood, the relevance of the theory is doubtful. The absence of emotions from at least 25–30% of the dream reports collected in several different lab studies, based on REM awakenings, are contrary to what the theory predicts. The REM-awakening study using a portable EEG in home settings is especially noteworthy. It not only discovered that 26% of the awakenings led to reports of no emotions, but it also found that the emotional intensity of the emotions was rated as low or medium in another 46% of the reports (Fosse et al., 2001, p. 2). It is also noteworthy that the strongest advocate of the emotions-regulation theory is a coauthor on this lab/nonlab study, which has not been factored into the emotions-regulation theory.

Equally problematic, the lab study that focused exclusively on the appropriateness of emotions to other aspects of dream content (Foulkes et al., 1988) found that 17% of the 88 REM dream reports were without emotions but would have had emotions in the same situation in waking life. This conclusion is based on judgments by both participants shortly after the REM awakenings and by independent judges. It seems difficult to explain why a sleep stage focused on regulating emotions would not be processing emotions in situations that would trigger emotions in waking life.

Finally, other evidence shows the alleged regulation of emotional memories during REM occurs just as well during slow-wave NREM sleep during naps, if not better: “Although prior evidence has connected negative emotional memory formation to REM sleep physiology, we found that non-REM delta activity and the amount of slow wave sleep (SWS) in the nap were robustly related to the selective consolidation of negative information” (Payne, Kensinger, Wamsley, Spreng, & Alger, 2015, p. 176). The researchers then said the “magnitude of the emotional memory benefit” conferred by REM sleep “can be economically achieved by taking a nap” (Payne et al., 2015, p. 176). Simply resting, according to another study, can have the same impacts (Humiston, Tucker, Summer, & Wamsley, 2019). These two sets of findings, whose coauthors include several of the advocates

of the emotions-regulation theory of dreaming, provide evidence that REM dreaming is at most a minor factor in processing emotions.

After three decades of research on dreaming and emotions regulation during REM sleep, it is highly unlikely REM sleep involves the reprocessing and regulation of emotions. At best, the evidence is inconclusive. To summarize, there is no evidence for the presence of memory consolidation during REM sleep in rodents. The low levels of activation in the frontoparietal, dorsal attention, and salience/ventral networks during human dreaming raise serious doubts. The cognitive unimportance of the loss of REM sleep in humans remains difficult for the theory to explain. The infrequency of emotions in dream reports and their near-total absence from children's dream reports until ages 9–11 is not what the theory would predict. The equal benefits of taking a NREM nap or taking a waking rest, when considered in the context of the other negative evidence, suggests that REM sleep does not have an important role in regulating emotions.

The Emotions-Assimilation Theory of Dreaming

The emotions-assimilation theory of the function of dreaming is “somewhat divergent” from the theory analyzed in the previous subsection (Malinowski & Horton, 2015, p. 3). It places greater emphasis on the assimilation and integration of waking emotions into the memory system during dreaming: “emotions act as a marker for information to be selectively processed during sleep, including consolidation into long term memory structures and integration into pre-existing memory networks” (Malinowski & Horton, 2015, p. 3). It thereby puts more emphasis on dreaming itself. Nor does it emphasize REM sleep as the only sleep stage in which emotions assimilation during dreaming can occur.

Instead, this theory focuses on the psychological benefits of emotions assimilation, such as its usefulness in facilitating insights and creative thinking during waking. It includes a greater emphasis on the assimilation of positive emotions than related theories do. In addition, the emotions-assimilation theory assigns more importance to the presence of metaphors in dream content, because they aid in emotion assimilation. It also claims “hyperassociativity” during dreaming has a role similar to that of metaphors. (Hyperassociativity is indexed by various forms of bizarreness during dreaming, such as sudden topic changes and highly unusual constructions in dream content.)

This theory first suffers from several of the same problems facing the emotions-regulation theory. As discussed in chapter 8, the relative deactivation during sleep of all but one of the association networks involved in the generation of waking emotions is highly problematic for all theories concerning the importance of emotions during sleep, including this one. The findings on the low frequency of emotions in quantitative analyses of dream content by independent coders is consistent with the neuroimaging findings and adds to these doubts. The theory's strong emphasis on the assimilation of positive emotions is problematic because most studies of dream reports conclude that positive emotions are even more infrequent than negative emotions. Nor does the importance placed on emotional assimilation during dreaming fit well with the low levels of dreaming in the first nine or 10 years of life or with the lack of emotions in the infrequent dreaming that does occur.

In addition, the theory is doubtful because it relies heavily on studies of emotions that make use of self-ratings. However, as shown in a section of chapter 8, self-ratings likely overstate the frequency of emotions. Nor is there evidence for bizarreness (hyperassociativity) in dreaming, as the theory assumes. In addition, several types of hyperassociativity are equally frequent during drifting waking thought (Klinger, 2009; Reinsel, Antrobus, & Wollman, 1992). Further doubts arise because of the lack of evidence for any appreciable amount of metaphoric thinking during dreaming, as demonstrated in chapter 5. The theorists' own study of metaphoric thinking during dreaming is based on metaphoric interpretations emerging in the course of interviews with the four participants. In each case, two dream reports with apparent "high levels of wake-dream continuity" and two with seemingly "low levels of waking dream continuity," were discussed (Malinowski, Fylan, & Horton, 2014, p. 164). However, reflections on dreams during interviews are very likely based on waking insights, not on what is in the dreams themselves (e.g., Blagrove, 1992; Edwards, Ruby, Malinowski, Bennett, & Blagrove, 2013).

Mastery and Rehearsal Theories of Dream Function

Two Freudian-oriented research psychologists independently suggested dreams have a mastery function, which primarily concerned the most important interpersonal conflicts experienced by the dreamer. For Richard

M. Jones (1962), dreams function to keep the person's identity integrated, a form of ego synthesis. Put another way, they help to resolve inner crises. In a similar vein, a second Freudian-oriented research psychologist thought that dreamers' understanding of their central personal problems improve during the course of a dream, putting them in a position of relatively more mastery than at the beginning of the dream (Witkin, 1969; Witkin & Lewis, 1967). There were no direct follow-ups on these speculations and the introductory evidence for them.

However, based on the later adoption of a cognitive emphasis by several theorists, new mastery theories were put forward in the twenty-first century. Generally speaking, they are social-rehearsal theories that can emphasize either solidification of social-interaction skills or the mastery of threatening situations. The most fully developed and visible version of a social-rehearsal theory emphasizes learning new skills during dreaming for dealing with threats (Revonsuo, 2000a, 2000b; Revonsuo & Valli, 2000; Valli & Revonsuo, 2009). The other social-rehearsal theories focus primarily on improving social skills (Brereton, 2000; M. Franklin & Zyphur, 2005; Revonsuo, Tuominen, & Valli, 2015). There is also one other mastery type of theory, which involves the efficient consolidation of updates in the neural substrates involved in predictive coding (Friston, 2014).

The Threat-Simulation Theory of Dream Function

The threat-simulation theory of dreaming combines a cognitive emphasis on simulation with an emphasis on the origins of dreaming in the "ancestral environment," in which "human life was short and full of threats" (Revonsuo, 2000b, p. 877). It begins by assuming dreaming prepares people to cope more adequately with waking threats that endanger reproductive success, without necessarily being recalled. At the brain level, it claims that the "biological function of dreaming is to simulate threatening events, and to rehearse threat perception and threat avoidance," which prepare people to cope more adequately with waking threats that endanger reproductive success (Revonsuo, 2000b, p. 793). The theory thereby assumes the neural substrate enabling dreaming has the capacity to support implicit learning (incidental learning without awareness) during sleep, which threat-simulation theorists regard as the most difficult assumption in the theory to test (Revonsuo, 2000a, pp. 890, 1081; Valli & Revonsuo, 2009, p. 33).

In fact, most experimental psychologists doubt the importance of implicit learning even during waking, due to its limited scope, its occurrence in only brief durations, and its relevance for only a few types of information (see Ryals & Voss, 2015, pp. 44–45, for a summary of the various criticisms). Moreover, the small amount of implicit learning requires the participant to be paying attention to the main task at hand. One study reported a “significant negative correlation between mind-wandering and implicit learning” (M. Franklin, Smallwood, Zedelius, Broadway, & Schooler, 2016, p. 223). Implicit learning during dreaming therefore may be extremely difficult because dreaming shares qualities with mind-wandering. In the case of implicit *sequence* learning, which seems to be the most relevant type of implicit learning in terms of the sequential, quasi-narrative nature of most dreams, a researcher who has studied the sequential-learning issue in detail concludes that implicit learning cannot be separated from explicit learning (Shanks, 2003, p. 38). Nor is there any evidence for new learning during sleep beyond a conditioning study that paired odors with tones to condition sniffing responses in reaction to tones (Arzi et al., 2012).

In addition to its reliance on implicit memory in order to learn from the very complex process of dreaming, the theory also assumes that this implicit learning can be transferred to waking situations, which is known as “transfer of learning” or “transfer of training” in the psychological literature. Once again, findings in the twenty-first century suggest that the transfer of learning also seems to be limited in its scope, with little or no evidence for improvement on tasks outside of tightly related, overlapping domains (see Sala & Gobet, 2017, and Sala, Tatlidil, & Gobet, 2017, for meta-analyses and overviews of very large literatures). Nor is there any evidence for transfer of learning from sleep to waking, and it is unlikely that such a complex transfer could occur. One neuroimaging study reported that the transfer of learning involves the regions in the brain that support the central executive network (i.e., the frontoparietal control network), which relies heavily on the dorsolateral prefrontal cortex (Verghese, Garner, Mattingley, & Dux, 2016). This finding, which needs to be replicated before it can be fully accepted, raises doubts about the threat-simulation theory because numerous studies show the dorsolateral prefrontal cortex is deactivated in both REM and NREM sleep (Fox et al., 2013; Uitermarkt et al., 2020).

The threat-simulation theory of dreaming does not focus heavily on other animals, but it does suggest the early mammals had “long periods of sleep,” with an emphasis on REM sleep. According to the theory, these REM periods may have allowed for the simulation of threat and survival skills during a time when the small early mammals had to compete for resources “with the much larger and more numerous reptiles” (Revonsuo, 2000b, p. 900n14). This speculation leads to the hypothesis that humans may have inherited threat scripts that are triggered by “ecologically valid cues” (Revonsuo, 2000b, p. 878). The evidence for this claim is based on the behaviors of decorticated cats, such as “hunting, stalking, running as if chasing imaginary prey,” which happen during REM periods. These behaviors also happen during waking, but this finding is brushed aside because “the brain in REM is most like the brain in very alert wakefulness” (Revonsuo, 2000a, pp. 1070–1071). However, there are large differences between waking and REM, as shown by neuroimaging studies, and there is no reason to believe there is imagination in the brainstems of any decorticated mammals. Nor is there any evidence mammals have the cognitive capacities needed to dream, such as mental imagery, narrative ability, imagination, and an autobiographical self, which are discussed in chapter 6 (Foulkes, 1983, pp. 317–319, 325–327, 332–333; 2017).

Threat simulation during dreaming is said to work well in children and adolescence “as soon as their perceptual and motor skills are at a level that enables threat recognition and avoidance in the waking state” (Revonsuo, 2000b, p. 899n5). This assertion is primarily based on an inadequate earlier study of children’s dream reports collected by parents and teachers, which is now known to be very risky due to suggestion and demand characteristics—among the many problems encountered when working with young children (Hall & Domhoff, 1963a). The study very likely greatly overstated the degree of aggression in children’s dream reports. As shown in subsequent research in well-controlled lab and nonlab settings, the few bland dream reports from preschool children contain no aggression, misfortune, or failure, and the dream reports of elementary school children very rarely contain these negative elements (Foulkes, 1982; Foulkes et al., 1990; Sandor et al., 2015).

However, the more soundly based laboratory findings were not factored into threat simulation theory because “these data do not show that such experiences are not possible, at least occasionally or in specific subgroups

of children who are living in less safe environments or who otherwise have been exposed to various threatening events" (Revonsuo, 2000b, p. 899n5). Moreover, the numerous waking studies of successful threat detection by children as young as ages 3–5 demonstrate they are already good at threat detection, including the detection of angry faces and perhaps even earlier on some specific issues, such as a threat response to snakes (LoBue, Matthews, Harvey, & Thrasher, 2014; LoBue & Rakison, 2013; LoBue, Rakison, & DeLoache, 2010). In other animals, one-trial escape learning after upsetting events and punishment has been well established for generations by means of experimental studies by research psychologists (see Postman, 1963, for a summary going back to the 1920s).

The theory also assumes that traumatic events lead to a more rapid development of the capacity to dream in children (Revonsuo, 2000b, p. 889n5), but this claim seems doubtful in terms of what is known about the gradual sequential unfolding of neural and cognitive development, as discussed in chapter 6 and in other sources (Fair et al., 2008, 2009; Nelson, 2005). The strong assertions on this issue by threat-simulation theorists were later amended to claim that threat-simulation dreams are possible at age 6 and thereafter (Valli & Revonsuo, 2009, p. 33). This small adjustment also remains unlikely in terms of the findings on the immaturity of the default network until ages 9–13 (Fair et al., 2007, 2008). The longitudinal and cross-sectional laboratory findings on the low frequencies of aggression, misfortune, and failure in the dream reports of children ages 6–9, also are at odds with this theory, as summarized in chapter 6 (Domhoff, 1996, pp. 91–95; Foulkes, 1982; Foulkes et al., 1990).

Turning now to empirical doubts based on studies of dream content, the indicators of threat used to test the theory on the basis of dream content encompass just about everything negative that can happen in dreams. In addition to physical attacks and threats of aggressive acts, they include threats to valuable material resources, social status, and events perceived as "subjective threats," such as mistakes and feelings of personal failure (Revonsuo & Valli, 2000, pp. 5, 23–25). Research by its proponents finds that 60–77% of dream reports have threatening events (Revonsuo & Valli, 2000, 2008). This finding replicates the following Hall and Van de Castle (1966) results in their normative samples of men and women almost exactly, but it overlooks some key points: only 44% of women's dream reports and 47% of men's dream reports have at least one aggression in them, only half of

which or less are physical aggressions; 33% of women's reports and 36% of men's reports have at least one misfortune, most of which are minor events; 10% of women's reports and 15% of men's reports have at least one failure; and overall, 70.7% of women's reports and 73.8% of men's reports have at least one of these three types of elements (see Hall & Van de Castle, 1966, as updated using a spreadsheet that includes 491 of the 500 women's reports and all 500 of the men's reports).

Similarly, when threat-simulation theorists report dreamers are involved in a large majority of the life-threatening events (Revonsuo & Valli, 2000, p. 10), they are replicating the Hall/Van de Castle (HVdC) normative findings on both female and male dreamers. These normative findings show dreamers are involved in 80% of the aggressive interactions in their dreams. But threat-simulation theorists ignore related findings revealing that the dreamers are the victims in the majority of the aggressive interactions. Also, the dreamers only infrequently respond to their victimization, as shown in table 3.2 in chapter 3. It is difficult to believe that the interactions relating to aggressions in dreams contain useful lessons to transfer to the waking state. At the same time, the exclusive concern with threats in this theory cannot explain the considerable percentage of dream reports not containing threats (Zadra & Donderi, 2000b). This criticism is supported by the 25–30% of the dream reports in the normative sample not containing the negative elements of aggression, misfortune, or failure. This figure seems too large to dismiss as a small glitch in an evolutionarily evolved threat-oriented dreaming process.

The nonthreatening nature of many dreams is demonstrated in two studies of dream reports from students at the University of Cape Town, both of which were meant to examine threat-simulation theory. Although the university is located in the most violent and crime-ridden area in South Africa, the first study found that very few dream reports had realistic life-threatening elements and that effective responses by dreamers to threats of direct physical harm were rare (Malcolm-Smith & Solms, 2004; Malcolm-Smith, Solms, Turnbull, & Tredoux, 2008b). The second of the two studies included a comparison with 116 dream reports from students at Bangor University, which is in a low-crime area in North Wales. Nevertheless, the sample from Wales contained a higher percentage of dream reports including life-threatening events than did those from Cape Town (18.6% vs. 8.7%) (Malcolm-Smith et al., 2008b, pp. 1285–1286).

The weaknesses of the threat-simulation theory are also demonstrated in a study by another team of independent investigators, which used 212 previously collected recurrent dreams (Zadra, Desjardins, & Marcotte, 2006). Recurrent dreams are acknowledged by threat-simulation theorists to very often contain threat simulations (Revonsuo, 2000a, p. 1076). Unlike what threat-simulation theorists would expect, the study found that 81% of the instances of threats “belonged to the realm of fantasy or fiction” or would be “very unlikely to occur in the subject’s waking life.” Furthermore, a great majority of the recurrent dreams with a threat of any type in them ended with the threat being fulfilled (40%), the participant awakening (37%), or the imminence of the threat changing “abruptly” (17%). As a result, only 17% of the recurrent dreams with a threat in them had a positive outcome (Zadra, Desjardins, & Marcotte, 2006, p. 457).

The content findings in studies of dream series also demonstrate the shortcomings of this theory because dream content is so consistent over time and responds very slowly, if at all, to changing waking circumstances, as discussed in chapter 4. For example, in a dream series spanning just over five decades, which was not discussed in chapter 4, about 72% of the 904 dream reports included at least one of six recurring personal concerns throughout the series (Domhoff, 1996, pp. 142–145, 206). Dorothea, the pseudonym the dreamer gave herself, was eating, starting to eat, preparing a meal, buying or seeing food, watching someone eat, or mentioning that she is hungry in just over 20% of her dream reports. In many of these dreams she is at the family dinner table with her parents and one or more of her several siblings. In these dream reports she often portrays herself as being treated unfairly as to portions. The last dream documented by this well-educated professional woman, who was living in a middle-class retirement home in an idyllic American state where she enjoyed a daily swim in its pool, was recorded four days before her unexpected death at age 78. It was about having dinner in a familiar home setting from the time when she was growing up. Her mother served her siblings too much food, which seemed to leave her with nothing to eat.

In about 16% of the dream reports she lost an object, which was most often her purse, and in about 10% of her dream reports she was in a small or disorderly room, or people were barging into her room. Another 10% involved the dreamer and her mother doing something together. The dreamer was going to the toilet in about 8% of the dreams and she was late

or worried about being late, or about missing a bus or train, in 6% (Domhoff, 1996, pp. 143–145). This repetition of several themes, along with the consistency with which she dreamt about her long-deceased mother, do not accord with the idea that dreams deal with new threat situations as they arise. Instead, they often deal with ongoing and past personal concerns. Dorothea’s dream reports are available on Dreambank.net.

A more dramatic and poignant example of the repetitiveness in a dream series, which was documented three decades after the previous example, concerns 315 dream reports written down over a period of several years by an artist (“Merri”), when she was in her late 30s. The most frequent character in her dream reports, her older sister, had been killed by a hit-and-run driver while she was jogging, three years before the dream series began. She was in a hospital on life support for five days, with the dreamer and her brother by their sister’s side when she died (Bulkeley, 2009, p. 98). Contrary to what a threat-simulation theory might expect, Merri’s deceased sister appeared in 34.3% of the dream reports in this series and she is at the center of the small-world social network constructed on the basis of coappearances by dream characters in dream reports, a topic discussed more generally in chapter 4 (Han et al., 2015).

These dream reports express the dreamer’s major personal concern: her preoccupation with the deceased sister she deeply admired for her many accomplishments. If these dreams represent threat simulations that eventually will allow her to move forward in waking life, they were very unsuccessful during the time span in which she recorded her dreams. The findings from the Merri series can be found on the “Information” and “Further Information” pages on Merri on DreamBank.net, and some of them appear in a published paper (Bulkeley, 2009).

In responding to the various studies of dream content that refute their theory, threat-simulation theorists discount the findings because the settings and circumstances in which the dream reports were collected allegedly did not include ecologically valid cues (Revonsuo, 2000a, pp. 1071–1073; Revonsuo & Valli, 2008). This rejection of solid, replicated findings thereby raises the possibility that the theory is unfalsifiable by studies of dream content, at least according to the theorists who created it, because of the repeated claim that ecologically valid cues were not present (Desjardins & Zadra, 2006; see Malcolm-Smith, Solms, Turnbull, & Tredoux, 2008a, for a similar suggestion). To remain viable at the level of dream content, the

threat-simulation theory also would have to explain the 25–30% of dream reports not containing a threat, whether physical or subjective.

Although the threat-simulation theorists reject the theory-threatening findings on dream content by other investigators, they nonetheless have to deal sooner or later with the serious doubts about the four main underlying assumptions upon which the theory is based. First, threat-simulation theory claims there was at least a rudimentary form of dreaming during REM sleep in ancient mammals hundreds of million years ago. However, this assertion does not fit with the strong evidence that no other animals, including other great apes, have the cognitive capacities necessary for dreaming. The time frame for the alleged ecologically valid cues purportedly shaping dreaming therefore would have to be greatly narrowed. Second, there is no evidence for complex implicit learning during sleep. Third, there is no evidence for the transfer of implicit learning to waking situations. Fourth, studies of young children between ages 6 and 11 suggest that they do not have the cognitive capacities to generate threat-simulation dreams with any frequency or complexity until they are in their early teenage years.

Until threat-simulation theorists provide convincing evidence showing that their four questionable assumptions are at all plausible, the theory remains in the realm of pure speculation, despite all the equally doubtful empirical evidence they bring forth. Their discussions of negative elements in dreams, and their resort to the concept of ecologically valid cues as a way to dismiss the wide range of empirical studies discussed in this subsection, is not credible. However, their mistaken portrayal of dream content is a secondary issue if the four assumptions upon which their theorizing is based cannot be satisfactorily defended.

Other Social-Rehearsal Theories

The other social-rehearsal theories focus primarily on the learning of social skills through positive social interactions (Brereton, 2000; M. Franklin & Zyphur, 2005; Revonsuo et al., 2015). They first would have to deal with many of the same objections raised in the specific case of threat-simulation theory, such as the lack of evidence for implicit learning during sleep and for the transfer of training to the waking state. They also would have to explain why there are relatively few friendly interactions in dreams, as well as the fact that these friendly acts are rarely reciprocated, as shown in table

3.2 in chapter 3. They also would need to account for the high frequencies of aggression and misfortunes in dream reports.

Nor can these theories readily explain the replicated finding that dream content does not change very fast, if at all, from the teenage years into old age, as discussed in chapters 4 and 7. And, once again, the infrequency of dreaming in young children until ages 9–11 and the small number of social acts in these infrequent dream reports suggest that the few plausible social rehearsals in dreaming do not occur until ages 9–11 at the earliest.

Dreaming as an Adaptation for the Consolidation of Waking Predictive Codes

According to the predictive-coding theory, the brain is designed through evolutionary selection to minimize surprises by constantly matching new sensory inputs with established neural patterns. If the brain detects a mismatch, it sends an “error message” to higher brain centers to update the neural codes and thereby enhances the chances for survival (Friston, 2010). Since the brain receives no new information from the environment during sleep, the role of REM sleep is to “optimize” the model by removing the “redundancies” that are “accrued during wakefulness” (Friston, 2014, p. 139). Two of the theory’s main proponents claim that “the mechanics of predictive coding provide a compelling three-way link” between brain waves that have their origins in the brain stem, the occurrence of rapid eye movements, and “the fictive percepts of dreaming” (Hobson & Friston, 2012, p. 97).

To test their hypothesis concerning rapid eye movements, the predictive-coding theorists reanalyzed a “short six-minute study” of video footage that contained 43 instances of rapid eye movement bursts. These 43 instances were obtained from 11 participants who were examined using fMRI. The researchers first carried out “24 independent studies” focused on the individual participants. They infer from their results with several of these individuals that the participants’ eye movements were scanning a “virtual sensorium,” which is supported by a “hot zone” in the “posterior left hemisphere” (Hong, Fallon, & Friston, 2021, p. 2). In addition, three of the brain areas predictive-coding theorists assign to the default network—the precuneus, posterior cingulate cortex, and retrosplenial cortex—were said to be deactivated when the rapid eye movements were occurring, so they assert that the default network is not active during dreaming (Hong, Fallon, & Friston, 2021, p. 11).

Since the theory has an evolutionary basis that long precedes humans, its emphasis on dreaming cannot be sustained. Studies claiming to show dreaming in other animals were found to be flawed, and no other animals have the ability to produce personal memories or narrative thought flow, or to develop an autobiographical self (Foulkes, 1983; Tulving, 2005). The human brain is much larger and has far more cortical connections than do other primates, and more anterior-posterior connections in the default network; the necessary capacity for a full imagination developed gradually within a group context over the past few hundred thousand years (Fuentes, 2020; LeDoux, 2019). Further, the lack of evidence for memory consolidation during REM sleep, as discussed earlier in the chapter, puts the onus on predictive-coding theorists to show that *any* type of consolidation or updating can occur, with or without dreaming, during REM sleep.

As for the hypothesis that the rapid eye movements during REM sleep in humans are scanning dream scenarios, it was first refuted in a study in which the four participants were immediately awakened from 75 REM periods that suddenly showed electrooculogram (EOG) evidence of one of four distinctive eye-movement patterns. A blind judge could not correctly match participant-based subsets of the 56 dream reports that described clear visual events with the accompanying eye-movement patterns at better than a chance level. Nor could plausible correspondences be discerned in a nonblind comparison of several visually distinctive dream reports with the participant's eye-movement patterns just before the awakening (Moskowitz & Berger, 1969, pp. 613–614).

Later systematic studies also rejected the scanning hypothesis (Christensen et al., 2019; Jacobs, Feldman, & Bender, 1972; Pivik, 1991, p. 227). These cumulative results are further supported by a comparison of eye movements during REM sleep and waking, which found that “REMs were significantly slower than waking saccades of comparable amplitude,” among several differences between eye movements in REM sleep and waking, so “one wonders why REMs behave so differently if they are simply the unmodified motor concomitant of visual imagery in dreaming” (Aserinsky, Lynch, Mack, Tzankoff, & Hurn, 1985, pp. 1, 9). Moreover, the primary visual cortex, which is of central concern for predictive-coding theorists, is relatively deactivated during REM sleep, and damage to it has no impact on visual dream imagery (e.g., Braun, et al., 1998; Solms & Turnbull, 2002, pp. 209–210). Taken together, these various studies raise two further questions about

the scanning hypothesis. Since visual imagery appears to be continuous throughout REM sleep dreams, it seems unlikely that eye movements that happen only periodically during the course of a REM period could be tracking the ongoing visual imagery. Nor can the scanning hypothesis account for the visual imagery that occurs in dreams outside of REM sleep.

The emphasis on the scanning hypothesis by predictive-coding theorists, despite the studies cited in the previous two paragraphs, is based in good part on studies of REM Behavior Disorder (RBD), in which the eye movements, twitching of limbs, and major body movements, including walking, are assumed to be the acting out of an ongoing REM dream (e.g., Arnulf, 2012). However, aside from the risks of confounds in using patients in dream studies, as discussed in chapter 1 and demonstrated in chapter 2, most of the motor events in RBD (66%–83%) are “minor, elementary, or jerky limb movements,” and only 1.8% have been described as possibly acting out the dream content, which makes them “exceedingly rare” (Blumberg & Plumeau, 2016, p. 35).

In one of the most detailed studies, “there were only 19 apparently goal-oriented behaviours in nine patients” who were studied over a period of 77 nights and reported their dreams after spontaneous awakenings (Leclair-Visonneau, Oudiette, Gaymard, Leu-Semenescu, & Arnulf, 2010, p. 1742). Based on an analysis of 162 episodes of rapid eye movements that occurred during these dreams, the researchers reported they had correctly predicted there would be eye movements in over half of these instances (58.3%), but they were wrong on the remaining 41.7% of their predictions; further, they reported that the eye movements were determined to be “concordant with the direction of the RBD-associated motor behaviour” in 82% of the cases with eye movements (Leclair-Visonneau, Oudiette, Gaymard, Leu-Semenescu, & Arnulf, 2010, p. 1742). While these results appear to be better than chance, such rare events in studies of a small number of patients are not a solid basis for making strong claims in the face of the systematic evidence to the contrary, based on representative samples of participants who were studied in a variety of well-controlled research studies.

The claim by predictive-coding theorists that the default network is not involved in dreaming is first of all weakened by the theorists’ statement that there were merely “modest” declines in the activation levels in the precuneus and the posterior cingulate cortex in 12 of the 24 independent studies of the 11 individual participants; there were also small decreases in activation levels in the retrosplenial cortex in 6 of the 24 independent

studies (Hong, Fallon, & Friston, 2021, p. 7). Whatever the degree of decline, the important point is that the precuneus is not generally considered to be part of the default network by neurocognitive researchers, and the posterior cingulate cortex is in the default network's zone of integration (Andrews-Hanna, Smallwood, & Spreng, 2014, p. 35). Furthermore, previous neuroimaging studies already had concluded that both of these areas are relatively deactivated during sleep. Therefore, they are not among the areas in the default network that are discussed in chapter 2 as part of the neural substrate that supports dreaming. As for the six instances of relative deactivation of the retrosplenial cortex, four of them involved only 1 of the 11 participants.

Most problematic of all, "in the group analysis, REM-locked fMRI signal decreases were not seen," which means the modest declines in some of the researchers' individual studies do not reach the level of statistical significance in the overall sample (Hong, Fallon, and Friston, 2021, p. 7). As they therefore frankly state in their discussion of the limitations in their study, the fact that they were "using uncorrected statistical thresholds" and did not find "statistically significant decreases at the group level" means that their "group and individual levels both call for replication" (Hong, Fallon, and Friston, 2021, p. 15). Until such a replication occurs, these results are not credible, and two of them, relating to the precuneus and the posterior cingulate cortex, are irrelevant in any case.

Finally, several established findings on dreaming and dream content cannot be explained by predictive-coding theory. First, dreaming is infrequent and not very complex until ages 9–11, as shown in chapter 6, so the theory cannot explain why preschool and elementary school children function so well during waking. Second, the loss of REM sleep dreaming by people who took the first generation of antidepressant drugs did not lead to cognitive impairments, as already discussed earlier in this chapter. Third, few events from the previous day appear in dream reports, as discussed in chapter 9, so there is very little new information to be updated. Fourth, predictive-coding theory is challenged by the consistency of dream content in the numerous dream series studied to date, as documented in chapter 4, chapter 7, and earlier in this chapter, which does not leave much time during REM sleep dreaming for updating.

Based on the findings in these various systematic studies using several different methodologies, the attempt to extend the waking-state predictive-coding theory to REM sleep and dreaming is not plausible.

Conclusions Regarding Adaptive Theories

As shown by the discussions of each of the three main types of theories proposing a possible adaptive function for dreaming, no empirical evidence supports any of them. At the same time, there are many replicated findings leading to grave doubt about all of these theories. Since these several different types of evidence cast strong doubt on all of these adaptive theories, the next section of this chapter turns to the evidence concerning the several ways in which people have creatively made use of dreaming and dream content in waking life. They do so in an attempt to cope with uncertainty, anxiety, grief, guilt, and the inevitability of death.

Dreaming as a Culturally and Individually Useful By-Product

As noted at the outset of this chapter, an abundance of evidence suggests that dreaming and the content of dreams have been put to use historically and cross-culturally in human societies. The most detailed cross-cultural study of a wide range of indigenous societies is based on a sample of 63 societies in the Yale Human Relations Area database. The researcher found four factors correlated with a high concern with dreams: supernaturals give people powers through dreams; shamans and priests use their own dreams in curing and in making prophecies; certain types of dreams are required before a person can assume certain roles (e.g., warrior, shaman); and special techniques are needed to induce dreams (D'Andrade, 1961, p. 321). In addition, it is hunting and gathering societies, which cannot rely on agriculture and/or animal husbandry for their food supply, that are most likely to make extensive use of dreams. This finding led to the insight that the uncertainty of a food supply may be a factor in explaining why people turn to dreams for guidance (D'Andrade, 1961, pp. 324–325).

This idea can be generalized to claim that dreams become important when there is any situation of crisis or uncertainty. This generalization encompasses societies in danger because of large-scale threats or violent intrusions by nearby societies. It also includes the many situations in which individuals perceive themselves to be in conditions of personal uncertainty and crisis, as discussed shortly. Then, too, shamans, who are important far beyond hunting and gathering societies, are in some ways similar in their functions to psychodynamic therapists. Both shamans and psychodynamic therapists make a transition to another realm—the spirit world for

the shaman, the world of the unconscious for psychodynamically oriented therapists.

Either way, whether in indigenous societies or Westernized nation-states, dreams are thought of as coming from “somewhere else,” as something that “happens” to people outside the realm of normal cognitive functioning. Shamans and psychotherapists also share the goal of learning the causes of an illness, which are generally attributed to angry malevolent spirits in indigenous societies and to unconscious forbidden wishes in Western civilizations, as is often discovered through dreams. Finally, shamans and psychodynamically oriented psychotherapists share the goal of curing illnesses, and shamans are sometimes called the “first professionals” by cultural anthropologists (Singh, 2018).

Within this context, and as already mentioned in the introduction to this chapter, dreams are often seen as the main source of new religions. This insight was first stated in the nineteenth century by one of the founding figures of anthropology, Edward B. Tylor (1871/1958). It was subsequently elaborated in greater detail by anthropologists (e.g., LaBarre, 1972; Lincoln, 1935). Relevant cross-cultural evidence demonstrates that dreams are sometimes an important part of a person’s conversion to a new religion (Bulkeley, 1995, 2008).

Dreams are very often intermixed with music in religious and healing ceremonies. This finding is of interest because music is a far more important “accidental by-product of traits that evolved for other purposes” than are dreams (McDermott, 2009, p. 164). This conclusion about music being a by-product is also attested to by other researchers (Patel, 2008, pp. 367–400). They include one of the deans of musical studies, who wrote that “many of the capacities for music emerge independently at different times in hominin evolution, but only with modern humans are we likely to find an integrated capacity for music together with language” (Cross, 2016, pp. 11–12). Music is very frequently at the center of peak experiences for individuals and groups, and music as an expression of “religious faith is a worldwide phenomenon,” including the work of great European composers such as Bach, Beethoven, Handel, and Hayden (Gabrielsson, Whaley, & Sloboda, 2016, p. 226). Music also can be helpful for stroke victims who have lost speech (Patel, 2010, pp. 15–20; 2014) and in calming people in postoperative hospital settings (Hole, Hirsch, Ball, & Meads, 2015). Music is far more important in most people’s cultures and personal lives than is

dreaming, but these two evolutionary by-products are often used together in some ceremonial events.

The close relationship between music and dreams in religious and healing ceremonies has been documented in the greatest detail in studies of the Temiar people in the highlands of Malaysia, who were one of the few small indigenous societies still almost fully intact in the early 1980s (see Benjamin, 2014, for the definitive account on music and dreams in this culture, and M. Roseman, 1991, for a detailed study focused primarily on music in the same small society). It therefore can be concluded that both music and dreaming have emergent cultural uses, which have been invented by human beings in many different societies in the course of their histories.

The way in which the connection between dreams and religion may have developed is seen in dreams about deceased loved ones, who sometimes are seen and perceived as alive in a dream experienced by a grieving survivor. The dreamers are amazed, shocked, or delighted because they realize they are talking to a deceased person. Such dreams have an even greater impact when the deceased loved one provides reassurances that all is well or gives solace or advice to the dreamer (see D. Barrett, 1992, for the seminal study of the dream reports of deceased loved ones, and Domhoff, 1996, pp. 199–202, for a summary and further evidence from student participants). When such dreams are told and retold by many people, they become evidence for life after death and the existence of a spirit world.

Several dreams of this type were documented on the morning after they occurred in the dream series kept by the widower. Ed did not consider himself to be a very religious person, although he attended religious ceremonies on important days in the calendar of his religion. However, he wrote in his reflections that in a few of the dreams it felt like he actually had been “visited” by Mary:

A few dreams have me wondering if I had actually “supernatural-like” experiences. I swear that Mary really did “visit” me. The first was my very first dream of her. I had this just a week or two after she died. She came to me in a dream and told me she wants me to be happy. (Domhoff, 2015, p. 4)

Dreams also may be seen as important for both an individual and a society when the transition from youth to adulthood occurs. In many societies, as part of this particular rite of passage, it is necessary for the young initiates into the adult world to have a revelatory dream to determine their future role in the society (see Van Gennep, 1909/1960, for the classic source on

rites of passage). This dream can be induced by social isolation, sleep deprivation, fasting, and/or the use of a hallucinogen. At a strictly individual level, dreams may become important during times of personal illness or family conflict, or when a loved one dies. For example, in questionnaire surveys and case studies concerning paranormal experiences, from one-third to two-thirds of the participants claimed that they had had a paranormal experience in a dream that foretold serious health issues, a major accident, or even the death of a relative (Van de Castle, 1977, 476–481). A summary of past research nearly four decades later concluded that “spontaneous case collections have shown that ESP is most likely to occur during dreaming, followed closely by daydream-like states” (Richard Broughton, 2015, p. 145).

Dreams can also have a lifelong impact on the lives of a few individuals (Bulkeley, 1994; Knudson, 2001, 2003; Knudson & Minier, 1999; Kuiken & Sikora, 1993). One of the most striking and often-cited examples seems ideal in this context because it involves both music and creativity. In this instance, a professor of music told one of his colleagues in psychology that a dramatic dream led to his finally going to college at about age 22, with a focus on music. He added that he later wrote a prize-winning musical composition based on the same dream. As he recounted, he had been a self-taught rock guitarist for three or four years after his graduation from high school. Then he attended a very different type of performance out of curiosity, a Beethoven piano concerto. The performance inspired him enough to buy a recording of it. After playing the recording “at least a thousand times,” he unexpectedly had a dream in which the leaves in swaying trees were like musical notes and he was hearing the music as well. At that point his life began to change. He went to college, took music lessons, and earned a doctorate in music. It was about 15 years after he completed graduate school that he won the aforementioned academic prize for a musical composition that had its origins in his profoundly inspiring dream (Knudson, 2001, p. 170).

Conclusions and Implications

Drawing upon a wide range of studies, this chapter concludes that there is no solid empirical evidence for any of the theories of dream function put forth since 1900. Moreover, there is much evidence that inadvertently casts

strong doubt on these theories. Each of these theories is called into question by one or more of the four types of descriptive findings summarized in the introduction to this chapter: the very small percentage of dreams that are recalled or remembered for very long if they are recalled; the absence of any immediate or major effects from lesions eliminating dreaming; the immaturity of the default network in children, which makes any adaptive function for dreaming highly unlikely until early adolescence; and the consistency found in studies of dream series.

In addition, there are various types of evidence casting further doubt on specific adaptational theories, such as the absence of evidence for repression; the low levels of reciprocity to friendly or aggressive acts; the questionable nature of free association as a method for studying dreams; the absence of evidence for memory consolidation during dreaming in REM sleep; the lack of evidence for implicit learning during sleep; the absence of evidence for any putative implicit learning during sleep being transferred to waking thought; and the absence of evidence that the functioning of synapses during REM sleep can support the consolidation of daytime updates in predictive codings.

At the same time, the neurocognitive theory of dreaming can explain the widespread belief in the importance of dreams in both cultural ceremonies and individual lives by pointing to the evidence for the inventiveness of the human mind. As in the case of an even more important by-product, namely music, dreaming has its most important emergent function in human history as a central aspect of religion and as part of the healing practices once related closely to religion in the history of Western civilization. Dreams can impact the personal lives of individuals as well, usually for short periods of time, but sometimes for decades or for a lifetime.

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

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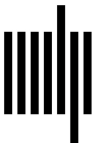
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