On Dreaming

by

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Abstract

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This dissertation discusses three independent questions in the philosophy of human dreaming: 1) Are dreams conscious experiences?, 2)Do we dream in color?, and 3) Do dreams serve an adaptive function? Each of these questions is addressed using sustained philosophical argumentation based on interpretation of recent findings in cognitive science.

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Introduction

We spend roughly a third of our lives asleep. Clearly we don't spend a third of our intellectual life trying to figure out our sleeping minds. A conservative estimate might be that we spend one one-thousandth of our intellectual resources on the study of sleep and dreaming. The proportion in philosophy might be more like one in five hundred, although almost all of that is focused on dream skepticism.

These ratios are a shame, because dreams provide a unique window into the human mind. Dreaming is arguably the most creative thing we can do. What someone can create in a few minutes while awake pales in comparison to what he can do in a few minutes any given night while dreaming. How does painting a still-life in real life compare to exploring an art museum in a dream, where one experiences one instantly-realized painting after another, as one walks through the virtual halls? How does telling a story compare to fabricating moment-by-moment a complete virtual world where one is simultaneously lead actor, supporting actor, costume designer, set designer, cinematographer, and screenwriter—improvising new stories several times a night?

At least, these are just a taste of the kind of adventures people *report*, upon awakening, that they just experienced while they were asleep. Generally, these dream reports come while people are awake. What are we to make of such reports? Any discussion of dreaming involves wading into deep philosophical questions in epistemology and the philosophy of mind.

The neuroscience of sleep and dreaming suggests that, according to typical definitions of dreaming, we spend about two hours a night dreaming. That adds up to years of one's life

essentially hallucinating complex, emotionally-charged storylines that are a unique reflection of the person who dreams them. Scientific studies suggest that almost everyone dreams, whether they remember their dreams or not, which, again, raises numerous philosophical issues about our experience of and knowledge about our dreams.

Such scientific findings and many fields invite philosophical speculation about the nature of dreams. First of all: What is dreaming? How are we to conceptualize this mysterious faculty we seem to possess? And: What sense can we make of the elusive content of our dreams? Naturally such thinking leads to the more fundamental question: What can we know about dreams? Do our waking recollections provide an accurate guide to the true nature of our dreams? How could we know? Also: Are dreams conscious experiences? What reasons could we have for thinking they are? These are some of the questions this dissertation aims to address.

Philosophical inquiry into dreaming is not new, despite the relative dearth of attention paid to dreaming (outside of dream skepticism). Aristotle in his work “On Sleep and Sleeplessness” in the *Parva Naturalia* wrote: "We must inquire what dreams are, and from what cause sleepers sometimes dream, and sometimes not; or whether the truth is that sleepers always dream but do not always remember; and if this occurs, what its explanation is" (Aristotle, c. 350 B.C.; 1952). We will see that we can use scientific insights into the nature of dreaming to illuminate such questions.

Perhaps the most famous philosopher to address the topic of dreaming is Descartes. Although Descartes is well-known for his project of epistemological doubt, which leads him to

question whether he can know whether he is awake or dreaming, his views on dreaming are much broader than this question alone reveals.

Norman Malcolm--the most notable philosopher of the 20th Century to take up the topic of dreams--takes issue with the received view of dreams accepted by Descartes. Here I quote Malcolm at length, both because his analysis of Descartes is well-stated and because Descartes' views serve as a contrast to Malcolm's own view, which he fleshes out in the rest of his monograph *Dreaming*, a book I critique in Chapter Two of the dissertation.

Malcolm writes:

> Many philosophers and psychologists who have thought about the nature of dreams, have believed that a dream is both a form of mental activity and a conscious experience. Descartes held that a human mind must be conscious at all times, this notion resulting from his supposed demonstration that the 'essence' or 'principal attribute' of mental substance is consciousness, and that so long as a mind exists there must exist 'modes' of that essence, i.e. states of consciousness, mental occurrences and mental acts. He says in a letter:
>
> > I had good reason to assert that the human soul is always conscious in any circumstances—even in a mother's womb. For what more certain or more evident reason could be required than my proof that the soul's nature or essence consists in its being conscious, just as the essence of a body consists in its being extended? A thing can never be deprived of its own essence.
>
> According to Descartes, a dream is part of this mental life. It consists of thoughts, feelings, and impressions that one has when asleep. In Part IV of the Discourse on Method, speaking of the 'illusions' of dreams, he says that 'all the same thoughts and conceptions which we have while awake may also come to us in sleep' (Descartes (2), I, p. 101). In the First Meditation he represents himself as at first thinking that surely it is *certain* that he is seated by a fire, but then as rejecting this in the following remark: 'But in thinking over this I remind myself that on many occasions I have in sleep been

> deceived by similar illusions, and in dwelling carefully on this reflection I see so manifestly that there are no certain indications by which we may clearly distinguish wakefulness from sleep that I am lost in astonishment' (Ibid, p. 146). (Malcolm, 1959, p. 1-2)

Malcolm goes on to argue that Descartes' picture of dreaming is radically flawed. In this dissertation, I will show why Malcolm's own skeptical arguments are inadequate.

One of the keys to this dissertation will be a liberal use of scientific findings to provide support for philosophical questions. In many cases, questions first raised by philosophers can only be answered by taking into account results of empirical studies of sleep and dreams.

Neuroscience offers many windows into the sleeping and dreaming mind. Ever since the discovery of Rapid Eye Movement (REM) sleep by Eugene Aserinsky in 1953, scientists have developed an incredibly sophisticated understanding of the complex interworkings of our minds while we are asleep. A thorough study of sleep mentation—using the tools of modern cognitive science—tells us that in many ways our brains are more active during sleep than they are during waking. Our sleeping minds are regularly cycling through identifiable neurological states, all of which are associated with certain kinds of reported experiences upon awakening. No longer can philosophers implicitly accept the view that sleep is a state of quiescence, one in which we basically turn off our mental functioning, with perhaps the exception of intermittent dreams, about which little is said. But, just what is going on while we are asleep?

Take sleepwalking for example. That people "walk" (and do much more) in their sleep has been known for millennia. But it is only recently that scientists have been able to say much with confidence about what is going on when a person walks in her sleep. Sleepwalkers are able to perform complex movements, all while they are recognizably asleep, as indicated by current

neurophysiological measures. At least one person has been acquitted of homicidal somnabulism: murdering someone in his sleep. According to the testimony given by neurologists and sleep specialists, it was quite possible for Ken Parks to get out of his bed while sleepwalking, get in his car, drive 16 miles to his parents-in-law's house, enter their home, and proceed to attack and kill his mother-in-law, despite having no motive whatsoever. There are many other cases of homicidal somnabulism throughout history: Ian Hacking (1995) traces back the defense to 1313. Sleepwalking is just one of an array of parasomnias, or disorders occurring sleep, that reveals people performing dynamic actions while asleep.

Scientists have also extensively studied cases of REM Behavior Disorder (RBD), a disorder in which individuals literally act out their dreams. When normal, healthy individuals enter REM sleep, the brain inhibits skeletal muscle function, presumably to prevent people (and animals) from moving around in response to the dream. For those with RBD, though, these inhibitory mechanisms fail, or are inadequate, resulting in patients doing things like defending themselves from a supposed attack by a bed partner, or jumping out of bed and dodging around as though they are trying to elude the tacklers they see in their football dream.

Even Norman Malcolm accepts that such happenings are relevant to any discussion of the nature of dreaming, if only to be dismissed, but we will see how his arguments against the inclusion of such data are inadequate. Scientists have built up an extensive edifice of scientific knowledge about sleep mentation, yet one can scarcely find any mention of it in the philosophical literature, except for a book by Owen Flanagan published in 2000.

Perhaps more important than any other finding in the study of sleep and dreams is the recognition that one can become aware that one is dreaming, while continuing to dream. In

most of our dreams, at least according to the received view, we are able to have certain kinds of experiences while we dream: flying, fighting, talking, dancing, and much more, but usually the dreamer is not at all aware that everything going on is happening in a dream world of her own devising. But there are certain kinds of dreams, called “lucid dreams,” where one can attain awareness that one is dreaming. Not only do lucid dreamers have some self-reflective awareness in their dreams, but they also report being able to consciously influence and direct the course of their dreams, something we don’t see in regular, non-lucid dreams, at least not in the same way. Almost none of the philosophical literature on dreaming takes into account the unique insights made possible by lucid dreaming. This dissertation seeks to remedy this deficiency: I will discuss lucid dreaming liberally throughout the chapters, using it as a type of experience we can usefully compare and contrast with wakefulness and non-lucid dreaming, for lucid dreaming is a perplexing, paradoxical mental state.

Fifty-eight percent of people report having had at least one lucid dream in their life (Snyder and Gackenbach, 1988). Lucid dreaming is a skill that has been known for millennia. Aristotle described lucid dreams in his work "On Dreams," where he writes, "when one is asleep, there is something in consciousness which tells us that what presents itself is but a dream" (Aristotle [c. 350 B.C.] 1931). Some 800 years later, Augustine recounts a lucid dream of his friend, the physician Gennadius. Thomas Aquinas also describes a lucid dream in the *Summa Theologica*: ‘... sometimes while asleep a man may judge that what he sees is a dream ...’” (Thomas Aquinas, Summa Theologica, I, Q.84, A.7, ad. 2).

Numerous independent studies have shown that lucid dreamers are able to use pre-arranged eye movements to signal that they are conscious during the dream. All of this occurs

during what is documented unambiguously as REM sleep, which is *typically* when dreaming is reported. While controversial at first, the fact of lucid dreaming has become settled science. (I will say more about this research in the dissertation proper, especially in sections on dreaming and consciousness.) The above three topics—sleepwalking, REM Behavior Disorder, and lucid dreaming—present just a taste of the topics that one can use to illuminate philosophical questions about dreaming. They give lie to the belief that there is no way to corroborate the reports of subjects about what occurred while they were asleep.

This dissertation addresses some perennial philosophical questions about dreaming in light of our most up-to-date cognitive science of the mind. In addition, I will use insights into dreaming to illuminate several current controversies in philosophy that have not benefitted from dreaming research. Many of the conceptual problems that have bedeviled philosophers when they talk of dreams benefit from insights from cognitive science, broadly construed. We can now answer questions Aristotle and Descartes asked about dreaming that simply couldn't have been answered in their day, because the science was not available. But, even though the science of dreaming has progressed immensely over the last fifty or so years, there are still deep philosophical issues about the nature of dreaming that science has failed to resolve. To answer these questions, we need the tools of philosophical analysis. However, as I see it, some philosophical analysis is not fundamentally different in kind from our best reflective science. In this dissertation on dreams, I take a naturalistic approach wherein philosophy and science exist on a continuum: there is no rigid divide between science and philosophy. Philosophers are simply more reflective about our reasons for our beliefs about dreams, particularly regarding questions related to epistemology and the philosophy of mind.

This dissertation treats a number of interrelated philosophical issues related to dreaming, but there is no single line of argument developed over the course of the entire dissertation. Instead, I have chosen to write three essays on fundamental questions in the philosophy of dreaming. Each of these chapters could stand on its own. So, for example, the arguments in Chapter 3 do not materially depend on arguments developed in Chapter 2, and so on. I could have called the dissertation "On The Philosophy of Sleep and Dreams," because I think it is by no means obvious what a dream is. To figure that out, we need to take a step back and look at all mentation during sleep.

Chapter One

1. What are Dreams?

> Our normal waking consciousness is but one special type of consciousness, while all about it parted from it by the filmiest of screens there lie potential forms of consciousness entirely different. –William James

It is no simple question to answer what we even mean by the term “dream”. First of all, for our purposes, we need to distinguish between mental states occurring during sleep and metaphorical usages involving our hopes and aspirations for ourselves, as in “the American Dream” or “I have a dream.” Whenever I use the term “dream,” I use it to refer to mentation during sleep. What kinds of mentation are there during sleep?

There are many kinds of sleep mentation, and it is a thorny problem how to demarcate these different kinds of mental states. Typically, when people think of “dreams,” they think of something along the lines of what Daniel Dennett calls “the received view”:

> the received view...that dreams consist of sensations, thoughts, impressions, and, and so forth, usually composed into coherent narratives or adventures, occurring somehow in awareness or consciousness, though in some sense or way the dreamer is *un*conscious during the episode. (Dennett, 1978a, p. 129)

Dennett is right to call it "the received view": most thinkers throughout history have considered dreams to be some form of conscious experiences occurring during sleep. This conception of dreaming is extremely broad: there are several different types of mental states that seem to occur during sleep, based on the reports of awake subjects. We could add “mental imagery” to this definition, an issue I take up in Chapter Five. Other than that, though, I will take Dennett’s

received view of dreams to circumscribe what the paradigmatic understanding of what is meant by the concept of a "dream". But, where appropriate, I will use non-paradigmatic sleep mentation to compare and contrast it with dreams as understood by the received view. For the purposes of this chapter, I will assume that waking reports reflect ongoing sleep mentation, an assumption that will obviously be scrutinized in the chapters that follow.

A *prima facie* interpretation of waking dream reports suggests such narrative-type dreams are only one of many kinds of sleep mentation. Below are some of the others. In addition to such narrative-type dreams there reports of a duller, more cerebral, perseverative type of thinking often associated with Non-REM Sleep, although, complicating matters, a significant percentage of NREM dream-reports are indistinguishable from those found when subjects are awoken from REM sleep. There are also cases where subjects report a kind of fleeting, associative imagery, which occurs just as one falls asleep (hypnagogic) or awakes from sleep (hypnopompic) (Hobson et al., 2000). Add to this the huge diversity of types of dreams, as understood even by the received view, and it can be hard to categorize types of experiences. Of course, there is the additional challenge of how to reconcile reports of subjective experiments with third-person neurophysiological data (e.g., EEG readings). Furthermore, David Foulkes has illuminated the complex ontogeny of the cognitive capacity to dream. According to Foulkes, based on his extensive study of children's dream reports, children's dreaming progresses through distinct stages, each of which is distinct in measurable ways from what is reported by healthy adults. Only at about the age of 11 or so do children's dreams exhibit the complexity we see in adults' dreams. This brief treatment of the received view also does not address the various divergences from the norm associated with pathology during sleep. Because of the

diversity of sleep mentation, it would be a mistake to aver some philosophical theory on dreaming (e.g., whether dreams are conscious experiences) without designating what types of states during sleep one is talking about.

Despite having pointed out complexities involved in identifying what a dream is, ultimately I will focus my discussion on narrative-type dreams, as depicted by the received view. Also such dreams are the most intriguing form of sleep mentation because of the complex ways they seem to unfold over time.

One final point: Dennett's received view diminishes the grandeur of our ability to create entire simulated worlds in our dreams. Our apparent ability to simulate virtual worlds raises fascinating philosophical issues, but we can proceed to do philosophical work based only on this more bare-bones conception of dreaming. For the purposes of this dissertation, I think it important to start conservatively in my definition of dreams.

Chapter Two

2. Are Dreams Conscious Experiences?

2.1. The Problem of Consciousness

A creature is either conscious or not, though consciousness may admit of degrees. To determine when and where consciousness occurs in nature, one can take one of two approaches: 1) Determine *which creatures* are conscious. Thus, we might ask: Are squirrels conscious? What about bees? To answer these questions we would ask: What characteristics is it necessary for a creature to possess in order for us to say it is conscious? 2) Another approach begins with a creature one accepts as conscious, e.g., human beings, and then asks: *When* are human beings conscious? I take the second approach in this chapter. My focus, then, is on one aspect of the larger question: When are human beings conscious? For Descartes ([c. 1641] 1971), who held that it is the soul's essential nature to be conscious, we are always conscious--from the womb until death. At least, many have interpreted Descartes to have thought as much. For many of us today, though, this answer seems unsatisfactory. Can't one go in and out of consciousness? What happens when somebody gets knocked out? Or is in a coma? Or asleep? *What about dreaming*?

2.1.1. Why Does It Matter Whether We are Conscious in Our Dreams?

It has been argued in many places that the conscious experience of sentient beings is the most important and valuable thing in the universe. If, for example, the human species were to evolve in complexity up to the point where we attempted to upload ourselves into machines, but, if in doing so, we failed to preserve human consciousness, then many would argue we will have snuffed out the most important thing in the universe—what we will have done will be a human tragedy on exactly the same scale as if the Earth itself and all humans on it were destroyed (Bostrom, 2004). So, let us assume it matters a lot whether conscious experience exists in the world. If it thus matters, then it is reasonable to assume that not only does it matter in what creatures conscious experience exists, but it also matters in what instances those creatures consciously experience the world. It surely makes a difference whether a person is conscious for one second of their twenty-four hour day or for 16 hours. If it so matters, then it is not unreasonable to think that it matters whether human beings are conscious for 16 hours a day or whether it is perhaps three, four, five, or even eight more hours every night.

In arguing this way, I have pumped certain intuitions. But I hope that I have conveyed the point that it matters a great deal to us whether we really did experience all those things we thought we did while we were asleep, or, whether, all we have are recollections of intentional contents that were not themselves conscious when they were invoked. Are dreams a fundamental part of our experiential life or are they just a screensaver that goes on unconsciously during the night? I think it natural to inquire into the nature of what many people take to be this fascinating and revealing aspect of human cognition.

2.2. The Current Framework

2.2.1. Some Neurobiological Indices of Consciousness

How is consciousness and unconsciousness studied by scientists today. Contemporary scientists have refined the notion of consciousness to account for our intuition that there are times when people are not conscious. The question is where sleep and dreaming fits into such accounts. Most people would say that a person in a deep sleep or in a coma is not conscious, but that maybe a person dreaming is. To handle such problem cases, scientists — neurologists, anesthesiologists, neuroscientists — have developed indices for levels of consciousness based on biological principles. I will not discuss these in an exhaustive fashion, but below is a sampling of such measures.

Neurologists employ the *Glasgow Coma Scale* to assess levels of responsiveness after brain injury (Zeman, 2002). In addition, anesthesiologists rely on algorithms incorporating data from EEGs and other physiological measures to calculate the BIS (Bispectral) Index (e.g., Struys, 2003). The *BIS index* ranges from 1 to 100, the number indicating the degree of responsiveness to varying stimuli patients exhibit while under anesthesia. More relevant to our enterprise, sleep scientists have codified the states healthy sleepers cycle through nightly. These states were first outlined in the standardized manual referred to informally as *Rechtschaffen and Kales* (Rechtschaffen and Kales, 1968), which defines neurological criteria for sleep onset and different stages of sleep. This manual has since been updated to become the *American Academy of Sleep Medicine Manual for Scoring Sleep and Associated Events* (Iber et al., 2007).

Standardized sleep stages correlate highly, but not exactly, with the types of subjective reports people make when they are awoken from different stages of sleep. Based in part on subjective reports, sleep scientists have demarcated types of sleep mentation, although the problem of precisely matching up neurophysiological data with types of subjective report remains elusive. But, putting together our best subjective and objective measures, one sleep neuroscientist, J. Allan Hobson, has developed the state-space model of biological states of consciousness. According to the state-space model, there are three core states for healthy adult humans: wakefulness, REM (rapid eye movement) sleep, and non-REM sleep (Hobson, 1999; Hobson, Stickgold, 1994). This trichotomy reflects the standard way of demarcating sleep based on neurobiological features, but, within that general framework, Hobson has developed his state-space model to explain transitions between these state-spaces across a continuum.

These three indices (the Glasgow Coma Scale, the BIS index, and the state-space model) are ways of dividing mental states into categories based on biological principles, the state-space model being most relevant to my discussion of sleep, although as LaBerge (2003) points out, even it is highly oversimplified. Hobson would likely not disagree, but the question of the degree of oversimplification exists as a subject for debate.

2.2.2. Philosophical Distinctions Concerning Consciousness

Philosophers have also refined concepts of consciousness. How do philosophers handle such cases as being knocked out or asleep? A common framework developed by David Rosenthal (1986, 1993) and accepted by many philosophers (Kriegel, 2007; Dretske, 1993; Carruthers, 2001) starts with the fact that human beings are sometimes conscious and

sometimes not. Rosenthal distinguishes *creature consciousness* from *state consciousness*. To have creature consciousness is to be awake and responsive to sensory input, whereas state consciousness is the property shared by mental states that are conscious, as opposed to those that are nonconscious. There is some difference of opinion about whether state consciousness or creature consciousness is the more basic notion, or even whether there is a useful distinction at all (Rosenthal, 2005). It seems that, according to Rosenthal (1993a, 1993b), in order for a human being to be *state conscious*, he or she must be creature conscious. In other words, creature consciousness is a biological precondition for conscious states. Thus, if in order for a being to be state conscious it must be creature conscious, and if creature consciousness depends on being presently awake, then while a creature is knocked out or asleep that creature cannot exhibit conscious mental states, in the sense of being state conscious.

In some ways, philosophers using this taxonomy have been inattentive to nuances of biological criteria for consciousness, despite the implicit assumption that the philosophical notion of consciousness is consistent with the biological one. When philosophers demarcate how the philosophical notion of consciousness differs from the biological one, the biologist may well ask: Which notion are you contrasting it with? Philosophers and neuroscientists often seem to be talking about quite different things when they talk about consciousness. Perhaps nowhere in philosophy is the problem of talking past each other more acute than in the voluminous literature on consciousness. Perhaps it is not even possible to use the word "consciousness" in a rigorous, precise way. If one must be awake to be creature conscious, what does it mean to be awake? This is by no means a clear-cut question. Such questions are relevant because consciousness, we presume here, is a biological notion, and despite the

coordination between the philosophical and biological concepts inherent in the definitions, philosophers' taxonomies have failed to do justice to the ways biological notions of creature consciousness coordinate with philosophical notions. For example, it is not clear how the state/creature consciousness distinction handles the case of dream states. My sense is that the current philosophical creature/state division vis-a-vis wakefulness and sleep is no longer sufficient, because it fails to handle problem cases such as dreaming and other mental states during sleep. I think we should encourage philosophers to pay heed to the updated, more specific biological notions of consciousness they are implicitly contrasting with philosophical ones. Of course, such approaches are natural practice among most philosophers of mind working today. But, with respect to sleep, in considering these updated, more expanded notions of conscious states, philosophers will need to pay attention to the unique properties of consciousness during sleep, because there are variations of cognitive states during sleep that combine elements never seen together during wakefulness. When philosophers expand the field of conscious states we may even find we have to refine our ideas about the properties of *all* conscious states, because we may have missed subtleties of consciousness, since so much of our understanding is based on conscious states. Setting up a common framework for talking about conscious states during both sleep and waking, however, is beyond the scope of this chapter on conscious dream states.

What is the current state of philosophical thinking about consciousness during sleep? For the most part, philosophers are happy to gloss over the question. John Searle, in the following quote where he defines consciousness, displays a common attitude of philosophers towards dreams:

> Like most words, `consciousness' does not admit of a definition in terms of genus and differentia or necessary and sufficient conditions. Nonetheless, it is important to say exactly what we are talking about because the phenomenon of consciousness that we are interested in needs to be distinguished from certain other phenomena such as attention, knowledge, and self-consciousness. By `consciousness' I simply mean those subjective states of sentience or awareness that begin when one awakes in the morning from a dreamless sleep and continue throughout the day until one goes to sleep at night or falls into a coma, or dies, or otherwise becomes, as one would say, `unconscious'. (Searle, 1993)

That he even implicitly accepts the relevance of dreams is notable. But, of course, for our purposes this definition is vague, especially given the complexity of what counts as a dream, to say nothing of the added question of what aspects of our sleep mentation are conscious.

Returning to the working definition of dreams I am using, here is Dennett's "received view of dreams":

> the received view...that dreams consist of sensations, thoughts, impressions, and, and so forth, usually composed into coherent narratives or adventures, occurring somehow in awareness or consciousness, though in some sense or way the dreamer is *un*conscious during the episode. (Dennett, 1978, p. 129)

The received view of dreams says that dreams are *conscious experiences* occurring during sleep, at least in some sense.

Because it is hard to say precisely what state consciousness is, philosophers often use examples to illustrate conscious experience (Rowlands, 2001). When people are in a conscious mental state, the world *appears* to them in a certain a way; there is *phenomenal* experience: for example, one might hear the sound of a G-string plucked on a guitar, or smell cinnamon

rolls baking, or taste ice-cold lemonade, or feel a feather on one's palm, or see a blue racquetball. All of these could be examples of a person experiencing a conscious mental state. Philosophers call such experiences instances of *phenomenal consciousness*. This term indicates the idea that the world *appears* to us in a certain way (Metzinger, 2009). The question is: Are there instances in which phenomenal consciousness ever occurs in dreams? Could one consciously feel a punch from a dreamt attacker? Could one consciously hear the sound of the voice of a dreamt interlocutor? In a dream, could one consciously experience seeing the face of a childhood friend? These questions raise the issue of whether there is ever "something it's like" (Nagel, 1974) to experience dreams, as opposed to sleep mentation just going on in the dark, so to speak, with no one there to experience it (Chalmers, 1997). It is with this contemporary picture of the philosophy of consciousness in mind that I approach the question: Does phenomenal consciousness ever occur during sleep? Because to be state conscious is to be phenomenally conscious, another way of putting the question for our purposes is: Are we ever state conscious in our dreams? My simple answer is yes; in the remainder of this chapter I explain the reasons for thinking *conscious states occur during dream sleep*.

It is important to be clear on what I am and am not doing in my account in this chapter. For example, I am not aiming to give a theory of phenomenal consciousness for dream states or any other mental states. According to Pete Mandik, a *philosophical theory of phenomenal consciousness* must do two things:

> it must explain what makes a mental state a conscious mental state (as opposed to an unconscious mental state) and it must explain what it is for a conscious mental state to have phenomenal character, that is, the property of the state in virtue of which there is something it is like to be in that state. (Mandik, 2005)

In this dissertation, I do not need to provide either of these desiderata in order to *show that conscious states occur during sleep*. First, in my argument for why conscious states occur during sleep, I remain neutral with respect to philosophical explanations for what makes a mental state a conscious state, as opposed to an unconscious one. Thus, I do not endorse any specific philosophical theory of consciousness, whether it be global workspace theory (Baars, e.g., 1997), higher-order thought theory (Rosenthal, e.g. 2005), first-order thought theory (Dretske, 1993), or some other major philosophical theory of phenomenal consciousness.

Secondly, in order to explain why conscious mental states occur during dreams (which are mental states that occur during sleep), I do not need to explain why one state during sleep is conscious while another state is not. I only need to give reasons why we should include some mental states during sleep in our already existing taxonomy of conscious states, there being no principled difference for attributing consciousness to waking states generally and yet not to certain states during sleep. In other words, my purpose in this chapter is to give reasons for thinking that mental states during dreaming sleep should be added to the taxonomy of conscious mental states. In this chapter, if I can show that mental states during dreaming sleep exhibit the same characteristics that are the basis for our attribution of state consciousness during waking, then I will consider my argument successful. (As a side note, whenever I speak of dreams, I am exclusively talking about mental states during sleep. Some thinkers have used the term "dream" to describe mental states that occur even during wakefulness, so-called "waking dreams". As I use the term, dreams are a type of mental state occurring during sleep. I don't dismiss the reasonableness of others using the term "dream" to apply to certain states during

wakefulness, but one has to pick one's foci, and my inquiry into dreams is only meant to include those dreams that occur during sleep.)

How are we to determine *whether* someone is (state) conscious? Those creatures who exhibit phenomenal consciousness—the capacity to consciously experience the world in a certain way—at any given time can either be in a conscious state or not. If they are in a conscious state, we call them state conscious. (Unless otherwise specified henceforth consciousness refers to state consciousness.) Some philosophers, wary of ceding too much ground to those who emphasize the primacy of the first-person point of view, take reportability, or the ability to report on the contents of one's mental states, as the standard criterion of consciousness. I accept reportability as the standard by which we determine whether a person is in a conscious mental state. In what follows, I'm assuming that people generally have conscious experiences while awake. We know this, because of their ability to report to that effect. In this chapter, to show why consciousness occurs during dream sleep, I argue that evidence supports the existence of reportability during what is unquestionably sleep. I develop my argument through the use of neurophysiological evidence and experiments (e.g., LaBerge, 1981; LaBerge and Levitan, 1995), along with thought experiments.

2.3. Challenges to the Argument That Conscious States Occur During Dreams

Daniel Dennett, in his 1978 paper "Are Dreams Experiences?," presents the most significant challenge to the view that conscious states occur during sleep. First, I will outline Dennett's cassette theory of dreams, including its variations in the *retro-selective* and

spontaneous construction theories of dreaming. (These are not his terms.) Then, I will show why the evidence does not support the cassette theory in any of its multifaceted forms. The strongest piece of evidence for my conclusion comes from evidence from so-called "lucid dreams".

2.3.1. The Cassette Theory of Dreaming

In this dissertation, I use evidence from sleep disorders and lucid dreaming as a window into the sleeping mind. Dennett (1978), however, dismisses the use of correlational physiological data of the type we see when in sufferers from REM Behavior Disorder (RBD). Those people with REM Behavior Disorder apparently *act out their dreams*. But, in Dennett's terminology, the physiological data could point to complex, purposeful mental activity during what is unquestionably sleep, but "the presentation process" (1978, p. 147) could still be lacking: there may be no "what it's like" accompanying the dream mentation or the bodily enacted. Dennett's position comes from his "cassette theory of dreams," which he presents as an alternative to the received view (outlined in Chapter One). The cassette theory of dreams is not so much a positive theory of dreams as a sustained attack on the presumptions of the received view. The cassette theory presents a many-tentacled theory, with a number of possible scenarios for how the received view could be mistaken. What unites the various versions of the cassette theory is the common argument that we are not state conscious in our dreams. Dennett's alternative theory derives from the matter-of-fact claim that people often have memories of events they were not conscious of at the time those events occurred. Dennett explains:

> On this theory dream memories are produced just the way the received theory says they are, except for one crucial thing: the process of dream-memory production is entirely unconscious, involves no awareness or experiencing at all. Even lucid dreams can be accommodated easily on this hypothesis, as follows: although the composition and recording process are entirely unconscious, on occasion the composition process inserts traces of itself into the recording via the literary conceit of a dream within a dream (Dennett, 1978a, p. 138).

> On the cassette theory it is not like anything to dream, although it is like something *to have dreamed*. On the cassette theory, dreams are not experiences we have during sleep: where we had thought there were dreams, there is only an unconscious composition process and an equally unconscious memory-loading process. (Dennett, 1978a, p. 138)

According to the conception presented above, the content of dream thoughts unfolds over time, but none of those dream thoughts are conscious. I think this hypothesis should be taken seriously: we can't simply assume dreams involve conscious experiences. As David Rosenthal (e.g., 1997) points out, perception can and often does occur without consciousness, as in cases of subliminal perception, peripheral vision, and the phenomenon known as blindsight, wherein subjects report no conscious awareness of their visual field, yet are able to guess at rates higher than chance where objects placed in front of them are located (Weiskrantz, 1986).

Another kind of mental state one could argue is analogous with non-conscious dreaming is so-called "automatic driving". According to those who propose that automatic driving occurs without consciousness, people sometimes drive for long stretches on roads on familiar roads where they "zone out," finding themselves with no conscious memory of having driven for the last minute or so, or perhaps longer. They were awake; they made slight adjustments to the

car's steering wheel in response to feedback from the road, but proponents of this view argue that such drivers are not conscious for a time, despite being awake (Of course, in real life, microsleeps with lapses in memory sometimes occur, especially among the sleep deprived, but they can also occur even among the well-rested. Microsleeps constitute cases where someone actually falls asleep for a brief period (typically defined as > 3 sec.) and then immediately returns to wakefulness (Benoit et al., 2001). Additionally, there are numerous reputable cases of not only sleep *walking* but sleep *driving* (e.g., Pressman, 2011), but here let us stipulate for this example such drivers are awake.) Now, to continue the line on automatic driving, one could argue that while they were driving, the drivers had non-conscious thoughts of the form: "nudge steering wheel to the right". In such cases, the drivers' brains were processing sensory details, but, on this hypothesis, they were not conscious of any such information for a period of time while they were driving. In order for Dennett's skeptical worry to have merit, we need not conclude that automatic driving or analogous cases definitively constitute lapses of consciousness—all we need say is that cases of automatic driving might plausibly be nonconscious. If they are, then dreams might well be nonconscious in an analogous fashion. With the cassette theory of dreams, Dennett is simply raising the skeptical hypothesis that a person could be dreaming content-filled thoughts in real time, but none of those thoughts would be conscious. Again, this is an alternative theory to the received view, one Dennett argues accounts for the data as well as the received view does. Dennett (1979) in his reply to Kathleen Emmett, clarifies that he is not committed to the cassette theory; he only suggests that the evidence for conscious experience of dreams is inconclusive. I am not aware of Dennett having modified this position on dreaming.Before countering Dennett's argument I will

address a similar argument by Susan Blackmore that is off-track for the same reasons Dennett's theory is.

2.3.2. The Retro-Selective Theory of Dreaming

Influenced by Dennett's cassette theory of dreams, Susan Blackmore puts forward a similar argument for denying we are ever conscious in our dreams. She calls the theory the "retro-selective theory of dreaming" (Blackmore, 2004, p. 347), which she attributes to Dennett. I haven't seen it spelled out in the same way by Dennett, but the theory fits in with Dennett's multiple drafts model of consciousness (Dennett, 1991), which he explicated some years after his paper on the cassette theory of dreaming. In the retro-selective theory of dreaming, Blackmore, in effect, puts the multiple drafts model and the cassette theory together. She writes: "According to the retro-selective theory, dreams are not ongoing conscious experiences at all. They are concocted retrospectively on waking by selecting from the myriad trains of thoughts and images that were going on in parallel in the dreaming brain" (Blackmore, 2004, p. 347). I take this to be a slight variation on Dennett's cassette theory. Rather than just saying upon awakening a person recalls a prior (unconscious) train of thought, the retro-selective theory says that upon awakening one chooses from an array of multiple trains of thought so as to best fit the waking narrative one is constructing. Thus, even more so than in the cassette theory, the retro-selective theory would seem to imply that the reported dream will be affected by variables affecting the way the dream is reconstructed, for example, the questions asked by an experimenter, the medium in which the dream is recorded (e.g., text,

audio, drawings), whether one includes waking associations in recording the dream, and so on. There is no doubt that such waking factors influence the contents of waking dream reports. Both the cassette theory and the retro-selection theories say dreams are ongoing nonconscious experiences happening in real-time that are subsequently reconstructed in some way upon awakening. It is only the subsequent reconstructed experiences that are conscious, not the dreams as they were occurring, according to Blackmore. I think this view is mistaken, but to see why first I want to elucidate what she is and is not saying.

2.3.3. Potential Alternative to the Retro-Selective Theory: The Spontaneous Construction Theory of Dreaming

It is important to clear up what Blackmore does *not* mean when she says dreams sometimes seem to be concocted at the moment of waking up. She is not claiming that all the contents of an entire dream are entirely fabricated nearly instantaneously upon awakening. An analogy here would be a skilled storyteller improvising a story or an anosognosic confabulating on the spot. Anosognosics are individuals who are constitutionally unaware of having some neurological deficit. But, rather than simply acknowledging that they can't, say, move their left arm, they confabulate, as the patient does in the following case:

> Dr. Ramachandran: "Esmerelda, how are you doing?"
> Patient: "I'm fine."
> "Can you walk?"
> "Yes."
> "Can you use your arms?"
> "Yes."
> "Can you use your right arm?"

"Yes."

"Can you use your left arm?"

"Yes, I can use my left arm."

"Can you point to me with your right hand?"

She pointed straight at me with her good right hand.

"Can you point to me with your left?"

Her left hand lay motionless in front of her.

"Esmerelda, are you pointing?"

"I have severe arthritis in my shoulder; you know that, doctor. It hurts. I can't move my arm now.

On other occasions she employed other excuses: "Well, I've never been very ambidextrous, doctor." (Ramachandran, 1998)

The above case might be thought of as an example of what Todd Feinberg (2001) calls "momentary confabulation," wherein an individual makes up a brief story, often to make up for a gap in her knowledge or memory. By definition, this story is not an accurate representation of facts or memories of facts. A dream, on the other hand, would be analogous to what Feinberg calls a "personal confabulation," which is "a variety of confabulation in which the patient tells a specifically autobiographical fictional narrative" (Feinberg, 2001, p. 175). Such personal confabulations are often found in those suffering neurological disorders of denial. According to the commonsense view, a dream narrative differs from a personal confabulation in that a dream narrative is a personal confabulation that one wakes up from; one then recognizes that the confabulation was not a product of real, ongoing negotiation with one's physical environment. In the retro-selective theory, unlike in the case of the above anosognosic, the dreamer is not fabricating a new train of thought from scratch. In other words, Esmerelda

probably wasn't thinking about arthritis before being asked to point with her left arm; she may not have even been feeling any pain prior.

The retro-selective theory is different from what we might call the *spontaneous construction upon awakening theory of dreaming*. A dreamer, according to the spontaneous construction theory, might be just as convinced as the anosognosic is about the reasons for her thoughts, but according to this theory, the dream contents have been fabricated anew after the dreamer awoke. Of course, in the above case, Esmerelda did not make up a reason *ex nihilo*—what she maintained arose from at least some beliefs she already had, for example, it was described in a language she speaks, etc.; but her confabulation presumably was something she conceived of spontaneously without any basis in her immediately prior train of thought. The retro-selective theory would accept that the reconstructed dream has some basis in the immediately prior trains of thought; it is only that those prior trains of thought were not conscious, and those intersecting trains of thought were not sufficiently distinct enough in the first place while being dreamt for there to be a definitive answer as to what the dreamer's mental contents were before she recounted them.

According to the would-be spontaneous construction theorist, a dream narrative differs from a waking personal confabulation in that a dream narrative is a personal confabulation that one believes to have just occurred during one's immediately prior sleep: the dreamer just doesn't realize that she has fabricated the memory of the entire autobiographical experience after she became awake. This immediacy of the spontaneous construction theory differs from the retro-selective theory. Unlike in the spontaneous construction theory, according to the retro-selective theory, the dreamer is not fabricating a new train of thought from scratch, as we

see in the above anosognosic. Instead, the retro-selective theorist accepts that dreams reflect cognition that occurred immediately prior during sleep, though this cognition occurred unconsciously. But, the retro-selective theorist assumes confabulation has occurred, too. According to the retro-selective theorist, the dreamer entertained multiple intertwining trains of thought during sleep. And, then, she confabulates when, upon awakening, she recounts the story of her dream with an unwarranted degree of coherence and consistency, because the contents of her dream thoughts were much more mixed up while she was sleeping than she assumes is the case when she is awake.

Although I haven't come across a name for the spontaneous construction (upon awakening) theory of dreaming, Dennett (1978) circumscribes his skeptical cassette theory so as to include such cases, and such a theory has historical precedent. Ludwig Wittgenstein and Norman Malcolm both endorsed some version of this theory. Malcolm goes so far as to define the meaning of a dream to be the *report* given upon awakening. Thus, for Malcolm, it is incoherent to even to talk about "what really happened in a dream." Also, Freud in *The Interpretation of Dreams (*[1900], 1965), discusses one classic dream that seems to offer a perfect illustration of the *spontaneous construction* theory. Freud recounts that Alfred Maury is said to have experienced a famous "guillotine dream". According to the story, Maury's bed railing broke and crashed onto his neck, waking him up suddenly. Upon awakening, Maury reported an elaborate dream in which he incorporated into his dream the sensation of the railing hitting his neck. Here is how Freud describes it:

> He was ill and *lying in his room in his bed*, with his *mother sitting beside him*, and dreamt that it was during the *reign of terror.* After witnessing a number of frightful scenes of murder, he was finally himself *brought before the revolutionary tribunal*. There he *saw*

> *Robespierre* and the rest of the grim heroes of those days. He was questioned by them and after a number of incidents which were not retained in his memory, was *condemned*, and *led to the place of execution* surrounded by an immense mob. He climbed onto the scaffold and was *bound to the plank by the executioner*. It was tipped up. The blade of the *guillotine fell*. He *felt his head being separated* from his body, *woke up* in extreme anxiety, and *found that the top of the bed had fallen down* and had struck his cervical vertebrae just in the way in which the blade of the guillotine would actually have struck them. ([1900] 1965)

The obvious question is: How could Maury have dreamt such an elaborate dream before being struck by his bed railing? The answer, says the spontaneous construction theorist, is that he couldn't have. A *memory* of an entire dream narrative occurs to one, but it is constructed wholly anew upon awakening. Maury's dream is just a striking illustration of this happening—it's just that most of the time we don't realize this is what we're doing, the spontaneous construction theorist would argue. Maury believed the dream was generated upon awakening by his starting with the guillotine image in his mind while awake and then projecting backwards in time to come up with the story of it having all occurred during his "dream" (Maury, 1861; cited by Schredl and Erlacher, 2011). Perhaps, the only alternative explanation for such a case is precognition, which, Dennett admits in his discussion of this dream, is quite a lot to swallow. Or, alternatively, one could argue, as Freud did, that the recounted dream was neither constructed spontaneously upon awakening nor based in an immediately prior train of thought; instead, the recounted dream came from the insertion of a prior phantasy the dreamer had already devised sometime prior. Again, Dennett suggests that this explanation is one possible version of his multi-pronged cassette theory, a theory held together principally because each of its versions represents an alternative to the received view of dreams.

To maintain this instantaneous-creation view of dreaming in the face of extensive evidence from the scientific study of sleep, however, is unsustainable. For example, we are able to see in REM Behavior Disorder actions that a sleeper performs actions in his sleep, and these actions can often be shown to correspond closely with waking reports. (See Section 2.9 below). All of this correspondence is available in special cases even when we are speaking only of ordinary, non-lucid dreams. I will say more about such real-time evidence later in this chapter.

The spontaneous construction theory could still be included as a special case in the larger picture of the retro-selective theory, with the major difference simply being the amount of time out of which the dream contents are retro-selected. According to this reasoning, if the retro-selective theory is true, it would be extremely surprising for there not to be cases of dream content that seem eerily prescient. One might liken this argument to the following reasoning. One may sometimes feel a premonition that someone is going to call us on the telephone, and then when one gets a phone call seconds later, one attributes this "knowing she would call" to precognition of the future, rather than recognizing that one often thinks about this person, including this person calling one on the phone and this happened to be one of those times, but most of those times the person doesn't call and one thinks nothing of it. For Maury, who was an extensive chronicler of his dreams, the guillotine dream may have been just one of those rare times that, after dreaming a series of overlapping thoughts, when presented by the stimulus of the bed rail, he retro-selected the previous thoughts into a coherent narrative of what had happened.

But, again, the retro-selective theorist, who questions whether any presentation process occurs in dreams, does not need to rely on memories of dreaming implausibly being created

instantaneously upon awakening, as arguably would be necessary for the content of Maury's guillotine dream to appear.

In another variation of the cassette theory, Dennett argues that the dream thoughts could be occurring in real-time, while the person is asleep, but those thoughts are never conscious until the dreamer wakes up.

In any case, superficially, the guillotine dream might seem to bolster the case of retro-selective theorist, but I believe this isolated anecdotal dream should not be taken seriously. Of the millions of recorded dreams throughout history, one would expect to find numerous examples of such prior trains of thoughts before stimuli are presented. A realist about dreaming would not deny that there could be cases of simple confabulation—people get things wrong or make stories up, but acceptance of such does not compel one to throw away the extensive evidence that shows dreams occur during sleep. The fact that stories of such dreams are so rare provides Bayesian evidence against a theory that goes contrary to known cognitive science. Furthermore, the spontaneous construction dream theory calls for a type of accelerated human thought process that seems to have no normal waking parallel, which is further evidence against it. All evidence of sleep mentation derivable from actions carried out by sufferers of REM Behavior Disorder points to a more typical pattern of sleep cognition unfolding over time, just as it does in waking thought (Olson et al., 2000; Ferini-Strambi and Zucconi, 2000; Iranzo et al., 2009.) (For numerous video examples of such, see this video (Zimmer et al., 2011).) For sufferers of REM Behavior Disorder, normal muscle inhibition in REM sleep breaks down, causing sufferers to act out their dreams. One exception to this evidence of unfolding over time might come from night terrors, in a which a person (usually a child) suddenly sits up while

sleeping and screams in terror. Night terrors seem to occur abruptly, and usually the child is unable to report any prior thought process that so terrified them. In any case, the diversity of sleep mentation makes it difficult to make universal generalizations .

In fact, dream research, has repeatedly demonstrated that dreams are ongoing trains of thought that occur during sleep. In many cases, individual have been found to regularly report incorporating certain stimuli into their dreams, whether it be a mist on the cheek, the sound of one's name, a train whistle, the smell of lemons, or any of dozens of other stimuli presented during sleep, which are incorporated into dreams at varying rates, all significantly greater that chance. In experiments where stimuli are presented after 10 minutes of REM sleep, and then subjects are awoken 30 seconds later, subjects often report the introduction of the stimulus in a narrative that proceeds to incorporate the stimulus into the storyline.(For a review of such studies, see Chapter 10 of Van de Castle (1994).) Finally, lucid dreaming (explained below) provides definitive disproof of the spontaneous construction upon awakening theory.

Wittgenstein argues that "an 'inner process' stands in need of outward criteria" (Wittgenstein, [1953] 2001, §580). Well, with REM Behavior Disorder we have such a correspondence between bodily actions and reported dream mentation. Our dreaming mind (an inner process) is corroborated by the unique, characteristic movements of the sufferer of REM Behavior Disorder.

2.3.4. The Retro-Selective Theory of Dreaming Presents the Strongest Challenge to Dream Realism

The retro-selective theory is a stronger and more plausible theory than the spontaneous construction theory, and thus, the retro-selective theory requires more serious philosophical argument in order to counter it.

What is the basis for formulating the retro-selective theory?

Blackmore (2004) puts forward "2 conflicting facts":

> 1. Dreams sometimes seem to be concocted at the moment of waking up.
> 2. There is evidence that dream events occur in real time (e.g. incorporation studies, lucid dreamers signaling from times [sic] dreams). (Blackmore, 2004b)

Much here depends on what Blackmore means by “concocted”. More critical to the argument of retro-selective theory is Blackmore’s (and Dennett’s) stance that the cassette theory (the retro-selective theory being one instance of the cassette theory) withstands evidence of lucid dreams. I disagree. The next section lays out the special importance of lucid dreams to the philosophy of sleep and dreams.

We spend a third of our lives asleep. Of that third, approximately one-fifth is spent in REM sleep. When subjects are awoken from REM sleep in the lab, about 90% of the time they report having just undergone “metachoric experiences” (Green, 1976; cited by Hunt, 1989), or experiences in which everyday waking experience of one’s surrounding physical environment is replaced by an entirely hallucinatory simulated world; these periods are commonly called dreams. In dreams, people report experiencing and interacting with their simulated surroundings, which includes other agents (human, animal, and beyond), objects (cars, swords, TVs, and much more), structures (their home, office buildings, the Taj Mahal, or completely

fabricated structures), and more. In order to do justice to dream reports, we ultimately have to judge whether and in what sense people can be having experiences of such things. Without begging any questions, I have kept my definition of dreams simple and general: dreams consist of a series of thoughts, feelings, perceptions, or images that people report having experienced while asleep. Initially, my data will be the waking verbal reports of dreams, being agnostic for the time being about whether such reported experiences occurred during sleep. In other words, people might be recalling a series of thoughts they had only upon awakening, or they might be attributing conscious experience to trains of thought that occurred nonconsciously during sleep.

2.4. Against the Retro-Selective Theory: Lucid Dreams

Lucid dreams present the strongest evidence of conscious mental states during sleep (van Eeden, 1913; LaBerge 1981; LaBerge and Rheingold, 1990). Lucid dreams are dreams where the dreamer is cognizant he or she is dreaming, while continuing to dream. At least, that is what subjects report, upon awakening, having just experienced while they were dreaming. People often describe lucid dreams as dreams where one is conscious one is dreaming. Here I avoid use of the words "conscious" or "aware" so as not to beg the question of consciousness during sleep. Instead, I use "cognizant" as a neutral term that is not meant to imply that one is conscious during the dream.

What are we to make of claims about lucid dreaming? First of all, we should recognize that claims of lucid dreaming are extraordinary, and if true, have implications for the

philosophy and science of consciousness. So we should be careful to elucidate what reports of lucid dreams do and do not imply.

Let's start by looking at the term "lucid dream" and its cognates. It is a matter of dispute who originated the use of the term "lucid dream". In his book 1867 book *Les Rêves et les moyens de les diriger* (*Dreams and How to Guide Them*), Chinese scholar Hervey Saint-Denys used the term *rêve lucide* (translated as *lucid dreams*) to describe dreams in which he had "the sensation of my situation" (Saint-Denys, [1867] 1982; quoted by Van de Castle, 1994). Despite this earlier use of the term *rêve lucide*, the Dutch writer and psychiatrist Frederick van Eeden is often credited with the invention of the term "lucid dream" (van Eeden, 1913) even though he came up with it after read Saint-Denys's dream accounts (Hacking, 2001).

Although the term "lucid dream" has recent origins, people have reported lucid dreams for millennia. Aristotle described lucid dreams in his work *On Dreams* where he writes, "when one is asleep, there is something in consciousness which tells us that what presents itself is but a dream" (Aristotle, [c. 350 B.C.] 1931). Some 800 years later, in a letter to Evodius, Augustine recounts a lucid dream of the physician Gennadius (Augustine, [415 A.D.], 2009). Thomas Aquinas also describes a lucid dream in the *Summa Theologica*: '... sometimes while asleep a man may judge that what he sees is a dream ...'" (Thomas Aquinas, Summa Theologica, I, Q.84, A.7, ad. 2). In the 8th Century A.D., Tibetan monks cultivated the art of lucid dreaming. For these monks, learning the art of lucid dreaming allowed them not only to be able to recognize the illusory nature of the dream world, but it also demonstrated to them that even the world we perceive while awake is *maya*, or illusion. (Van de Castle, 1994). Rene Descartes, Pierre

Gassendi, Thomas Reid, Fredrich Nietzsche, and Sigmund Freud, among many other notable thinkers, all describe experiences of lucid dreaming.

In one survey on lucid dreaming, over 58% of people said they have experienced at least one dream in which they were "aware" they were dreaming during the dream (Snyder and Gackenbach, 1988). (The term "aware" is used in the study.) 21% of people in the same study report experiencing at least one lucid dream a month. Such numbers provide *prima facie* evidence that lucid dreaming describes a real phenomenon, one commonly experienced by a large segment of the population. Of course, on the basis of such surveys, we cannot determine what people are really experiencing while asleep.

Lucid dreams are often reported to be more vivid and intense than ordinary, non-lucid dreams. (From here on, I refer to dreams not involving lucidity as "ordinary" dreams.)

While some lucid dreamers also claim to be able to exert some measure of control over the course and content of their dreams as a dream unfolds, not all lucid dreamers report this ability. Again, I only use the term lucidity to imply the recognition one is dreaming. Have I just begged the question of whether people are ever conscious in their dreams? No, I don't believe I have. The reason why is because nothing I have said so far is meant to stand as an argument for why consciousness occurs during dreams: cognizance does not imply consciousness.

Perhaps an example will illustrate why cognizance does not imply consciousness. Take the case of the distance-standing practices of a culture. Every culture adopts common practices for what is a comfortable distance to stand apart from someone else when carrying on a conversation. (This example comes from Dreyfus, 1990.) One could easily use the term cognizant to say that someone is cognizant of the polite and proper distance to stand apart

from someone, but this cognizance is something most of us are seldom, if ever, aware of. Thus, a person ("Hugo") might be cognizant that "this guy is standing too close" and thus might step back a few inches to find the distance that feels right but Hugo might not consciously realize that he is doing this. Instead, if he is aware of anything, he might consciously think this person is somewhat bold or aggressive, while having no conscious recognition that the proximal distance between them is the cause of his belief.

Lucidity simply indicates that the content of one's thought is such that it includes the knowledge that one is dreaming. It begs the question to say lucidity entails that one is (consciously) aware in a lucid dream. All we can say is that the content of one's thought includes the content "I am dreaming." Whether that constitutes evidence of conscious experience is another question. As Dennett indicates, there could be cognizance of a lucid dream, but without a "presentation process".

As Dennett states, nothing about a thought with the content "I am dreaming" in of itself constitutes evidence of state consciousness while dreaming. This position contradicts Emmett (1978), who argues that we can conclude someone is conscious based on their testimony upon awakening. Dennett writes contra Emmett:

> The subjective testimony she believes to refute the cassette theory concerns 'lucid dreams', and she offers *bona fide*, non-fictional transcriptions of such testimony. What, though, do they show? They show what the subjects, on waking, believe they experienced, but unless we let such beliefs be authoritative or incorrigible or constitutive, they are only very inconclusive data against the cassette theory. Why so inconclusive? Because, as I said, the cassette theory can handle 'lucid dream' reports "via the literary conceit of a dream within a dream" (p. 161 [Emmett, 1978]). (Dennett, 1979)

But Dennett argues that nothing about this dreamt content necessarily indicates consciousness. I agree. Dennett goes on:

> Since Descartes at least, it has been a commonplace that a dream can tell any story at all, can have any content at all, in particular can in principle mimic a bit of conscious life – any bit of conscious life – indistinguishably well. I see no reason to challenge that. It is proposed, then, that there are at least two sorts of dreams: *lucid* dreams (well described by Emmett) and – shall we say – *ordinary* dreams. The distinction drawn does not put any restriction on what may transpire *within the story frame* of an *ordinary* dream. Then if someone gives a waking report of the lucid dream variety, there will be two hypothesis [sic] consistent with the report; the subject had, as she believes she had, a lucid dream; or the subject had an ordinary dream *in which* she was aware she was dreaming, decided to fly in her dream, etc. She wasn't *really* aware she was dreaming, of course; she just dreamt she was aware she was dreaming. So subjective testimony, Emmett's criterion, cannot establish that lucid dreams are anything other than a variety of ordinary dreams, viz., dreams of having lucid dreams. (Dennett, 1979)

To show that dreamers are conscious, one might think we could rely on the reports of subjects who, upon awakening, say they had experienced lucidity in their dreams. But this is not enough. Even though we might find strong correlations between physiological criteria and subsequent dream reports, the skeptic would still not be persuaded that conscious states occur in dreams. It would seem that the skeptic requires us to demonstrate that a person is conscious *while the dream is going on*. (Of course, no report of a mental state is instantaneous, but the skeptic would seem to be calling for a roughly contemporaneous report.)

Some people, particularly those with a rich dream life, find it counter-intuitive to deny that dreamers can become conscious in their dreams; these dreamers are so convinced they

have been conscious when they were dreaming. Is confidence enough? How else could we explain people's tendencies to wake up to report complex dream narratives in which they say they were aware that they were dreaming during the dream? They also report being able to manifest characters and objects simply by managing their expectations of what will appear in their lucid dreams. If there were an account of how it could be that good dream recallers (if that is what they are) consistently wake up to report having experienced complex narratives, then it might be easier to accept that dreamers are not conscious during dreams. Dennett in his paper "Are Dreams Experiences?" (1978a) devised the cassette theory of dreaming to explain such reports and to provide alternative accounts, and, thus, counter people's intuitions that they are conscious while dreaming. The cassette theory aims to explain away our waking impressions that we had conscious experiences while we were asleep. In the paper, Dennett gives the most cogent argument available for rejecting the dream reports people give upon awakening. Like Dennett, I treat dream reports like anything else people report: as data to be factored alongside physiological data. Dennett is right to scrutinize our reports of dreaming but his skeptical challenge can be met, thanks to insights gained from experimental research on lucid dreaming.

2.5. Reportability

Whether awake or asleep, people are not absolute authorities on the contents of their mental states; it seems, for example, as though our peripheral vision is much more acute than experiments reveal it to be. If we were to actually test our peripheral vision by focusing on a

point directly in front of us, we would find that we are not even able to discern the color of, say, a playing card, even just a few inches off to the side away from our point of focus (e.g., Schwitzgebel, 2007). Most people are shocked to find that beliefs about their experience are so far off. There are many such findings that rightly shake our assuredness that we make accurate judgments about the nature of our experience. Clearly, our confidence in the nature and content of our experience becomes all the more suspect when it comes to knowing what transpires in our dreams. Still, I take it as given that reports of detailed experiences during sleep indicate mental activity that needs to be explained. Here I am following Daniel Dennett's intentional stance (1991, p. 76):

> we must treat the noise-emitter as an agent, indeed a rational agent, who harbors belief and desires and other mental states that exhibit *intentionality* or "aboutness," and whose actions can be explained (or predicted) on the basis of the contents of those states.

Thus we can interpret the noises people make upon awakening, not just as sounds like stomach gurglings, but as meaningful speech acts. There are many ways one can report on one's mental state. Speech is not the only way to report on one's mental state. In this dissertation, I interpret coded signals performed through various physiological movements during sleep as meaningful reports on dreamers' mental states. I am interested in this chapter in showing that *conscious states* occur during sleep, so I will not concern myself with the perhaps varied nature of the *contents* of those mental states. In other words, interesting as it may be talk about what we dream about, I focus on my attention on the question whether we are conscious or not in our dreams.

In this dissertation, when examining first-person accounts, I begin by provisionally accepting what people say about their experience and then proceed to scrutinize whether they are right. (In using this method I'm also assuming people are sincere in what they say about their experience.) First, I seek to understand the way people describe their experience. My adopted method is analogous to the way an anthropologist studies the experiences of people from a foreign culture. This is the "heterophenomenological method," outlined by Daniel Dennett in his book *Consciousness Explained* (1991). Heterophenomenology offers a scientific way to study first-person experience: A subject might say: "It looks like a circular shape with four holes. No, it's not really circular. It's more ovular." Such a first-person description is then analyzed from the third-person point of view: "Subject says there is an 'ovular shape with four holes.'" Whether or not the subject is an accurate guide to his experience, it is a fact that she describes her experience in a certain way. That is the data to be explained. I accept that the science of consciousness has to proceed on the basis of such objective third-person data. I'll try to explain people's first-person accounts of their experience, while keeping in mind that a person is not an absolute authority on how he or she *really* experiences something; in other words, people can be wrong about their own experience, e.g., they don't realize they have blind spots or they don't realize how poor their peripheral vision is. Much of Dennett's book *Consciousness Explained* can be read as a sustained attack on people's certainty about how they experience the world.

To return, lucid dreams are dreams where one is cognizant one is dreaming, while continuing to dream. At least, people, upon awakening, report such mental contents were present in their dreams. Whether or not such beliefs are accurate is the subject of this chapter.

One could argue, though, that I am going out of order by treating queer reports of lucid dreams before considering ordinary, non-lucid dreams. But focusing on the special properties of lucid dreams provides the clearest-cut experimental evidence for the existence of conscious states during what would otherwise unquestionably be called sleep using standard neurophysiological measures (i.e., polysomnography (cf. Iber et al. 2004)). The reports of subjects *during lucid dreams while they are asleep* are the most reliable forms of report during sleep. Arguably, such lucid dream reports are the *only* reliable form of report during sleep.

Here in this section, I argue that we should accept lucid dreams as conscious mental states during sleep. After having argued my case for lucid dreams, I will, in the next section of this chapter, try to bridge the gap between lucid and non-lucid dreams by examining sleep mentation as it occurs in REM behavior disorder, a type of sleep disorder in which sleepers seem to act out their dreams.

The standard criteria for determining when someone is state conscious is *reportability*, or the ability to spontaneously report the contents of one's mental state (e.g., Chalmers, 1996; Rosenthal, 1997). To be able to report on one's mental state one must be conscious. Reportability, as Rosenthal indicates, "fixes the extension of conscious states" (1990b). Reportability is a standard used widely in cognitive psychology (e.g., Marcel, 1983; cited by Rosenthal, 1990b). In Marcel's paper, an exemplar of many such papers in cognitive psychology, the focus is on distinguishing conscious perceptual states from nonconscious ones. For my argument here, what's crucial is simply the *ability to make a report* on one's mental state. It's not material what the content of that mental state is other than the fact that it indicates a conscious mental state.

I argue that lucid dreamers meet this criteria for consciousness: *they can report while asleep*. One might argue that lucid dream reports do not constitute evidence of reportability because lucid dreamers are not reporting on the *contents* of their mental state. In effect, all they are doing is reporting *that* they are conscious. That may be one way to interpret what lucid dreamers are doing. Another is to interpret the lucid dreamer as reporting the contents of her mental state as being "I am dreaming." We might liken what lucid dreamers are doing to a cognitive psychology experiment in which subjects are asked to press a button when they are aware of some stimulus. In lucid dream signaling, we might take the lucid dreamer's initiation of pre-arranged signals as a time-delayed report. What is the dreamer reporting on? The fact that she is aware of the contents of her dream.

We will see that, due to pragmatic limitations, some of the reports involve coded signals (e.g., eye movements back and forth: left-right-left-right-left-right) but in principle I see no reason why signals could not be put into Morse code and expanded to make words and phrases, and hence count as more meaningful verbal utterances. It is well understood that experimenters in studies unrelated to dreaming get somewhat different results by asking subjects to, for example, push a button or blink an eye, instead of reporting via verbal speech (Marcel, 1993), but the kinds of reports given during lucid dreams are of such a specificity and complexity that the most reasonable conclusion is that the subject is conscious at the time of the report. It is true that asking subjects to blink twice to reply yes and blink once to reply no are not equivalent in every way to asking them to verbally express their replies of yes or no, so experimenters can get divergent results depending on the way subjects are asked to report their mental states. But such discrepancies do not affect my aims in this paper. Any such

variation in reports does not negate the fact that such subjects are reporting on their mental state, thus indicating that they are conscious. Such variation does not concern me here because my main interest is the *capacity* to report: other factors such as the relative time from stimulus to report are irrelevant, although, even here, we will see that the reliability of reports during lucid dreams is perhaps surprisingly strong. In any case, my main aim here is to show *that* people can report on their mental states while asleep.

Since Dennett first published his paper "Are Dreams Experiences?," a wealth of data on normal sleep has appeared, including strong evidence of a correspondence between reported dream actions and physiological actions. In his paper Dennett acknowledges there is evidence of correlations between physiological data during sleep and subsequent reports. Much more data is now in and it is overwhelmingly in support of the received view. Although I will have more to say about this correspondence, for now the following anecdote will suffice: A man is woken up from REM sleep after several right-left eye movements and reports just having dreamt of a fast and furious ping-pong match. For some time, such reports remained on the level of anecdote. Thanks to the skills of lucid dreamers, however, we now have concrete data testifying to what was previously largely anecdotal.

2.6. Unprompted Real-Time Reports Occur While a Person is Lucid Dreaming

The foundation for Dennett's entire skeptical attack is the claim that "our only expressible access to dreaming is retrospective" (1978a, p. 244). This turns out not to be the case (assuming a reasonable interpretation of the word "retrospective"). Lucid dreamers can

communicate using pre-arranged signals while they remain asleep. In a typical such study, subjects who report regular lucid dreams upon awakening are hooked up to the polysomnographic technology (which includes electroencephalograph (to detect brainwaves based on changes in electrical potential as measured in different locations on the scalp), electromyograph (to gauge muscular tension, something greatly diminished during REM sleep), and an electro-oculograph (to gauge eye movement patterns).

Before the subjects fall asleep they initiate an eye movement pattern that is extremely statistically unlikely to occur by chance. One common pattern would be that subjects, moving only their eyes, look all the way to the left then all the way to the right, and repeat left-right four more times for a total of five. Such eye movement patterns are recorded by the electro-oculogram through placement of electrodes on subjects' temples. Subjects are then instructed to go to sleep, and, then, should they become lucid in their dream, they are to initiate the same eye movement pattern, providing a signal as to their conscious mental status (LaBerge et al., 1981). Similar evidence of lucidity during dreams has similarly been demonstrated through multiple physiological signaling methods. Stephen LaBerge (LaBerge et al., 1981) and other researchers have recorded subjects engaging in pre-arranged actions—e.g., eye movements or fist clenches—that are verifiable reports of subjects being conscious of their mental state. In one study (LaBerge et al., 1981), the subject initiated a pattern of fist clenches to spell his initials. When dreamers become lucid, they are able to enact distinctive actions with recognizable physiological effects, all while remaining asleep according to standard criteria for sleep.

> The most complicated signal (shown in figure 58.1) consisted of a single upward dream-eye movement followed by a series of left (L) and right (R) dream-fist clenches in the order "LLLLRLL." This sequence is equivalent to the subject's initials in Morse code (LLL= ... = S; LRLL = .-.. = L. The complexity of this signal argues against the possibility that he EMG discharges might be spontaneous. (LaBerge et al., 1981)

Morse code requires access to language faculties enough to spell out letters. Not only does the physiological data signaled in Morse code suggest that subjects are conscious but such actions indicate that there is a level of reflectiveness possible in dreaming comparable to waking levels. How else could subjects perform actions as complex as Morse code signals? The types of actions performed are far too intricate for them to be mere chance events.

In the above study, subjects clench their fists when they attain lucidity. The EEG, EOG, and EMG (measuring chin muscle tone) patterns of such subjects still shows up as REM sleep, but slight changes in muscle tension are detectable in the wrists, as measured by electromyography (EMG). Let's look more closely to see what needs to be the case for subjects to signal using fist clenches in Morse code. A subject who knows Morse code must memorize the pre-arranged signal. Then he has to fall asleep. Perhaps hours later, the subject while asleep must gain some measure of voluntary action. He must recall previous information--he is sleeping in the lab for the purpose of signaling while asleep. He must remember what the pre-arranged signal is. He must perform the signaling actions. For example, clench his fists in Morse code: right wrist for long, left for short. (One subject in the study successfully signaled on 14 occasions over 20 nights (LaBerge et al., 1981.) Finally, the subject must later wake up and report having had a lucid dream and having signaled according to the pre-arranged code. Such evidence seems to me overwhelming evidence that the subject was conscious while (lucid)

dreaming: signaling one's initials in Morse code qualifies as a report; if one contests this, in principle I see no reason why the signal could not have been more elaborate so as to produce full verbal reports--instead of letters for initials, letters to make up words. When the full implications of these data sink in, one can't help but be astounded at the level of purposeful reflectiveness occurring while the subject is asleep. Let me add that there is no question-begging reason for calling the biological state in which the signaling occurred anything other than sleep. To claim that what occurs during the given time period is not sleep, one would have to put forth an alternative neurophysiological theory of biological states, one presumably based in part on subjective reports. (Foulkes (1991) makes some motions in this direction.)

One might still argue that, despite the complexity of the signals, it is conceivable that subjects were merely performing automatic actions and thus were not conscious of them at the time they were being performed. This argument would deny that the subject was responding consciously in real-time. The signals were so overlearned, so this argument might go, that they could occur over and over like some kind of automatic reflex. In Dennett's terminology, the physiological data could be what they are, but "the presentation process" (1978a: 238) would still be lacking; there would be no "what it's like" (Nagel, 1974) to the dream process. This idea, of course, comes from Dennett's cassette theory of dreams, his alternative to the received view. As we have seen, the cassette theory of dreams is not so much a positive theory of dreams as a sustained attack on the assumptions of the received view. Dennett's alternative explanation derives from the matter-of-fact claim that people often have memories of events of which they were not conscious at the time they occurred. Dennett explains:

> On this theory dream memories are produced just the way the received theory says they are, except for one crucial thing: the process of dream-memory production is entirely unconscious, involves no awareness or experiencing at all. Even lucid dreams can be accommodated easily on this hypothesis, as follows: although the composition and recording process are entirely unconscious, on occasion the composition process inserts traces of itself into the recording via the literary conceit of a dream within a dream (1978a, p. 238).

To maintain this view in the face of recent lucid dream experiments one would have to hold that Morse code signals, such as the subject's signaling his initials, are traces of the (unconscious) composition process. But this explanation not only doesn't account for the complexity of the pre-arranged signals, it can't handle the issue of their varied nature, for example, some subjects can clench their fists while others can move their eyes. Still another signaled in a pre-arranged manner at the onset of sexual activity (in the dream) and again at orgasm, and the physiological data associated with such activities corresponded to waking levels (LaBerge, 1990).

But the case for lucid dreaming is so strong that one could, through a thought experiment, stretch one's skepticism to the limit. We have seen that lucid dreamers can communicate (what else can you call it) in Morse code using, for example, fist clenches: right clench for long, left clench for short. Such clenches show up as discharges on the EMG, or electromyograph, a device that measures muscle tension. So the skilled lucid dreamer seems to communicate with the experimenter. How could we demonstrate the subject's responsiveness at the moment he signaled? What if there were two-way communication? Might the experimenter be able to communicate with the sleeping subject? I think lucid dream signals already demonstrate consciousness during sleep, but if we take it further: if meaningful

exchange could take place, the cassette theory would be refuted, since there would be back and forth interaction that the cassette theory couldn't account for. It doesn't take much imagination to see that such an exchange is conceivable, and I would argue realizable. There is no reason in principle such two-way exchange could not take place.

Sleep is often spoken of as state in which the sleeper is not receptive to stimuli from the environment. This, of course, is not entirely true. For example, it is quite common for sleepers to adjust their sleeping position in response to some minor disturbance, while remaining asleep. Whatever the level of stimuli need be for a given person, depending on how deep a sleeper he or she is, there will always be some range of stimuli resulting in a response—roughly from stimuli having no effect on EEG patterns to stimuli having effects on EEG patterns but not enough to wake up the subject to stimuli that will wake the subject up momentarily, and so on. It turns out that this is a pretty wide spectrum for most people. In other words, there is usually a range of stimuli which that neither wake a person up nor have a negligible effect on their (neuro)physiology. What we are interested in are stimuli that could have a distinctive effect on the dreamer's mental contents. Could lucid dreamers attune themselves to such stimuli? Experiments have been done on sleeping subjects to see if they incorporate stimuli, such as puffs of air or musical melodies into their dreams. Typically there is a null result, but, based on reports upon awakening, sprays of water onto the subject's body seem to have the most robust effect, being reported in dreams at least briefly in 42% of cases (Dement and Wolpert, 1958; cited in Nielsen, 1993). Whatever the percentages, there will always be a range of stimuli—from stimuli that will wake a person up to stimuli that will not. So, in the middle of that range are stimuli that will have a noticeable effect on sleeping subjects, but won't wake them up.

These results jibe with our intuition: we have heard stories where people incorporate a siren or an alarm or some other stimuli into a dream; unlike in the guillotine case, however, such dream incorporation is not so fanciful. I would argue that, if lucid dreamers are trained to look for such stimuli, they could come to recognize the stimuli while they are still asleep. Actually, there is a popular device on the market for inducing lucid dreams: the "DreamLight" flashes red lights into the sleepers' eyes. The idea is that subjects would detect the stimulus and realize they are dreaming without waking up. It appears to work (LaBerge and Levitan, 1995).

Well, if this "DreamLight" can be used to signal to someone so they can *recognize that they are dreaming*, it presumably could also be used to engage in two-way communication with a lucid dreamer. We could ask the lucid dreamer questions. We might, for example, use Morse code to ask: Are you conscious? Or, What does 2 + 3 =? We could also ask trickier questions like: What can you see right now? I don't see any reason for thinking that a lucid dreamer who could clench his wrists in Morse code couldn't also reply to questions in Morse code. Limitations here would seem to be more pragmatic than theoretical. For example, it might seem impractical to ask whole questions in which case we could have subjects memorize questions by number and answer when a given number is flashed. Just so things don't become confused, we might want to have them use a different "channel" to reply: we could ask questions with eye flashes and the sleeping subject could answer with wrist clenches. If we could pull this off, we'd be able to discern not only the *fact* that someone is conscious, but we'd have a lucid dreamer who could report in real-time the *contents* of his consciousness while he is asleep. Of course, reports would be of what was just experienced, but this same limitation applies when a person is awake. Still, there's not much more in terms of conscious experience

we could ask of a subject who was awake. In fact, sleeping subjects could perform actions no typical waking subject can. For a start, when we ask them to imagine a purple elephant they may well reply they actually see it, whatever we take that to mean. A recent study using functional Magnetic Resonance Imaging was able to decode brain wave patterns of subjects looking at videos on YouTube. Simply from algorithmic analysis of subjects' brain waves scientists were able to reconstruct eerily accurate visual images corresponding to what the person was seeing. It is not outrageous to speculate that similar technology in the future could be used to display a person's lucid dreams. Lucid dreamers say they make simulated objects appear in their dreams all the time, although there are difficulties: conjuring written text and turning lights on and off are considered hard tasks to do. Thus, these last two tasks make for effective "reality tests" for determining whether or not someone is dreaming--if they open a book and the text on the page is blurry, they must be dreaming (LaBerge, 1990). Despite such cases, lucid dreamers often report that lucid dream experiences are *more* vivid than waking experiences. The success of lucid dream signaling experiments suggests we should try to explain such reports. With a more advanced theory of representation in the brain and the technical means to detect it, we might be able to predict the contents of dream reports, lucid or non-lucid (AFP, 2008). The ability of scientists to specify the function of neural activation patterns during wakefulness is already astounding. In sleep, there have been modest gains in finding correlations between neurophysiological activity and the contents of waking reports: it's been shown, for example, that eye movement patterns during sleep approximate waking visual patterns. Dream eye movement patterns are quite different from those evidenced when a waking subject imagines an object; One famous anecdote is William Dement studying a subject

in which the EOG detected “no less than twenty-six regularly spaced to-and-fro horizontal [eye] movements with no vertical components whatsoever.” Because of the extreme rarity of such a pattern, the sleep researcher awakened the subject and asked him to report his dream.

> He stated that he had been watching a ping pong game between two friends. In the dream, he had stood at the side of the ping pong table so that he had to look from side to side to watch the ball. He also reported that he had been watching a rather long volley just before he was awakened (Dement, 1974).

Obviously EOG patterns are rudimentary compared to what one imagines is possible when in future neuroscience. In such a vein, Dennett speculates that scientists could:

> predict from certain physiological events observed during sleep that the subsequent dream report would allude to, for example, fear, falling from a height, eating something cold, even (in the Golden Age of neurocryptography) buying a train ticket to New Haven for $12.65 and then forgetting which pocket it was in (Dennett, 1978a, p. 229).

For Dennett, who puts forth the cassette theory of dreaming, only the waking reports would be conscious experiences. But if we accept that the above-mentioned interactive communication is possible, we would have subjects reporting experiences of variable type through ongoing communication with the external world. There would be no basis for a claim to consciousness present in a similar standard waking report that would be missing in such sleep reports. So far as I know such real experiments with two-way communication haven’t been performed, though again I think they are reasonable extrapolation of experiments that have been done. If there were incentive to undertake such a complex experiment I see no reason why there couldn’t be successes, at least on a limited level. With the right lucid dreamers, for example, those with very long REM periods, more might be possible. If so, there certainly are all kinds of science fiction possibilities one can imagine being explored in the neuroscience of the coming decades.

Now it might be argued that reports during lucid dreams are not evidence of consciousness because they do not demonstrate knowledge of the dream state. That they do not demonstrate knowledge of the dream can be shown by the fact that so-called false awakenings are relatively common. In false awakenings, the dreamer believes herself to have awoken; often dreamers will subsequently report experiencing the sights of their bedroom, but the experienced awakening was a false one. The experience of the bedroom was part of the simulation created by the dream. Then after a false awakening a person wakes up to the real experience of their bedroom. Here a person falsely believes that she is awake and attuned to her physical environment. One might argue that the fact that we can be so readily mistaken as to whether we are awake when we are in fact dreaming casts doubt on how much we can say the dreamer knows about her occurrent mental contents. How can we say she knows if she is so easily and often wrong. (I will say more about such epistemological issues in Chapter Three.) But evidence of reportability from lucid dreams does not demonstrate *that one is dreaming*, except indirectly. All one is demonstrating through initiating pre-arranged signals is that one is consciously aware enough of one's present state so as to report on it. One could still be wrong about whether one is dreaming or not. For example, the polysomnography might show that a person has awoken and was not in fact asleep and dreaming when they initiated the pre-arranged eye signals. Although uncommon, the person could be experiencing full-blown hallucinations while awake, perhaps waking hypnopompic hallucinations or perhaps under the influence of a remogen such as ibogaine. In such a case, the initiation of the pre-arranged signals would still demonstrate the person was conscious; it’s just that the dreamer herself wouldn't incorrigibly be able to certify that she was experiencing a lucid dream and not some

other kind of hallucinatory waking state. This skepticism about her self-knowledge of her own state might be relevant for extreme epistemological doubt, but, unless there is reason to believe some other form of hallucinatory state is occurring, if the subject suspects she is asleep and experiencing an entirely simulated world, she should on that basis be able to conclude she is dreaming lucidly as the inference to the best explanation.

Put another way, that the lucid dreamer is conscious and dreaming is something the third-person party is actually able to ascertain more definitively than the subject herself, as the subject is not aware of her own neurophysiological state. When he witnesses a lucid dreamer signaling with sufficient with complexity while asleep, the third-person party is able to conclude, arguably on a sounder basis than the subject herself, that the subject is dreaming lucidly.

Now after all this one might still argue that there is something special about such signaling reports that make them unrepresentative of lucid dreams in general. Maybe, this argument might go, signaling dreams are conscious but typical lucid dreams are not. There is, however, nothing to support such an argument. In principle, there is every reason to believe that anyone who becomes lucid could signal in such a manner as outlined above. The diversity of such signals and the number of people who have learned this skill point to there being nothing exceptional about lucid dream signaling. In fact, it is a commonplace of lucid dreaming that, once they become lucid, lucid dreamers often seek to change some features of their simulated world. (Whether and how easily they can actually change their simulated experience is a more difficult both from a first- and third-person perspective.) Because, in the dream state, one's experience of a simulated world is so convincing, it is a common tactic to attempt to

perform some action in a dream (e.g., jump into the air and stay up, try to fly, do a backflip, turn on a light switch) to see if one is really dreaming. Signals through eye movements, hand clenches, breath holds, etc. would simply be instances of those performative actions. The major difference between the gamut of actions performed by lucid dreamers and the ones I outlined above is that the above-mentioned ones happen to be detectable by current scientific instruments used by researchers monitoring sleep in the lab.

2.7. Are Lucid Dreamers Asleep?

Lucid dreamers, I have argued, can demonstrate the ability to form conscious judgments during sleep. Obviously this ability is vitiated if lucid dreamers are not asleep at the time they form such judgments. Norman Malcolm argues that it is impossible for a person to form the true judgment "I am asleep." According to Malcolm, the notion itself is self-contradictory. Why? Malcolm writes:

> In order to know that when a man said 'I am asleep' he gave a true description of his own state, one would have to know that he said it while asleep and that he was aware of saying it. This is an impossible thing to know, because whatever showed that he was aware of saying that sentence would show that he was not asleep. The knowledge required is impossible because it is self-contradictory. (Malcolm, 1962, p. 10-11)

This raises the question of how it can be shown whether or not someone is asleep.

Malcolm cites Wittgenstein's saying "'I am in pain', either to others or to himself, can be a use of language only because a connection has already been established between those

words and the outward phenomena that are the original criteria of pain.'' (Wittgenstein, [1953] 2001 §244; quoted by Malcolm, 1962, p. 16).

The same approach applies to sleep. In Wittgenstein's dictum, "an inner process stands in need of outward criteria" (Wittgenstein, [1953] 2001, § 580). Lucid dreamers, however, display the same outward criteria as ordinary sleepers both in terms of neurophysiological data and typical sleep behavior, with three possible exceptions noted below.

How are we to determine whether someone is asleep? My view is that the ultimate appeal should be to a neurophysiological assessment based on our most up-to-date neuroscience. We can imagine a future neuroscience so sophisticated as to make demarcating healthy human sleep easy, with perhaps the issue of borderline or dissociated cases being a matter of decision in the same sense as whether we should say of a submarine that it “sets sail” or "swims" (Chomsky, 2000, p. 148). The philosophical study of vagueness tells us, though, that while in certain borderline cases it may be difficult to ascertain whether a person is asleep, we can nevertheless point to paradigmatic cases of sleep. And we can do that today for all virtually all human beings alive. As of 2013, our scientific measures, while extremely reliable, are not free of problem cases that involve dissociated states of wakefulness and sleep (Mahowald and Schenck, 1992). Lucid dreaming, however, is not a problem case: lucid dreamers are clearly asleep.

Malcolm, however, believes we determine whether someone is asleep not based on scientific criteria but based on behavioral criteria.

> If we were required to find out whether someone is asleep what should we look for? It would be things of this sort: that he is recumbent, his eyes are closed, his breathing regular, his body mainly inert, and that he does not react to various sounds and

> movements in his vicinity to which he would normally react if awake. If he was whistling, writing, staring at the window, examining a map, or conversing we should not say he was asleep. Our ordinary application of the word 'asleep' is not guided by any consideration of what is going on in someone's cranium, spinal column or other inward parts, but rather by how his body is disposed and by his behavior or lack of it. Another thing we consider is how *sleepy* he looks and acts when ostensibly waking up from ostensible sleep. We expect him to be somewhat dazed or groggy and not, for a few moments at least, able to perceive and take in things with normal acuteness. (Malcolm, 1962, p. 22)

Lucid dreamers stand up to these paradigmatic ways of understanding sleep. One cannot distinguish the sleep of those who report lucid dreaming from regular sleepers, except in the case of detection of pre-arranged eye movement signals. But, were one not looking for certain physiological signals (as outlined below), one would be unable to detect when someone lucid dreaming and when one is sleeping normally.

2.8. Consciousness and Non-Lucid Dreams

Having now made the case for consciousness during lucid dreams, we can address the question of whether we are ever conscious in our ordinary, *non-lucid* dreams. Anecdotally, it is often said that what triggers lucidity for the dreamer is the recognition of some incongruity in a dream. The dreamer suddenly thinks to herself something like the following: "That's weird. [X] should not be like that....I must be dreaming." Many lucid dreamers believe that cultivating this sense of questioning one's reality allows them to develop the skill of lucid dreaming (LaBerge, 1986). Lucid dreamers call it "reality testing". If you want to experience lucid dreams, LaBerge and

others counsel would-be lucid dreamers to do reality checks many times a day, asking themselves: "Am I dreaming?" The idea is that if you keep asking yourself this question when you are awake you will ask it again when you are dreaming—and this question will trigger a lucid dream. Though the validity of this method has never been tested empirically, anecdotally it has some support (LaBerge, 1986).

I have two arguments for conscious states occurring even in ordinary, non-lucid dreams. One argument comes from the similarity between the pre-lucid dream and the dreamer's mental state after the triggering of lucidity. If there were no principled difference between the mental states before and after triggering of lucidity, then there is no basis for concluding that lucid dreams are conscious whereas non-lucid dreams are not. This continuity between states argument only supports the view that some dreams are conscious, not that all dreams are.

The other argument for consciousness during non-lucid dreams derives from the position that verbally expressed thoughts are invariably conscious. If we can say verbally expressed thoughts occur in dreams and that verbally expressed thoughts are always conscious,, then we are conscious in our dreams in which we verbally express thoughts.

Let's take the first argument of continuity between lucid and non-lucid dream experience. I argue that, when we look closer at the triggering act of lucidity, we are hard put to claim there occurs a transition to state consciousness out of nonconscious thought, as if all of the contents of the dream would now become conscious simply because one realizes one is dreaming. Instead, as I have indicated in my usage of lucidity, lucidity simply connotes a cognizance of the fact that one is dreaming. One is conscious even in ordinary, non-lucid

dreams; lucidity, as gleaned through physiological signals, simply serves as the corroboration we needed to prove dreamers are conscious, as had been denied by Dennett and others.

In her paper "The Psychological Content of Lucid Versus Nonlucid Dreams," based on an extensive analysis of dreams, Jayne Gackenbach concludes: "The overwhelming finding of these numerous analyses assessing manifest content differences between lucid and non-lucid dreams is that they are more alike than they are different." (Gackenbach, 1988)

Much evidence points to a continuity between lucid and non-lucid dreaming. Of course, there are changes that occur once one becomes lucid. And here one might attempt to argue that the onset of lucidity is reflective of a higher-order thought about one's mental state. This remains a possibility. Perhaps this a question that might be adjudicated by more sophisticated neuroscientific evidence.

Still, there does seem to be something to the idea that lucidity confers some added measure of criticality and self-reflectiveness that wasn't present before the dreamer became lucid. Thomas Metzinger (2009) has argued that what lucidity confers is access to the phenomenal self-model that is always constructing our dreams. In lucid dreams, lucid dreamers report being able to exert some control over the unfolding of their dreams. This control is associated with greater forebrain activation than that seen during non-lucid dreams. It is reasonable to assume that such activation underlies the greater reflective capacity apparent in lucid dreaming, which may be just the kind of capacity turned off in ordinary dreaming. More specifically, noted sleep scientist J. Allan Hobson and philosopher Thomas Metzinger plausibly speculate that the dorsolateral-prefrontal cortex becomes activated in lucid dreams, allowing this kind of reflective capacity. The dorsolateral prefrontal cortex is known to be a major area of

the brain implicated in our waking capacity to reason, plan, and reflect upon our experience. Despite the above conjectures, because of their elusive nature, lucid dreams have not yet been studied using real-time imaging such as fMRI. This remains an area of study worthy of further exploration.

We have seen that in lucid dreams, dreamers can perform voluntary actions to signal that they are conscious. What about the case for consciousness in ordinary, non-lucid dreams? REM Behavior disorder provides reasons for believing conscious states occur even in ordinary, non-lucid dreams.

Comparisons between the psychological content between lucid and non-lucid dreams provides further support for the view that the nature of dreaming remains largely the same even through the transition to lucidity. If we can trust the validity of reports under lucid dreaming conditions—and I believe demonstrations by LaBerge, Hearne, and numerous others have shown we can, at least under experimental conditions—then, just as we trust the report of waking subjects as to what has been going on for them in their last few seconds, it is reasonable to trust what lucid dreamers say they have experienced just before they became lucid. Thus, the mental states over which we can say they can reliably report should include those seconds right before dreamers became lucid. In other words, it seems implausible to argue that simply having a thought with the following content: "I am dreaming," could trigger phenomenal consciousness when there was none there before. And if lucidity were to trigger phenomenal consciousness this would be inconsistent with what lucid dreamers report. Lucid dreamers simply report that when they became lucid they became aware *that they were dreaming*. One could argue that there is no compelling reason to posit a radical break in

phenomenal consciousness at the point of lucidity. And we have seen that lucid dreamer's ability to report indicates consciousness during lucid dreams. So, if there is no reason to think that there is a transition to consciousness that occurs as a result of becoming lucid, then it is reasonable to conclude that dreamers were already in conscious states even before they became lucid.

But one point going against this thesis of the continuity of lucid and pre-lucid dreams is the fact that the triggering of lucidity sometimes affords lucid dreamers a degree of control over the course of their dreams. Because as of 2013 we have only waking reports of lucid dreams, it is difficult to determine to what degree lucid dreamers can exert control over their lucid dreams. One of the most fascinating questions about lucid dreaming is the nature of the apparent "resistance" to the will that lucid dreamers report experiencing in their lucid dreams. Lucid dreamers cannot just conjure anything they would like to appear in their dreams. So lucid dream control does not seem to work like the imagination where we can simply will a thought with some content. It is a fascinating question, the nature of this give and take between one's will and one's imagination in lucid dreaming, but I do not at present see how to explain it.

Now it might still be the case that even if some dreams are conscious, other non-conscious dreams occur. All the above argument shows is that there are reasons for thinking conscious states can occur in pre-lucid dreams. Of course, not all dreams are lucid (or pre-lucid); in fact, most dreams are not lucid. Some people cannot recall ever having a lucid dream. So how can one go to conclusions about lucid and pre-lucid dreams to more general claims about a larger portion of dreams? Here I would turn to the fact that there seems nothing significantly different about reports from ordinary dreams from reports about lucid dreamers'

pre-lucid dreaming experience. And we have seen earlier that there is reason to trust the reports of lucid dreamers about their lucid dream experiences, because lucid dreamers exhibit a degree of criticality and self-reflectiveness that makes possible the various kinds of reportability seen above.

On the basis of the argument that there is no radical transition from non-lucidity to lucidity, I have argued that we are conscious in our ordinary, non-lucid dreams, at least some of the time. It seems to me, however, that, given the vagueness of the boundary between different dream states, it would be unwarranted to declare that all dreams are conscious dreams. Given our current understanding, mental states during sleep are too variegated for us to demarcate precisely, especially when one considers parasomnias such as REM behavior disorder.

2.9. REM Behavior Disorder

Dennett in his 1978 paper argues that it is an empirical question whether dreams are (conscious) experiences. Depending on the data, our theories of conscious experience might or might not include states during sleep. I hope I have given good reasons for thinking there are conscious states during sleep. My main source of evidence has been experiments in which lucid dreamers signal while they are dreaming. Now I turn to normal, non-lucid dreams. In this section, I will examine the evidence for physical and mental activity throughout REM sleep, where most of the complex, narrative type of dreams are reported to occur. We can see more clearly some of the properties of REM sleep by examining a sleep disorder called REM behavior

disorder. REM behavior disorder, in giving us some idea of the real-time unfolding of a dream sequence, offers us a direct link between reported sleep mentation and observable bodily actions.

First, some background information about the neuroscience of sleep. When healthy humans and other mammals enter REM sleep, mechanisms in the brain's medulla and pons initiate actions resulting in the inhibition of motor neurons (Rechtschaffen and Siegel, 2000). Inhibition of motor neurons causes loss of muscle tone, or atonia. For some patients, particularly for those suffering from narcolepsy, malfunctions in this inhibitory system can also occur, resulting in inhibitory aspects of REM sleep intruding into waking life. Examples of such malfunctions are sleep paralysis (people are awake but REM atonia persists, so they can't move), hypnagogic (sleep-onset) and hypnopompic (sleep-"offset") hallucinations (people are awake but when falling asleep or just getting up they report experiencing the kinds of imagery found in healthy subjects only in REM sleep), and cataplexy (sudden involuntary REM-like loss of muscle tone, typically triggered by strong emotions such as elation or fear). Except for cataplexy, these manifestations are not that unusual: even healthy sleep-deprived people occasionally report seeing things or not being able to move when they first wake up (e.g., Roth and Roehrs, 2000). Salvador Dali induced hypnagogic imagery as source material for his surrealistic paintings (Dali, 1976; cited in Nielsen, 1991-92). Nielsen writes:

> Salvador Dali once described a method which permitted him to harness the creative power of hypnagogic images. He dozed off to sleep with a spoon in his hand positioned above a metal plate. When the muscle weakness of hypnagogic sleep came upon him, the spoon dropped into the plate and awakened him. He claimed that between the

> time the spoon left his hand to the time it awakened him, he had experienced a wealth of spontaneous surrealistic imagery (Nielsen, 1991-92, p. 353).

REM behavior disorder, then, is an instance of the converse class of the class above. Put simply, in the class above, aspects of sleep appear in wakefulness; in the case of REM behavior disorder, aspects of what we normally only see in wakefulness appear during sleep. Another way to contrast the two classes is to say that for the first class of behaviors, features of REM sleep (e.g., atonia, imagery, etc.) occur even though a person is awake. In the other class, REM behavior disorder (RBD), a sleep disorder, represents the breakdown of normal REM sleep motor inhibition during sleep. A paper in the journal *Sleep* surveying the 16 history of the disorder begins with this description:

> REM sleep behavior disorder (RBD) is a multifaceted parasomnia involving REM sleep and the sensorimotor system in which problematic behavioral release occurs and this is usually experienced by the individual as enactment of distinctly altered, unpleasant, and combative dreams. (Schenck and Mahowald, 2002)

In REM behavior disorder, soon after patients enter REM sleep, they typically begin moving around so much that they wake themselves up, only to fall back to sleep and have it start over again. Because their REM sleep is often quickly disrupted, patients live in a state of REM sleep deprivation. When people are deprived of REM sleep, it is common for what little REM sleep they get to involve vigorous and occasionally violent actions. Often sufferers from RBD will only come into the hospital when their partners have refused to sleep in the same bed with them because they kick or thrash at night. Here is how Hobson describes a few cases of REM behavior disorder:

> Dreaming that he is a star setback, one patient suddenly gets up, runs across the room, and collides with the dresser. Dreaming that he is driving on a perilously curving road and needs to make a sharp left turn, a patient who is supine suddenly flings his left arm in a 180 degree arch and swats his wife. Dreaming that he is operating to remove a tumor deep in the third ventricle, a neurosurgeon patient makes elaborate movements with his outstretched hands and issues clearly articulated verbal orders to hallucinatory assistants to "grab that retractor," "give me a kelly clamp" (Hobson, 2001, p. 172).

I want to examine more closely the last case. Let's call Hobson's neurosurgeon 'Leonard'. I will present four possibilities for Leonard based on whether Leonard is awake or asleep and whether he is state conscious or not. But before doing so one might object that Leonard is neither awake nor asleep: he is in some dissociated state, possibly one requiring a fundamentally new taxonomy of conscious states in order to demarcate it. Whether one accepts Leonard's case or not, there are similar cases to Leonard's in which subjects are asleep based on current criteria for sleep (Iber et al., 2007). I see no reason why we should now modify current criteria for sleep and wakefulness, criteria that has been effective in scientific study and clinical treatment for over 40 years. So I want to stipulate that, based on current criteria for sleep, Leonard is asleep. Assuming one does not alter the current biological practice for sleep, one might say there are four possibilities for Leonard.

> 1) <u>Leonard is awake and state conscious</u>. This option declares by fiat that a person must be awake to perform such actions, so the stipulation that Leonard is asleep is invalid. This is the tactic I presume would be taken by Norman Malcolm in his book *Dreaming* (1959). Malcolm argues that it would be "stretching" (p. 28) the term 'sleep' to apply it to a sleeper visibly agitated by a nightmare. According to Malcolm, anyone who moves around a lot (as in a nightmare) is doing something different from our typical concept of sleep, so what that person is doing could only *resemble* sleep. How then are we to

decide problem cases such as Leonard's? Malcolm avoids this question, and in his conceptual analysis of sleep and dreaming, argues that neurophysiological criteria can play no role in determining what we call sleep. Here I part company with Malcolm, as I think a conceptual analysis of what sleep is will take us only so far, which is not far at all. In this paper I have employed what Owen Flanagan (2000) calls the "natural method," an approach to studying consciousness that takes up insights from philosophy, phenomenology, psychology, neuroscience and other fields. I believe such a method is the only way to get a complete picture of conscious states from a naturalistic perspective. Malcolm begs the question of what can and cannot occur during sleep by defining sleep in such a manner so as to exclude dreaming occurring during sleep. In addition to being contrary to standard usage, the combined evidence shows that subjects are in a state that we would otherwise call sleep. Malcolm's archaic classifications of "deep sleep" and "half asleep" are completely inadequate to the problem at hand. The complex, purposeful nature of the movements of sufferers from RBD compels us to say that dream cognition unfolds during sleep over a period of time analogous to the time actions take during our waking life.

2) Leonard is awake and not state conscious. There seems to be no reason to argue for this position.

3) Leonard is asleep and state conscious. This is the position I advocate below.

4) Leonard is asleep and not state conscious. One is here accepting sleep by stipulation, so one must be argue that this is a case of lack of state consciousness during sleep. (Presumably one could still argue there are conscious states during sleep but somehow this is just not one of them.) This denial of state consciousness even to active states would seem to be the position taken by Dennett (1978a) in 'Are Dreams Experiences?' According to this picture, dreaming could involve activity, even intentional states, but there would still be no "presentation process" (1978a, p. 238) to dreaming, no "what it's

like" (Nagel, 1974) for Leonard. As Susan Blackmore puts Dennett's view: "According to the retro-selective theory, dreams are not ongoing conscious experiences at all. They are concocted retrospectively on waking by selecting from the myriad trains of thoughts and images that were going on in parallel in the dreaming brain" (Blackmore, 2004, p. 347). In arguing for 3) below I am arguing against position 4).

In his dream paper Dennett sets up a dichotomy between "active" (not his term) dreams, where the sleeping subject does things like wince and moan in pain, and "inactive" dreams, where the subject sleeps quietly.

> Whereas nightmares accompanied by moans, cries, cowering, and sweaty palms *would* be experiences, bad dreams dreamed in repose (though remembered in agony) would not be, unless, contrary to surface appearances, their entry into memory is accomplished by engagements of the whole behavior-controlling system sufficiently normal to distinguish these case sharply from our imaginary delayed hallucinations (1978a, p. 248).

Case studies from sleep disorders reveal why this distinction is untenable. Some people twitch and jump a lot during REM sleep; others don't. There is great variation in how people's bodies' behave while they are asleep. Does it make sense to have categories of dreams depending on how overt the twitches or facial expressions of the sleeper are? This is the position that Malcolm (1959) takes:

> Nor would a man who was tossing about, crying out and groaning in the throes of a nightmare, be a good example of a person asleep. These violent movements and sounds and the appearance of mental agitation diverge too far from the criterion of behavior appropriate to sleep, i.e. "he is recumbent, his eyes are closed, his breathing regular, his body mainly inert, and that he does not react to various sounds and movements in his vicinity to which he would normally react if awake. (Malcolm, 1959, p. 28)

Malcolm goes on to say on p. 22,

> Our ordinary application of the word 'asleep' is not guided by any consideration of what is going on in someone's cranium, spinal column or other inward parts, but rather by how is body is disposed and by his behavior or lack of it. (Malcolm, 1959, p.22)

The question then becomes one of how we are to define sleep. Are we to define it behaviorally in terms of the commonsense platitudes and assumptions we have about "how sleep should look" or should we define it according to our best contemporary biological criteria. He might argue that the ordinary usage of sleep fixes the category of what sleep is. That it does not we can see from an explanation of the biological properties of sleep. In fact, dreams involve mental activity that unfolds over time. We simply don't see a healthy sleeper's actions, because, for healthy people, motor functions are typically inhibited. We can now see that this explanation makes sense because such inhibition does not always occur, as in cases of REM behavior disorder.

What is it that is so intrinsically different about the experience in the following two scenarios which we imagine take place over the course of about a minute and a half:

> 1) Leonard is awake and performing surgery. He is using instruments, talking to nurses, looking at the clock on the wall, etc. He says to his assistant "grab that retractor" and "get me a kelly clamp." Someone then asks him to describe what he had just been doing for the last minute. He recounts some details from the surgery and having asked his assistant to grab a retractor and get him a kelly clamp.
>
> 2) Leonard is asleep and engaging in actions consistent with a person performing surgery. He is talking coherently, saying out loud "grab that retractor" and "get me a

kelly clamp." Someone wakes him up (or he wakes up himself) and the person asks Leonard what he had just been doing for the last minute or so. He recounts some details from a surgery he dreamed he performed. These actions are consistent with the movements he was making in his sleep. He also recalls having just asked his assistant (in his dream) to grab a retractor and get him a kelly clamp.

There is a continuity visible in both scenarios. Everything seems to show that there is a correlation between neurophysiological data, the physical actions, the speech acts and waking reports. Some dreams illustrate that correlation better than others. And REM behavior simply makes that correlation obvious. Normal dreamers too will often wake up with experiences fresh in their minds as if they had just performed those actions. What reason is there for positing some fundamental divide that occurs at the moment of wakefulness? I think much of the reason stems from intuition about the passive nature of sleep; when we show how active a sleeper can be the motivation for denying consciousness becomes less attractive. Admittedly there does seem to be some difference between good recallers and those who infrequently recall their dreams, but this difference has been shown to be largely a matter of practice, motivation, and time intervening between occurrence of the dream.

What is our basis for attributing consciousness uncontroversially in the first case and perhaps controversially in the second? I think if Leonard performs the above actions and then wakes up with the memory of his bodily movements along with what he said as he performed those movements, then we have reason to attribute to him the same state consciousness in dreams that we find in waking cases, because of the complexity of his mental states and his recollection of previous mental states, just as occurs in waking life. In both the typical waking case and the above thought experimental case, we have reportability. I'd say that what Leonard

is doing in the second case is analogous to snapping out of a waking reverie. He may be disoriented for a few seconds but he can tell anyone what he was just thinking. If anything, the daydreaming example is deficient compared to the REM behavior disorder example. In Leonard's case we have a record of him performing actions that correspond with the actions he describes performing while he was asleep. It seems intuitive to think as Dennett does that there could not be this level of activity without consciousness. Dennett writes:

> If it turns out that sleep, or at least that portion of sleep during which dreaming occurs, is a state of more or less peripheral paralysis or inactivity; if it turns out that most of the functional areas that are critical to the governance of our wide awake activity are in operation, then there will be good reason for drawing the lines around experience so that dreams are included. If not, there will be good reason to deny that dreams are experiences (Dennett, 1977: 238).

According to Dennett's own criteria, then, REM behavior disorder seems to provide evidence of conscious mental states during sleep. One might perhaps argue that the dreams of sufferers from REM Behavior Disorder are too different from the dreams of ordinary dreamers, so there can be no basis for comparison, but this position would unfounded. The fact is that , the major difference is that RBD sufferers tend to have more active, physically aggressive dreams, but these kinds of dreams are quite common in the general population, particularly among males.

2.10. Speech and Sleep

What are we to make of the fact that Leonard spoke coherently in his sleep? Might the ability to speak one's mind be an indicator of conscious thought? Such is the view put forth by David

Rosenthal (1990b) in his paper "Why Verbally Expressed Thoughts are Conscious". In the paper, Rosenthal treats only waking thoughts, but he argues that anytime anyone verbally expresses a thought that thought must be conscious one. Rosenthal's arguments for this view are complex. But let us for the sake of argument accept that such a view is correct. It then seems natural to extend Rosenthal's argument to cover cases such as Leonard's but also cases of normal dreams, for language use in dreams is surely commonly reported. Speech is commonly reported in dreams. In one study of over 500 dreams, 63.6% of the subjects reported verbal content of some kind (Meier, 1993). Again, we potentially have the problem of relying on waking reports of dreamt experience. But, I adduced the case of Leonard to illustrate the fact that verbal utterances can occur that are audible to others, in at least some cases. The issue of using speech as an indicator of consciousness is vexed in the case of sleeptalking, a distinct parasomnia from REM Behavior Disorder. (Unlike in REM Sleep where the brain is as active or even more active than some waking states, sleeptalking typically occurs during deep Non-REM sleep when the mind is often comparatively inactive.) A study by Meier (1993) provides evidence subjects reported dream conversations are as complex as waking ones. As Domhoff says, "Sentences uttered in dream reports are as grammatically correct as in waking life, and they are appropriate to the situation in the dream" (Domhoff, 2011). One might object that only deliberate thoughts are conscious and not thoughts spoken of in an offhanded or automatic way, as one might argue must be the case in sleep. Rosenthal, however, explains why "verbally expressed thoughts are conscious whether the verbal expressing is deliberate or instead automatic and unthinking" (1990b: 7). I cannot do justice here to the detail and subtlety

of his argument. I mention it now because the view gives further support to my argument that Leonard was conscious while asleep.

More problematic conclusions might follow from Rosenthal's argument, and one might be led to nonintuitive positions; for example, one might have to countenance conscious states occurring during deep sleep. This takes us beyond simply REM sleep, a state that is recognizable because the brain is in some ways more active in it than it is in waking. The reason that we might be led to countenance conscious states during deep sleep is that sleeptalking—the phenomenon in which people express coherent speech while asleep—takes place in deep sleep, when the brain is much less active compared to wakefulness and REM sleep. Actually, I don't see how one can accept the view that verbally expressed thoughts are invariably conscious while also denying that sleeptalking is conscious. If Rosenthal is correct about verbally expressed thoughts, then one would be led to the position that there are conscious states during (Non-REM) sleep, if only intermittently. It turns out that, while 90% of the time when people are awoken from REM sleep they report some mental content, it is also the case that 60-80% of the time people are awoken from Non-REM sleep they also can give reports about what they believe was going through their mind just previously when they were asleep. This puts one uncomfortably close to the position of Descartes quoted at the beginning of this paper, where he says we are always conscious even when asleep or knocked out. Most philosophers would be reluctant to go this far, and I am one of them. REM behavior disorder and lucid dreaming provide windows into the mind during REM sleep, but a view into the mind during Non-REM sleep is more obscure. Perhaps, though, future research might allow us to gauge degrees of awareness during Non-REM sleep.

2.11. Conclusion

In this chapter, I have put forth reasons for thinking conscious states occur during sleep. I have argued that conscious states occur in both lucid and non-lucid dreams, although, given the vague criteria for distinguishing "dreams" from other kinds of sleep mentation, I would not argue that all dreams involve conscious states. We ultimately await better methods of detecting awareness during sleep and we will need to explore better explanations of the basis of consciousness, whether awake or asleep, if we want to be more clear about how and when a person can be conscious while asleep. There is certainly more to be said about the role that sleep plays in conscious experience, but evidence from lucid dreaming makes the case strong for conscious states during sleep. As I have said, the case for consciousness during non-lucid dreams is less strong, but I believe the reasons outlined above provide evidence for thinking conscious states occur even in ordinary, non-lucid dreams.

Chapter Three

3. What Can We Know About Our Dreams (When We are Awake)? Do We Dream in Color?

Why inquire at all into whether human beings dream in color? Why should the answer to this question matter at all? Well, first of all one could reply that there are features of human experience that we would like to understand for their own sake. What does it mean to see? How does color perception work? Why do we experience optical illusions? These are fundamental questions about our experience of the world, and the answer to such questions helps us understand the kinds of beings we are. Answering the question of color perception in dreams would be part of any attempt to fully our dreaming experience. And doing philosophy helps us clarify what is meant by such questions so that we can apply rigorous analysis and argumentation to try to figure out the answers.

But I think there is an even deeper epistemological concern about the nature our dreams, a concern that does not arise from Descartes' dream skepticism. We want to know what are dreams are like. A healthy person may spend over a decade of her life dreaming. Depending on how one defines dreaming, decades of a person's life could be spent in certain kinds of sleep. Much of that sleep may be consciously experienced. It is natural then to want to understand and inquire into the experiential nature of this part of our mental life. But in undertaking such an inquiry, the epistemological question arises: From the vantage point of our waking life, what can we know of our mental life when we are dreaming? What basis do we have for thinking that people accurately report their dreams?

So there is the question: where do we start in attempting to do an epistemology of the content of our dream? One of the best avenues to pursue epistemological questions about dreams is in the realm of vision, particularly color vision. Dreams are primarily visual phenomena. In fact, in many languages, people use a locution that says, "I saw a dream," rather than in English, where we say, "I had a dream." We could take some feature of waking reports of dreams and see if widely held beliefs about what happens in our dreams stand up to scrutiny. Just as we think we remember many other features of our dreams many are quite confident they see colors in their dreams. But this naïve belief invites scrutiny. Eric Schwitzgebel has done much excellent philosophical work to call into question whether we hold accurate beliefs about the nature of our color experience in dreams.

Schwitzgebel's skepticism of color experience in dreams reflects a larger worry. There is so much we would like to learn about and understand about our dreams. But if we are radically misguided about the nature of our dreams even when it comes to fundamental features of our dreams such as color experience, then we may well be mistaken about much more of our dream experience, especially aspects that seem much less assured.

I start with color experience in dreams because I want to show that, despite evidence to the contrary, there are actually numerous persuasive arguments for believing that we experience colors in our dreams. This result should increase our confidence that other aspects of dream recollection are accurate. Of course, there are further questions to be pursued individually, but one can confidently assert that we haven't fallen down at the first step in understanding the nature of our dream experience. And, one hopes, that this first piece of

knowledge might be one of a series of further milestones along the path of our pursuit of a more comprehensive understanding of our dream experience.

3.1. Introduction

We have seen that Dennett's cassette tape theory of dreams challenges the received view which says dreams are conscious experiences during sleep. I have argued that we are phenomenally conscious in both lucid and non-lucid dreams, although the case for the latter is less solid. So, if my arguments were correct, then the facts that we are phenomenally conscious in lucid dreams, and, most likely, ordinary dreams, present themselves as examples of claims we can know about our dream experience. What else can we know about our dreams? (In this chapter, I ask that question from the vantage point of our waking, reflective mind.)

Any discussion of dreams must deal with the fact that most (but not all) of what we think we know about sleep mentation we arrive at while we are awake, when we reflect upon what we think has occurred while we were asleep. Here is the picture: some kind of mentation occurs during sleep, and the dreamer awakens and reports (in whatever form) what she thinks was just going through her mind while she was asleep. In a much less reliable method, people answer survey questions about general characteristics of their dreams. Currently, insofar as we wish to study subjective mental experiences during sleep, we are largely restricted to these subjects' waking reports. What makes our study particularly difficult is the chasm that separates waking mental states from sleeping ones.

The interplay between different kinds of mental states during sleep and waking, each dependent on different underlying neurophysiologies, presents a challenge to our understanding of the human mind, but the diversity of our experiences in these different mental states also excites the interest of many of who would like to determine what we can know about one kind of (sleep) state when we are in another mental state (wakefulness). Dreams reveal the multiplicity of healthy mental states. But the difficulty of this investigation of one type of state from another type is compounded by the fact that our rational faculties are diminished during normal dreaming. How can we ascertain what are dreams are really like? To what degree are we warranted in relying on our beliefs about what we experienced while we were dreaming? There are many complicated questions to untangle. But we may be able to acquire knowledge of our perceptual experience during dreams.

But we can't set up the same kind of experiments to investigate our experience while we are asleep. Some would argue that the problem with attempts to gain knowledge of our dreams is that we lack the ability to verify anything the dreamer says about what she says experienced while asleep. Unlike in waking life when we are negotiating with our surroundings, we can't check our perception to see if it accurately reflects reality. Because in dreams we lack the criteria for veridicality we have for our waking experience, some question whether we can know much, if anything, about our dream experience.

To get at the nature of dream experience we have to take more roundabout routes. We have seen we can use neurophysiological evidence to corroborate verbal report. And, to overcome the problem of our typical lack of self-reflectiveness in ordinary dreams, we can take reports made by lucid dreamers while asleep. We can even extrapolate from those real-time

lucid dream reports what we can reasonably assume lucid dreamers would be able to report under ideal conditions. Furthermore, we can examine the best philosophical arguments of those who deny we can know features of our dreams. If we find their arguments wanting, then that provides further reason to believe that we can have knowledge of at least some features of our dreams.

In order to address the epistemological question of what we can know of our dreams when we are awake, I take up in this chapter one of the most basic questions we can ask about our dreams: Do we dream in color or black-and-white? If we cannot know the answer to this basic question, or if there is reason to doubt our ability to answer this question, then this result has epistemological implications for dream investigation far beyond the issue of color perception. In several works, Eric Schwitzgebel addresses the question of whether we can know whether we dream in color or in black-and-white, or perhaps whether neither of these categories apply (Schwitzgebel, 2002, 2003, 2006, 2008, 2011). Schwitzgebel's conclusion is that we should be skeptical about claims to know that any of the three possibilities obtain—we simply don't know enough to say. In this chapter, I provide numerous arguments for why color experience occurs in dreams. In addition, I critique Schwitzgebel's arguments, showing why they are ultimately unpersuasive. I argue that we do in fact know that we dream in color, at least some of the time.

3.2. Do We Dream in Color?

Do we dream in color or black-and-white? Some may find even raising this question surprising. Isn't it obvious we dream in color? Although perhaps surprising to some to ask it, it is not at all obvious that we dream in color. In fact, not only is it not obvious that we dream in color but it actually may be false. Schwitzgebel has mounted powerful arguments for why we should be skeptical of claims that people dream in color (Schwitzgebel, 2002, 2003, 2006, 2008, 2011). Schwitzgebel does not argue that we definitely do not dream in color; ultimately, he concludes only that there is good reason to be skeptical about whether we know this aspect of our dream experience. As I understand him, Schwitzgebel's main target for criticism is the unscrutinized contemporary view that "we dream in color." But, again, he is not claiming that we definitely *do not* dream in color or that we definitely *do or do not* dream in black and white; he only counsels skepticism: we simply don't have enough of a basis to conclude that we ever dream in color, even some of the time.

There could hardly be a more fundamental question about our dream experience than the question of whether we dream in color. But there are many questions we might be asking. We might, for example, be asking: Do all dreams involve experiences of color? Or: Is our visual experience in dreams comparable in richness to our waking visual experience? I do not claim to answer these questions in this dissertation. I only defend the weaker thesis that *dreams at least some of the time involve experiences of color*. This weaker thesis provides enough reason to reject Schwitzgebel's color skepticism. Even if we accept this thesis, it might still be that dreaming does not involve a representation of a wide, rich visual field, for reasons similar to why we think the brain doesn't do so while we're awake, as experiments on change blindness and the playing card experiment mentioned earlier seem to indicate. A second more

substantive reason for my arguing for a weaker thesis is that sleep mentation is variegated, more so than waking experience in many ways, and this variegation makes it unreasonable to argue that *all* dreams *always* involve color experiences. The problem of making universal statements about dreams is compounded because of the vagueness involved in circumscribing what counts as a dream, as opposed to some other kind of sleep mentation, such as perseverative thought. In addition to these difficulties, it is plausible that dream experience is more discontinuous than waking experience, making it problematic to maintain that some feature remains continually present throughout a dream experience. Future scientific advances should offer more experimental evidence, which will allow us to construct a more comprehensive theory of dream experience.

3.3. Schwitzgebel's Skeptical Argument

The unifying thesis of several papers on dreaming by Schwitzgebel is the following skeptical conclusion:

> In the 1950s, dream researchers commonly thought that dreams were predominantly a black and white phenomenon, although both earlier and later treatments of dreaming assume or assert that dreams have color. The first half of the twentieth century saw the rise of black and white film media, and it is likely that the emergence of the view that dreams are black and white was connected to this change in film technology. If our opinions about basic features of our dreams can change with changes in technology, it seems to follow that our knowledge of the experience of dreaming is much less secure than we might at first have thought it to be. (Schwitzgebel, 2002, p. 649)

In other words, Schwitzgebel argues that we should be skeptical about what we think we know of our dreams, because, a simple interpretation of the results of numerous surveys compels us to conclude that large groups of people have held wrong opinions about the nature of their dream experience. If we can assume that the neurophysiology of alleged color perception in dreams itself is unlikely to have radically changed in the last few decades (about which possibility I will say more later), then we should conclude, says Schwitzgebel, that almost everybody is mistaken about color perception in dreams. Either those who thought they dreamt in color must be deluded, because we in fact dream in black and white, or those who thought they dreamt in black-and-white must have been deluded, because we dream in color, or members of both of these groups must be deluded, because we neither dream in color nor black-and-white, i.e., our dreams do not involve either of such kinds of visual experience. Through his skeptical arguments, Schwitzgebel aims to temper our confidence in our ability to accurately identify the features of our visual experience in dreams. And his skepticism about knowledge of our dreams is part of a larger philosophical project in which he raises doubts about how well we can know many features of experience simply through introspection.

As I understand him, Schwitzgebel main argument is against the standard contemporary view that "we dream in color." But, again, he is not averring that we decidedly do not dream in color but neither is he claiming that we definitely dream in black and white. He is also not arguing that we do not dream in black and white; he only counsels skepticism: his conclusion is that we simply don't have enough of a basis to conclude that we dream in color, even if only some of the time.

The primary thrust of Schwitzgebel's argument comes from historical surveys in which people answered questions about whether they dream in color or black and white. Evidence suggests that a major factor influencing those survey results was the predominant form of video media at the time the surveys were taken: roughly speaking, black-and-white movies and TV predominated in the first half of the 20th Century and color movies and TV in the latter half. When people answered surveys in the early part of the 20th Century, large percentages of people said they dream in black and white. But, after the introduction of color video media, those reporting that they dream in black and white dwindled more and more, until today, when the vast majority of Americans who are asked say they dream in color. But how do we square current American popular opinion that says we dream in color with the fact that in the first half of the 20th Century, before the rise of color media, most Americans, when asked, responded that they dream in black and white? Schwitzgebel (2011) lays out the evidence in detail:

> In 1951, Calvin S. Hall announced in Scientific American that 29 percent of dreams have at least some color in them. He called such dreams "technicolored," explicitly likening them to the technicolor movies that were increasingly prevalent at the time and implicitly contrasting them with lower-tech black-and-white movies and dreams. Some of Hall's contemporaries might have thought he was overestimating the occurrence of color in dreams. In 1958, Fernando Tapia and colleagues found that only about 9 percent of their non-psychiatric hospital patients reported dreaming in color (versus 12 percent of "neurotic" men and 21 percent of neurotic women). In 1953, a large majority of Manfred de Martino's undergraduate respondents said either that they never saw colors in their dreams or that they saw them less than once a month. In 1942, Warren Middleton reported that only 10 percent of his students said they rarely or never did (19 percent said they saw colors in their dreams "occasionally"). A widely shared opinion

> was that dreams were predominantly black-and-white phenomena, comparable to black-and-white movies, with an occasional splash of color here and there.
>
> Scientific opinion changed dramatically in the 1960's, beginning with a report by Edwin Kahn and colleagues in 1962. Kahn and colleagues asserted that people awakened during rapid-eye-movement (REM) sleep attributed color to 83 percent of their dreams. In 1963, Ralph Berger, using a similar technique, found that color dreaming was reported after 71 percent of REM awakenings. In 1968, John Herman and colleagues reported 69 percent. In 1970, Frederick Snyder suggested that all dreams may contain color, even if the colors are not always remembered. (Schwitzgebel, 2011, p. 1-3)

In a study undertaken by Schwitzgebel (2003), respondents answered the question "Do you dream in color or black-and-white?" And Schwitzgebel writes, "The response options were 'color' (selected by 62 percent), 'black-and-white' (0 percent), 'both' (23 percent), 'neither' (0 percent), and 'don't know' (15 percent)" (2011, p. 3). Schwitzgebel concludes that, based on the extreme variation in responses given by people throughout the 20th Century, "the last of those options is, unfortunately, the best." He then writes, "I don't know, and you probably don't know, whether we dream in color or not" (2011, p. 3-4). Thus, any confidence people have in their answers about this aspect of their dream experience is, "misplaced" (2011, p. 4), according to Schwitzgebel. It may well be true that many people's reasons for believing they dream in color are not as solid as they suppose, but I marshal many arguments that profound reasons for believing that people at least some of the time dream have visual experiences of color in their dreams.

This argument seems superficially plausible. How could there be such variation in reports of color in dreams, if we really do know that people dream in color? It doesn't make

sense, the reasoning goes, that what people report could change so dramatically, if people in fact have color experiences in their dreams. How could one survey early in the 20th Century have 9 percent of respondents say they dream in color, whereas other later surveys show that as many as 100 percent of respondents report dreaming in color? Schwitzgebel concludes that the best explanation for such discrepancies is that people don't know the nature of their dream experience, at least when it comes to color vision. Schwitzgebel's arguments are subtle, but these varying results are the basis for the conundrum. I argue that, despite these findings, which I take to be unreliable, people can have knowledge that they have had experiences of color in their dreams.

In Section 3.4., I lay out many arguments for why color experiences occur in dreams. In several of these sub-sections, I further flesh out arguments for Schwitzgebel's positions and then give counter-arguments against those positions. Many of the arguments, however, are not specifically aimed at countering Schwitzgebel.

3.4. Counter-arguments to Schwitzgebel's Skepticism about Color Experiences in Dreams

3.4.1 "Unspecified" Colors

Clarification: In this chapter I argue that dreams often involve experiences of color. There may, however, still be experiences in dreams in which color is "unspecified".

In order to conclude that most people at least some of the time have dream experiences of color I need to rebut why so many people have held wrong opinions about their dream

experience. It may be that people report such varying experiences about their dreams because our visual experience in dreams is not suffused with color as in normal waking experience but neither is it suffused with a black-and-white field, as is thought to be true for dogs. Schwitzgebel calls color in such dreams "unspecified" (Schwitzgebel, 2008c). Thus, if color is characteristically unspecified in dreams, one could accurately answer "No," to the question: "Do you dream in color?" I accept that it might well be true that people are overconfident about whether objects in their dreams are generally color specified. But this would not negate the fact that people still often report having experiences of color in their dreams. That dreams are not color-specified in general but still contain isolated experiences of color-specified objects may make the most sense of the data, for there are overwhelming numbers of reports of awakened dreamers who report experiencing distinct colored objects in their dreams. In this sense, Schwitzgebel and I may not even be in disagreement here, in that I accept in this chapter that color in dreams may in fact be unspecified, as Schwitzgebel suggests. Schwitzgebel suggests our experience of color in dreams might be similar to our imaginative experience of colors when we are reading a novel. When we read a description of how the "Toyota Camry pulled out of the garage" we may picture the car and the garage, but there is no color attached to the imagined object. This is analogous to what Schwitzgebel means by calling color "unspecified". Of course, there might also be in that same novel a description of the "baby blue 2011 Camry with Silver rims pulling out of the yellow-stucco garage," in which case our imagination would in this special case attach a color to an imagined object where we might otherwise have imagined the object but with the color unspecified. And this account of colors as unspecified dovetails with the so-called imaginative theory of dreaming. But, to say that we

neither dream in color nor black-and-white still needs to make sense of the voluminous reporting of color experiences in dreams. I think there is much evidence to suggest that such experiences of color are quite common, even though it might be the case that objects are in general color-unspecified. Here the argument for color experiences is not decisive, because, as we have outlined above, people may well be wrong when they introspect about their experiences. I suspect, however, that the weight of arguments below in favor of color experiences tips the balance such that it is reasonable to conclude that we often have experiences of color in our dreams, although I accept that my arguments do not resolve the issue. It may be that we need confirmation of this view from a more advanced study of the mind and brain.

There remains the issue of what I aim to demonstrate in this chapter. Schwitzgebel might argue that he is focusing on the question of whether we dream in color or black-and-white, or neither of these. I agree that this is an important and interesting question. Again, I am simply arguing that ordinary dreamers, at least some of the time, upon awakening, veridically report experiences of color perception in their dreams. This position I refer to as dream color realism. One might argue that this skirts the issue Schwitzgebel is aiming at. I admit that I am not arguing for the position that "we dream in color" in the sense that all of our dream experience is suffused with color in a way indistinguishable from our normal, waking color visual perception of the world. But, I do believe that experiences of color are quite common and are experienced by just about all normal, healthy people who are able to report on their dreams. In other words, I affirm that people commonly experience episodes of color perception in their dreams. Below, I present a series of arguments that argue it is reasonable to accept that

that “we dream in color”. I believe each of the arguments stands on its own as an independent argument for that conclusion, but they also, taken jointly, provide compelling warrant for the position that people have experiences of color in their dreams. Thus, I take the arguments below to defeat Schwitzgebel’s skepticism about whether we can know that we dream in color, black-and-white, or neither of these categories. We know, at least some of the time, that we dream in color. In conclusion, however we might characterize the nature of our dream experience, I provide arguments for the view we have experiences of color in at least some of our dreams.

3.4.2. Philosophical Analysis and the Current Limits of Scientific Investigation

In this sub-section I argue that philosophical analysis of color perception in dreams is the best we can do given that there is no neuroscientific evidence currently available to use as a basis for corroborating phenomenological reports of dreams. I suspect we will soon find more sophisticated neuroscientific evidence to bring to bear on the question of color experience in dreams, and, when it is brought to bear, we will find that neuroscience plays a crucial role in resolving questions about the nature of our dream experience. Arguably, however, such evidence will never be decisive. For the time being, my assessments of the state of real-time 3rd-person scientific study of the sleeping mind is that we are not close to having decisive neurophysiological evidence for whether we experience colors in our dreams. It may be that philosophy is all we can do in the meantime if we want to find the answer to the question of whether we dream in color.

3.4.3 Dream Surveys are a Poor Source of Evidence about Dream Experiences

The major source of evidence Schwitzgebel adduces for his skepticism of color experiences in our dreams comes from surveys. These surveys are not a reliable basis on which to reject dream color realism. Reports of dreamers immediately upon awakenings are superior in reliability to surveys. After immediate awakenings, preferably in the sleep lab, subjects are more likely to remember and report accurately what they have just experienced in a dream. And we find that those subjects who answer using the immediate awakenings method are much more likely to report dreaming in color and seeing colors in their dreams than those subjects who answer survey questions. These discrepancies are due to the fact that most are not very familiar with their dream experiences, and their ability to report on their experience in surveys is more unreliable than other methods. Surveys are also highly dependent on how the questions are asked. We find that when subjects are asked about whether they saw anything colored in their dream, they are more likely to say yes; thus, it is misleading to accept high percentages of people who say they dream in black and white when asked: "Do you dream in color or black and white?" When the question is asked differently, comparable groups of subjects readily acknowledge seeing colors in their dreams. (See further sections below for other methods of gathering evidence that are also superior to survey questions.)

Survey results in which people report that they dream in black and white are not sufficient evidence for rejecting dream color realism. Here's why.

Many people seldom, if ever, remember their dreams. But, as Schwitzgebel admits, those who had the poorest recall of their dreams were also the ones most likely to describe their dream experiences as occurring in black and white. Thus, the more they claimed

knowledge of and recall of their dreams, the more likely subjects were to report that they dreamed in color. If someone seldom recalls their dreams, then, other things being equal, it is reasonable to conclude they are less likely to know what their dreams are like, relative to those who remember their dreams well. In addition, if people don't know their dream experience particularly well, simply asking the question whether you dream in black and white is likely to get a substantial percentage of responses, as opposed to if one were to ask about colors in a more roundabout fashion. Survey responses differ greatly based on how questions are asked. When subjects are asked *whether they dream in color or black and white*, they are much less likely to say they dream in color than subjects are who are asked whether there were *any colors* in their dreams. In other words, the way the question is asked has a significant impact on the answers people give. Subjects who are given a forced choice where one of the choices is "black and white" are much more likely to choose that option than subjects who are merely asked "whether there were colors in their dreams". Now one might conclude that such variation in responses suggests that such survey answers are not to be trusted much at all, if they can vary so dramatically. And here I agree: when subjects are asked if there were colors in their dreams, people who might well have answered that they dream in black and white in surveys, readily acknowledge that they see colors in their dreams, especially when they are asked immediately after they have been awoken from REM sleep. In this case, we are dealing with similar populations of people during similar time frames, and, we find, that the way questions are asked matters. Such findings make it increasingly tenuous to base one's skeptical argument against dream color realism on surveys of the general population wherein people are asked whether they dream in color or black and white. The likelihood of their judgments being

contaminated is too great; the best way to avoid such contamination is to ask people immediately upon awakening from a period of sleep when they are most likely to have dreamt. People are most likely to be able to report the contents of a dream when they are awoken from REM sleep.

Surveys are also unreliable because they pool from a sample of people with more members who admit lack of familiarity with and remembrance of their dreams. Simple logic tells us that studies of spontaneous dream reports and sleep-lab awakening reports reveal reports of dreams people claim to have just had. Many members of the general population might have poor knowledge and recall of their dreams, making them more likely to be influenced by cultural factors like the prevalence of black-and-white media. In general, we would expect the answers of those who claim better knowledge of and recall of their dreams to be better judges of their experience. Consequently, we should put less stock in the answers of groups likely to lack of familiarity with and memory of their dream life. Far more reliable are the dream reports of those who regularly remember or take an interest in their dreams, particularly if those reports come immediately after they have had a dream.

Not having clear memories of their dream experience, perhaps those who are less familiar with their dream experience are more likely to describe their dream experiences in a diminished fashion (e.g., black-and-white as opposed to color). An loose analogy might be someone who does not play video games who might reflect on what little of them he has seen and conclude that video games are quite simple, lacking depth or complexity. Ask expert gamers for a review of gameplay or graphics and you will get a much more perceptive response. Arguably, a dismissive attitude towards video games more often reflects a lack of familiarity

with complex gameplay, rather than a reasoned judgment that the level of complexity is low. Similarly, people inattentive to their dream life may form judgments about their dream experience, but those judgments may be more likely to reflect a poor memory of and lack of acquaintance with their dreams, rather than a positive knowledge that their visual experiences in their dreams, in this case that dream visual experiences take place exclusively in black and white. In other words, people who lack familiarity with a topic are more likely to judge that that topic inherently lacks complexity or variation. If one pursues this argument, one might then wonder why so many subjects surveyed responded that their dreams were black-and-white, as opposed to neither color nor black-and-white. It might be that, given most people's familiarity with the types of content found in dreams, it seems weird or outré to consider dreams as not involving coloration or black-and-white-ness at all. Perhaps if an analogy was made between dreams and waking imagination, which often is void of both color or black-and-whiteness, more respondents might have chosen neither color nor black-and-white.

Still, in some of the surveys a large percentage of respondents reported that they dream in black and white. What are we to make of such results? If one does not regularly remember one's dreams or does not take an active interest in one's dreams, it seems plausible that when such individuals are surveyed about their dream life they are likely in their response to rely on their exposure to a rich diet of black-and-white media experiences that they can readily recall. We might call this an instance of the availability heuristic with respect to color dream experience. For those who have poor memory of their dreams, not being able to reconceptualize what their dream experience is like, either because they can't recall precisely or because they are influenced by the predominant forms of media, they confabulate what they

think their dream experience must be like. The fact that people's beliefs about dreams could vary so dramatically does present powerful evidence that people responding to surveys do not know their dream experience well at all. This argument amounts to accepting that our knowledge of our dream experience is generally quite poor. But, one could argue, if our knowledge of our dream experience were not so poor then people would not fall back on drawing on their being influenced by black-and-white media. To this counter-argument I would reply that dream experience is something at which there are very likely to be degrees of ability or familiarity: some people know their dream experience better than others. The person who records their dreams every morning in their dream journal and tries to decipher what their dreams means is likely to know more about their experience than the average person, who may be totally uninterested or untutored in dreaming. Lucid dreams illustrate particularly well that knowledge of one's dreams varies considerably. Some lucid dreamers have demonstrated that they have ability to make complex reports that require some degree of focus. Lucid dreamers also maintain that they have much greater capacity for self-reflective and critical thinking, and their ability to give the kinds of complex forms of report I talked about in Chapter Two provide evidence of that ability. As I explain in 3.4.13, we should look to lucid dreamers for what is likely to be the most accurate reporting about what goes on in the dream state. It is significant that lucid dreamers consistently report color experience, often more vivid and bright than waking experience (as I explain in Section 3.4.13 below.) And even within the cadre of lucid dreamers there is strong evidence that some are more skilled than others. For example, I think it likely that, if there were some new neuroscientific test that would provide insight into the nature of some aspects of dream experience, it would most likely come from those who are the most

expert (lucid) dreamers (e.g., Stephen LaBerge, the scientist who virtually single-handedly originated the serious scientific study of dreaming and who is able to experience multiple lucid dreams a night, including being readily able to signal from within a lucid dream using a range of physiological markers). I would put much less stock in a survey of 100 Americans, most of whom take no special interest in dreaming, and many of whom seldom if ever remember their dreams; furthermore, few, if any, are likely to have developed skill in lucid dreaming, the most reliable basis for reporting on dream experience. Some people's dream reports can be shown to be more reliable than others. I predict that innovations in brain scanning will provide further evidence of the difference in reliability between the reports of expert (lucid) dreamers and the average person in the street.

I said that large percentage of people don't even regularly remember their dreams. I suspect that point may be less true today. And this is a minor point, but there is reason to believe that people today take much more of an interest in their dream experience than they did in the first part of the 20th Century, so we might marginally update our beliefs towards the view that people today are more knowledgeable about their dream experience than they were, say, 100 years ago. (Here I am limiting my anthropological focus to Americans.) As an indicator of this interest, we can look at sales of books on not only dreaming, but lucid dreaming. One can look at Amazon.com and find dozens of books on lucid dreaming alone, with thousands more about dreaming more generally. We could take such numbers as a rough indication that people are simply more informed about dreaming: they know how to better remember their dreams; they know better techniques to induce lucidity; they are more aware of scientific thinking about dreams. Now someone might counter that this awareness of what is written in

books has put ideas in people's heads about what their dream experience is like, and those ideas aren't necessarily accurate. That is the whole point of Schwitzgebel's critique. And, of course, there are more people, so the percentages of people interested could still be low or lower. All I am arguing here is that people have some more familiarity with their dream experience, and many of the books available are based on high-quality scientific findings about dreams, so much of what they're reading may be accurate. Here I am thinking of topics like what people report dreaming about, when dreams are most likely to occur, dream induction experiments showing people can be provoked into dreaming about certain stimuli, etc. Not much is written on the subject of color experience in dreams. (In fact most books probably assume that we dream in color, but color experience is not something explicitly discussed in great detail in most serious contemporary books on dreams, at least those that I have come across, and I have read quite a lot of them. This argument is anecdotal, though it does reflect deep and broad reading of contemporary literature on dreaming.)

Many people don't know their dream experience well, and thus are likely to give responses that reflect the accepted cultural wisdom. If we accept, though, that there are better ways of studying dreams, for example, by taking the reports dreamers give when they are awoken from REM sleep, then we can see that much more can be known about our dream experience. One indication of this is what happens for many people who claim not to dream at all. We find that such people report complex narratives when they are awoken from REM sleep in the lab, and are then asked to report on "what was just going through their mind".

What, then, is the best method for determining whether or not someone dreams in color? Outside of real-time lucid dream reports, dream reports collected in the sleep lab are

the most reliable source of information about dreams, and in such studies, subjects are much more likely than survey respondents to describe themselves as experiencing color in their dream. Why? First of all, subjects can be awoken from REM sleep, the mental state strongly correlated with narrative-style simulatory dreams. Then, they are asked "What was going through your mind before you were woken up?" Here, it stands to reason they are much more likely to be reporting what was immediately prior going on in their experience. For the same reason that when you ask people after a car accident about the details of what happened they are much more likely to be accurate than hours or days after it happened, when people are awoken and asked for their thoughts, their reports are much more likely to be more accurate, and extraneous information since the time of the experience is less likely to interfere with their recall.

Memory clearly plays a key role in people's reports of color in their dreams. It is widely acknowledged that people's memory of their dreams is poor. Even those who remember several dreams a night (which is a very small percentage) are almost certainly forgetting many dreams because their memories of those dreams weren't consolidated before they entered another stage of sleep, thus causing the loss of their train of thought. Typically, unless a dream is followed by some period of wakefulness, the dream will be forgotten. We know that such sleep mentation is probably occurring because of how readily people report distinct dreams if they are awoken at different times throughout the night. Many of the people who fail to report colors in their dreams may just be failing to recall their dreams. So much of the variation in reports of color experiences may stem from differences in recall of colors in dreams. If those who report good memory of their dreams report experiencing more colors than those who

report poor recall of their dreams, then that provides some reason for thinking that even those who say they do not remember experiencing colors likely experienced such colors and simply forget. And this is what we find: people who better remember their dreams are more likely to report dreaming in color. Also, evidence from sleep-lab studies of dreamers awakened from REM sleep supports the view that people forget experiences of colors in their dreams. In such studies, people—even those who generally report poor recall of their dreams—often report having just experienced colors in their dreams. Many of these subjects awoken in the lab are surprised to find out just how rich their dream life is.

Even better than REM awakenings of normal subjects are REM awakenings of lucid dreamers who have just had a lucid dream. Just as we look to the expertise of economists, or physicists, or philosophers with regard to certain questions, I would argue it is reasonable to look to the expertise of lucid dreamers when it comes to questions about our dream experience. (See section 3.4.13 for more of this argument.)

As Schwitzgebel acknowledges, most, if not all, of the evidence supporting the conclusion that we dream in black-and-white or that color is unspecified comes from general surveys given to people with no special interest or skill in dreaming. People in such surveys could report widely different beliefs about dreams because most people don't know their dream experience particularly well, but that is not to say that one cannot attain such knowledge. In fact, in many cases, those who responded that they dream in black-and-white reported less dreams, were less familiar with their dreams, remembered fewer of their dreams, reported their dreams were less vivid, etc. It is well known that knowledge of dreams is often fragmentary and is not always uniformly reliable. Furthermore, when people are surveyed

about their dreams in the middle of the day, when it may be days or even weeks from when they last remember having a dream, they are liable to a host of influences from their ongoing waking life. Such general surveys should thus be seen as a less reliable guide to people's dream experience. Stretching things further, we could also say that people in 2012 are far more likely to take an active interest in cultivating and understanding their dreams than people were on average in the first half of the 20th Century. For one, people in the first half of the 20th Century simply didn't have the resources to learn much about dreams; for many topics, like REM Sleep, lucid dreaming, sexsomnia, REM Behavior Disorder, sleep apnea, nothing or almost nothing was none, while, as I have said, in 2012 one could easily find over 100 books on Amazon.com alone that explore the subject of lucid dreaming. Thus, although this is not a central point, we should also expect subjects in the latter part of the 20th Century to be more familiar with and knowledgeable about their dream. As it stands, the previous argument is incomplete, but I believe, if one took the trouble to argue for it in depth, one could motivate the conclusion that Americans today, for example, know their dream experience much better than Americans of 100 years ago. But, nothing major rests on this point that there is a contrast in people's knowledge about their dream between these different time periods.

The crux of Schwitzgebel's argument is the discrepancy in the survey results between the different time periods. Roughly speaking, people in the first half of the 20th Century were much more likely to respond that they dream in black and white, whereas people in the second half of the 20th Century were much more likely to say they dream in color or to answer yes when asked whether they see colors in their dreams. The standard explanation is no doubt at the heart of the matter: one era had predominantly black-and-white video media whereas the

other had predominantly color media, and this divergence in the predominant form of media accounts for the divergence in survey results. The question is how the role of black-and-white versus color media explains the divergence. An argument that discredits the view that we dream in black and white does not necessarily need to offer an explanation for why the view would be so popular, but I think providing an explanation of why we see the results we see will help motivate us to reject the basis for the conclusion that we either dream in black and white. Other arguments below will motivate the conclusion that it is overwhelmingly likely that we experience colors in our dreams.

What follows below in the remainder of this sub-section is an attempt to try to explain why it is that we find the results of the experiments and questionnaires that we do.

David Foulkes, the pioneering scientist of the study of children's sleep and dreams, makes an important distinction between "Dream A" and "Dream B". Foulkes writes:

> Dream A is the involuntary conscious experience of mentation during sleep and some other states, most often in the form of momentary, and, if sequential, narrative, imagery. Our best, and perhaps only reliable, knowledge of this mentation comes from a person's report recorded immediately following abrupt arousal from the experience in question. The prime instance of Dream A is, of course, the laboratory dream report." (Foulkes, 1999, p. 35-36)

Here I think Foulkes is not perfectly rigorous about distinguishing the mental states during sleep from the report of those states immediately upon awakening, but the centrality of Dream A is nonetheless obvious.

Dream A, however, exists in contrast to Dream B. Foulkes explains:

> Dream B is a person's everyday account of an experience, described with greater or lesser accuracy and with greater or lesser conviction, as having occurred during sleep. The forms of Dream B are far more varied than those of Dream A, because they are much more responsive to the diverse waking personal and social situations of the dreamer. Dreams of class B are likely to be imbued with value, and to be viewed by the dreamer as emblematic of the self and of the dreamer's current personal situation and development. (Foulkes, 1999, p. 36)

Foulkes continues: "More generally, although once thought to index Dream A, Dream B is now best conceived as a waking personal/social construct that often has minimal, and sometimes no, relation to involuntary sleep mentation" (Foulkes, 1999, p. 36-37)

I believe, because the beliefs of Dream B are so amorphous and prone to bias, these beliefs about dreams are particularly vulnerable to influence by types of questions asked by experimenters. It is very different to ask "What was going through your mind just before I woke you up?" than it is to ask "Did you experience colors in your dreams?" versus "Did you dream in color or black or white?" or "Do you remember experiencing color in your dreams?" I suspect that the beliefs people have about their dreams (their Dream B) are not at all an accurate or reliable guide to the nature of people's dreams.

While there is some question of whether laboratory studies affect the content of dreams, I think it is clear that the evidence gained through laboratory awakenings and questionings is far superior to that gained through asking people in surveys, where people are swayed by all manner of cultural and personal beliefs. Furthermore, it stands to reason that in the sleep laboratory upon awakening we should be less subject to cultural and personal beliefs about dreams, because they such laboratory questions are more immediate and much more likely to reflect a better memory for what has just occurred in their dream life. Thus, while it is

not at all surprising that we would see large numbers of people have probably inaccurate beliefs (i.e., that they dream in black and white) in general about their dreams when asked survey questions, it would be much more significant if we found such results when we asked people in laboratory awakenings. The fact that we do not find these same results in laboratory awakenings strongly suggests that people in fact regularly experience color in their dreams. In other words, when we use our best form of evidence to determine whether people experience colors in their dreams we find overwhelmingly that they do, and that is the evidence that we should most strongly rely on.

3.4.4. Not Uncommonly, People Report Experiences of Specific Colors That Play a Significant Role in the Content of the Dream

It is not uncommon for people to report dream experiences in which specific colors played a significant role in the content of their dream. The best explanation for why people arrive at such beliefs about their dream experience is that they experienced a color in their dream. The fact that they wake up and report a specific color playing a role in their dream strongly suggests they experienced such a color. To suggest otherwise, is to cast into doubt virtually everything people report about their dream experience, for the colored content of objects is but one of myriad types of content people report of their dreams; color experience in dreams is, if anything, more assured than other contents such as words spoken or characters who appear. If we throw out colored experiences, we are forced to throw out much of our dream experience, but to do so would be unwarranted by the evidence. Such a stance seems to go too far, given that other reliable methods corroborate on some level the accuracy of dream experiences (e.g., REM Behavior Disorder, stimuli induction experiments, lucid dreaming signaling, salient

patterns of eye movements corresponding to waking reports). (See Chapter Two for more cases of confirmation of the reliability of content reported in dreams.)

Because of the relative surety of our knowledge of our color experience in dreams, the dream knowledge skeptic would have to argue that people are unwarranted in much if not most of what they allege has occurred in their dream experience. Rather than throw out all of this content, it seems more likely that people really are experiencing colored objects in their dreams and retaining the memory of those experiences. If none of these people experienced colors in their dreams, then it seems implausible that so many of them would have such clear memories of specific colors playing a role in their dreams.

One might think one could have the intentional content "I am seeing the color red" in a dream but there was no concomitant perceptual experience of red; people's intentional content and perceptual content might not match up. But such a take on the evidence does not jibe with the way people often report experiences of color in their dreams. When one examines databases of dream reports, one often comes across reports of dream experiences in which specific colors played a significant role in the content of the dream. Not uncommonly, people report dream experiences like “The dress was stained red with blood, which disgusted me.” Or: “I got scared when I saw the blue flashing lights of a police car.” Or: “The red light went on, so I knew I was supposed to wrap up my performance on stage.” And so on. What is often noteworthy about such reports is how the color of objects seems to stand out or be different from what is usual or expected. For example, “I was kidnapped on an island where all the people had blue skin like the creatures in the movie ‘Avatar’.” Not only do people see colored objects, or at least report doing so, but they are struck by *significance* of the colors they see,

and they often notice it in the dream, making it something they are more likely to recall upon awakening.

So it is not at all uncommon for someone to report that something in a dream had a specific color. If it was just a matter of seeing a school bus or a fire truck then we could perhaps assume that people are unconsciously filling in the expected color of the vehicle when they recount it while they are awake; but there are numerous cases of people reporting specific colors in their dreams; not only that; this incongruity is occasionally even the source of a trigger into lucid dreaming—"I wasn't expecting the house to be purple, but it was—that's when I knew I had to be dreaming." It seems odd that people immediately upon awakening from REM sleep would report having just experienced surprising color incongruities in the dream they just awoke from. Where would such confabulation come from if not from an accurate expression of what they seemed to experience in their dream? One could, I suppose, argue that there was no "presentation process" to the content of the color experience in the dream, but this leaves us back to the argument about whether dreams are conscious. In this chapter, I am assuming that it is true that dreams are conscious experiences. Or at least the weaker position that lucid dreams are definitely conscious experiences. If we can accept that we have conscious experiences in our dreams, at least some of the time, then one can proceed to argue that we have color experiences in dreams. If one argues that we dreams are never conscious, then we are at impasse in any attempt to argue that dreams involve experiences of color. (But, I believe I have dispatched that argument in the prior chapter, at least with respect to lucid dreams.)

People would seem to be having dreams with contents of the kind "I am seeing red," or at least they would wake up and report having such experiences but, even though such were

the contents of their beliefs, the philosopher who denies we have color experiences is compelled to argue that those contents were inapplicable to their actual perception—they had no such perception (or imagination) of such colors in their dreams. I find it implausible that so many people would have such consistently false beliefs about the contents of their basic experience of color. I find this position especially implausible given the universal emphasis that dreams are primarily visual in nature.

The skeptic who rejects the view that we dream in color (or even in black-and-white) might acknowledge that people, upon awakening report experiences of significant colors in their dreams, but this skeptic might argue that these memories would be confabulated in some sense, at least when it comes to inserting color experiences into dreams when they weren't there. One wonders how awakened dreamers might insert such experiences. What might happen is that people hardly know their dream experience well at all, and yet they confabulate what their experience during sleep must have been. In doing so, they are heavily influenced by the ubiquity with which they experience color perception in their waking life; and they simply posit similar experiences during sleep without proper warrant. The fact that people confabulate aspects of their dreams is almost certainly true, but it requires an extreme form of skepticism to say that whenever people report colors In their dreams that they must be confabulating. How would such color confabulations fit with the rest of a person's dream report? Is all dream reporting confabulation? This seems extreme. As we have seen, evidence from dream induction experts, REM behavior, and lucid dreaming contradicts this position. Are just *reports of color* confabulation? It seems ad hoc to argue that we can reliably report the contents of our dream

experience, i.e., what happened but somehow at strategic points involving color perception people's reports of experiences automatically become suspect.

Alternatively, along similar lines, it may be that people misremember the contents of their experiences in the dreams. They are not necessarily confabulating, or making up completely, what they experienced in their dreams; they are only misremembering certain experiences, perhaps filling in color details in their memory of their dream experiences. I admit that, even if such color experiences never occurred in dreams, if we thought that dream reporting was very unreliable, it would not be surprising that people could confabulate or misremember such experiences of colors in their dreams. Color may have been unspecified in people's dreams but they don't remember that and, thus, they find themselves filling in details to shore up gaps in what they remember.

One additional difficulty might be that such reports might be true of a small segment of the population. But, if the dream knowledge skeptic acknowledges that such reports are true of some subjects, she has already conceded significant ground. Because of the commonality of dream reports we find from people across the world, I think it not unreasonable to assume that if we find some feature of dream experience in some sample of people's dreams we would be likely to find the same feature in the general population, if we were to catalogue all of the dreams of all the people in the world. Of course, any sample of studied dreams will always be only a tiny fraction of the dreams of the more than 7 billion people in the world. But the commonality of human perceptual experience combined with the similarity of dream reports of those who have been studied suggests that people who report color experiences in their dreams are probably not outliers.

3.4.5. Dreams Are Universally Recognized to Be Primarily Visual. And We Know Visual Experience in Our Dreams Better Than Any Other Aspect of Our Dream Experience

The universal recognition that dreams are primarily visual in nature suggests that, if there is any area of dream experience about which we can gain knowledge, it is our visual experience in dreams. And reports of our visual experience in dreams suggest that we see colors in our dreams. Further support for seeing color in our dreams comes from the apparently universal recognition that dreams are primarily visual in nature, for those with normal, healthy vision. As I said in the previous section, if we throw out the visual aspect of our dream experience, then much of what we report about our dreams could also be open to doubt. Going this far leaves us with extreme skepticism about what we can know of our dreams. But dream induction experiments, REM behavior disorder, and lucid dreams provide reasons for thinking we can know features of our dream experience. As I have said, it is recognized in every place and time (at least that I have come across) that dreams are primarily visual in nature. We also know that various areas of the visual cortices are active during REM sleep, a stage of sleep where people report dreams 90% of the time when they are awoken from it. In addition, in many languages, when describing the experience of a dream one uses an expression that, when translated literally into English would be “I saw a dream,” rather than “I had a dream.” I think it is reasonable to accept that if we have an experience that is primarily visual, our knowledge of this visual aspect of our dream experience might well be better than our knowledge of other aspects of the experience. Greater brain activation of the visual cortices indicates our dreams

are primarily visual, and thus it is not surprising that most of the memories people have of their dreams involve primarily visual aspects.

The fact that dreams are primarily visual in nature suggests that, if there is any area where we might be likely to attain knowledge about our dreams, it would be concerning the visual aspects of our experience. Conversely, if we are skeptical of what we can know about our visual experience in dreams, then we should by this reasoning be skeptical of much of what we think we know about dreams. When we combine the fact that dreams are primarily visual in nature with the voluminous number of reports of color experience, it seems prima facie reasonable to conclude that people really are having such experiences of color. If there is one area of our dream experience that might be at all reliable it would seem to be our visual experience. And it is clear that visual cortices are highly activated during REM sleep, the state out of which narrative-type simulatory dreams are most often reported.

To see why this is not a trivial point, we can contrast visual experience in dreams with olfactory experience. There is some debate about whether we experience smells in our dreams. Some people seldom or even never report smells in their dreams. There are neuroanatomical reasons why this is the case. The normal olfactory pathway occurs in a more "primitive part of brain" and does not pass through the thalamus on its way to the cerebral cortex. We know that the thalamo-cortical plays a critical role in dreaming. So, here is a case where both neuroanatomy and subjective reports combine to suggest that olfactory sensation is less assured than vision, which consumes so much of our dream experience (King, 2011).

3.4.6 Black-and-White Visual Experiences in Dreams are Implausible on Neurophysiological Grounds

In this sub-section I argue that it is implausible on neurophysiological grounds for the general population to have exclusively black and white visual experiences in dreams. It would be surprising to find that human visual experience, which for normal healthy people, is rich and full of color, shift radically to become exclusively black and white in our dreams, while otherwise still remaining like our waking visual experience of the world. There are disorders where a person's ability to see colors is compromised and they see the world as black and white (e.g., achromatopsia), so it is not as though such types of experience could never happen, but there is nothing about the neurophysiology of the brain during dreaming to suggest that it such a shift in visual experience occurs. It is not natural to simply "turn off" color vision in some way; when we find extremely rare cases where people cannot perceive colors (achromatopsia) this is typically due to lesions in the ventromedial extrastriate visual cortical areas (Barbur, 2004). There is no reason to believe that similar breakdowns of healthy nervous system functioning are occurring during dreams or that there is decreased activation in these areas of the brain. Admittedly, breakdown in these areas might not be necessary in order for vision to appear black and white; there could be other factors in play that cause visual experience in dreams to appear in black and white. Thus, one could also object that the neurophysiological implausibility argument commits the fallacy of argument from ignorance in that it goes from not knowing that there is deactivation of such areas to claiming that there is no such deactivation. I do not believe this objection stands, for fMRI studies of the visual cortices during sleep show widespread activation during REM Sleep, and the burden of proof for thinking there is such specific deactivation is on the person arguing that it occurs.

One might perhaps argue that other animals experience the world in black and white, so it would not be so outlandish for human beings to do so in their dreams. But, it is actually a misconception that dogs, for example, do not see colors—dogs and other mammals do in fact see colors but the range of their visual spectrum is more limited than our own. In general, then, there is little independent neurophysiological reason to suspect that exclusively black-and-white visual processes occur in our dreams.

Along different lines, dream processes exhibit an inconstancy compared to our waking experience; in dreams, experiences shift from one to the next without the gradual transition we generally experience during waking, but this shifting of experience is due to the lack of sensory input occurring in dreams. Waking pathological hallucinations of myriad types and other cases of perception not derived from sensory input (e.g., hallucinations in a sensory-deprived environment) suggest that such proper sensory input is not necessary in order for people to have experiences of color.

Of course, nothing about the argument that black-and-white dreaming being neurophysiologically implausibility contradicts the position that the color of dreams is "unspecified". If dreams are exclusively imagistic rather than perceptual processes, as some have suggested (e.g., McGinn, 2004, 2005, 2007; Sosa, 2005; Ichikawa, 2008a, 2008b, forthcoming), then it may make sense to accept this conception of colors as "unspecified," but, whether dreams are imagistic or perceptual phenomena, it is implausible on neurophysiological grounds for dreams to be exclusively black-and-white visual experience. It may well be that dreams are not typically color experiences of the kind we find in our waking life, but, in any case, it is implausible that our visual experience in dreams becomes like what a person

experiences when looking at a black-and-white film. Although this next point is admittedly not necessarily an assumption of the thesis of black-and-white dreams, but the technical reasons why media were first produced in black and white have little connection to the neurophysiological reasons for how or why such experiences would occur in our brains.

3.4.7. Extensive Evidence Suggests People Reported Color Experiences in Dreams Even at the Zenith of Black-and-white Media

Extensive evidence does not even support the contention that people reported fewer color experiences in their dreams during the period 1900-1949 than people reported color experiences during the period 1950-1999. Furthermore, these spontaneous dream reports are a more reliable source than surveys of the general population.

Robert Hoss (2010), based on a thorough examination of 25,222 dream reports over the course of the 20th, concludes that people in the first half of the 20th Century were no less likely to report color experiences in their dreams than people in the second half of the 20th Century were. Actually, according to Hoss's analysis, people reported color experiences in their dreams slightly *more* often in the first half of the 20th Century. Thus, it may be that the data do not even support the finding that people reported color experiences in dreams less frequently between 1900 and 1949 than they did between 1950 and 1999.

Here, once again, we find the limitations of survey answers. While the use of spontaneously recorded dreams upon awakening has its limitations (as compared, say to reports arising directly from lucid dream awakenings and REM sleep awakenings), the proximity in time and place to the original act of dreaming makes such spontaneously recorded dreams a

more reliable source of evidence than general surveys of the population at large. At the very least, all of the people who spontaneously recorded their dream upon awakening report sufficient memories of their dreams to be able to record them; the same can't be said of the population at large.

3.4.8. People Frequently Report Color Experiences in Dreams

The frequency with which people report color experiences in their dreams is, other things being equal, support for them having experienced colors in their dreams. It might seem obvious to say this, but it is still worth including as an argument: the fact that people report having had experiences of colors while they were dreaming provides *prima facie* support for the argument that they actually experienced such colors in their dreams. While Schwitzgebel, for one, raises questions about the reliability of people's reports about their dreams, the *frequency* with which people report colors in their dreams and the commonality across cultures of people's reports of specific colors in dreams, other things being equal, supports the view that color experiences occur in dreams. While obviously other arguments must be brought to bear, in the interest of comprehensiveness it is worth acknowledging this simple reasoning: if people report that they had color experiences in their dreams, then it is more likely they have had such experiences than it would be if people never reported such experiences. (Of course, Schwitzgebel is skeptical of the force of this argument.) But, according to the DreamBank (Schneider and Domhoff, 1999; Domhoff and Schneider, 2008), a compilation of over 20,000 dreams recorded between 1912 and 2008, people have used color words to describe aspects of their dreams

consistently throughout the 20th Century and early 21st Century. And we find similar results whenever we look at the dream reports of different cultures around the world: reports of experiences of color are commonplace. These results undercuts the arguments based on survey results where people claim they dream in black and white. If the majority of people, even during the heyday of black-and-white media, are still using color words to describe aspects of their dreams, then something has to give—either the general surveys or the specific spontaneous dream reports are wrong. I submit that that the general surveys on dreaming are the weaker form of evidence compared to spontaneous dream reports upon awakening.

If we look at the DreamBank (Schneider and Domhoff, 1999; Domhoff and Schneider, 2008), we find that people report color experiences in a significant percent of dreams consistently throughout the near-hundred-year period. If it was just a matter of people reporting seeing a yellow school bus or a red fire truck in their dreams, then we could perhaps explain such reports as the product of people unconsciously filling in the expected color of the vehicle, or whatever, they recount experiencing in the dream; but there are numerous cases of people reporting specific colors in their dreams, and the colors play a salient role in their dreams (see Section 3.4.4.). Furthermore, this color salience or incongruity is not uncommonly reported to be the trigger for a person to dream lucidly. (I discuss lucid dreams and color experiences in the next section.) Reports such as the following are common: "I wasn't expecting the house to be purple, but it was—that's when I knew I had to be dreaming." If people weren't actually experiencing colors, color changes, or bizarrely colored objects in their dreams, then it seems odd that they would upon awakening report having just experienced such surprising color incongruities. People are more likely to be right about triggers of salience or incongruency

than they are about absolute characteristics of their experience. People might not notice significant changes, as we see in change blindness and choice blindness studies. But, when they do notice a change, it is hard to argue that they didn't notice an alteration in their experience, in this case, of color. Once again, to cast doubt on such reports calls virtually all aspects of dream reports into question.

3.4.9. Color Experiences are Often More Intense in Some Dreams Than Other Dreams or May Even Be More Intense Than in Waking Experience

Not only do people report experiences of color in their dreams, but they also frequently report that certain colors were more intense or vivid in some dreams. Often, too, the specific color of an object plays a salient role in the dream as reported. Such findings suggest that we experience colors in our dreams.

If there were no experiences of color whatsoever, it seems surprising that people would so frequently report experiencing dreams, particularly lucid dreams, with colors that are *more intense or vivid than their usual dreams*, or more intense or vivid than their everyday waking experience of color. Why would people so often describe their dreams experiences as more saturated with color than usual, unless they were actually experiencing colors in their dreams in the first place? I think we should be more accepting of testimony arising from lucid dreams than we are from reports arising from ordinary dreams. I have argued that we should accept testimony of expert lucid dreamers awakening from a lucid dream as being as reliable or almost as reliable as the testimony of waking subjects. There may even be some circumstances in which reports of expert lucid dreamers upon awakening are more reliable than reports arising

from some states of waking consciousness, such as hypnosis. The fact that lucid dream reports of color very often include descriptions of unusually bright or vivid colors presents strong evidence that we see color in our lucid dreams, and, given the assumption that our ordinary non-lucid dreams do not involve radically different perceptual processes than our lucid dreams, it is then reasonable to conclude we experience colors in our ordinary dreams as well.

The counter-argument to the argument that people frequently report exceptional color experiences might be that we should not be surprised to find that there are variations in the intensity of the colors people report experiencing in their dreams. How could there not be variation? According to this counter-argument, people obviously differ in their experiences, so we should expect to see some cases in which dreams are reported to have more vivid colors and some cases in which dreams have less vivid colors. My reply to this counter-argument would be that we would expect to see such variation across the range of dream reports, but statistical variation alone would not explain why dreamers *so frequently* report that their dreams are more vividly colorful *when their dreams become lucid*, or that their lucid dreams are more vividly colorful than their other dreams. For example, lucid dreamers report that colors in their dreams are more vivid than in their non-lucid dreams. This added intensity of lucid dream experience is not surprising, given the greater (forebrain) brain activation, we find in lucid dreamers.

3.4.10. Consistency of Historical Precedent

The consistency of historical accounts of color experience suggests that we experience color in our dreams. Throughout history, insofar as I have been able to ascertain, in every culture and time where the subject of dreams has come up, save that of Early 20th Century America, it has been commonly assumed that people experience colors in our dreams. Of course, there is an aberration with the introduction of black-and-white media in the US (and the effect would probably have been found in other cultures with similar media experiences), but, *ceteris paribus*, the consistency of historical reports supports the position that we experience colors in our dreams. The more people in more cultural epochs who describe dreams as occurring in color, or who describe experiences of colored objects in dreams, the more Bayesian evidence, perhaps slight though it may be, that people in general probably experience color in their dreams. If our dream experience occurs solely in black-and-white or if color is unspecified in our dreams, it seems to me extremely surprising that no one has ever raised this skeptical objection in the history of human thought. Obviously, this argument is not decisive, but the weight of historical precedent is suggestive. It is certainly possible that everyone (so far as I can tell) who lived before the introduction of black-and-white media who claimed to have experiences of colors in their dreams could all be mistaken. But, in all of their dream journals, in all of their reports of descriptions of colors in their dreams, in all of their myth-like stories about dream experiences insofar as I have been able to ascertain it has always been assumed that people experience color in their dreams. Again, all these people could be inaccurate in their beliefs, but all of human history provides a massive amount of evidence in favor of the view that people throughout history have probably dreamed in color, and that people today likely do as well. One needs to marshal an extremely powerful skeptical argument to overturn the weight of

historical opinion. I'm not convinced that the evidence from black-and-white media overturns this evidence.

Now this argument from optimistic induction of historical experience might seem to be naïve. Clearly, almost every pre-scientific cultural position on the natural world has been wrong, whatever they thought about how nature worked, and this inaccuracy would no doubt extend to just about anything they claimed about the mechanisms underlying our perceptual experience, to say nothing of the physical world or cosmology, but recognizing their ignorance about such matters does not entail that their beliefs about their phenomenology were wrong to the same degree. If so many people in so many times and places have been wrong or at the very least ignorant about how their perceptual experience works, why should we trust their judgments about the nature of such experiences in their dreams? The difference is that, while we should reject any pre-scientific account of the physical world, our phenomenological experience is unlikely to have changed significantly in the last few thousand years of recorded history. In just a few thousand years, there has hardly been time for genetic changes in dream perception to propagate. So, arguably, we are just as much in a position to trust the phenomenological reports of cultures in other times and places as we are to accept the phenomenological reports of people Americans today. (Here I am limiting my purview to Americans in the 20th Century because that is the data on which I am basing my arguments.)

Although, I accept the heterophenomenological method which advises that people's views are only to accepted as provisional data, data that might be superseded by a more advanced scientific explanation, I think it still reasonable to assume that, other things being equal, the sheer weight of historical evidence of reports of color experience in dreams provides

some support for the view that we experience color in our dreams. Here, we can make a distinction between the mechanisms responsible for our perceptual experience being the way they are and people's subjective reports of what their experiences were like. We should obviously reject any pre-scientific explanation of, for example, visual experience, but that is quite different from saying that it is unwarranted to say that pre-scientific people across the world probably experienced colors in way roughly similar to the way we do. Certainly we would expect their of macroscopic objects to conform rather closely to our own reports of our perceptual experience. (I take it I can maintain this position while still remaining neutral with respect to eliminative materialism, the view that our folk psychological accounts of, say, perceptual experience, insofar as they fail to be informed by a more sophisticated neuroscience, constitute a radically false theory.

The following quote from Daniel Dennett is about consciousness more generally but his point is also relevant to our understanding of dreaming, as potentially a certain kind of conscious state. If anything, knowing our dream experience is even more complex than understanding the nature of our waking consciousness.

> Human consciousness is just about the last surviving mystery. A mystery is a phenomenon that people don't know how to think about - yet. There have been other great mysteries: the mystery of the origin of the universe, the mystery of life and reproduction, the mystery of the design to be found in nature, the mysteries of time, space, and gravity. These were not just areas of scientific ignorance, but of utter bafflement and wonder. We do not yet have all the answers to any of the questions of cosmology and particle physics, molecular genetics and evolutionary theory, but we do know how to think about them .... With consciousness, however, we are still in a terrible muddle. Consciousness stands alone today as a topic that often leaves even the most

> sophisticated thinkers tongue-tied and confused. And, as with all of the earlier mysteries, there are many who insist -- and hope -- that there will never be a demystification of consciousness. (Dennett, 1991, p. 26)

I would argue that our phenomenological experience in dreams also falls under the category of mysteries yet to be explained, but this limitation in our understanding does not negate the reasonable pre-theoretical position that our reports of our phenomenological experience offer themselves as accurate for the most part, given the general acuity of our perceptual faculties, which there are no doubt good evolutionary reasons for.

3.4.11. Dreaming and the Indistinguishability Argument

The majority of thinkers who have written on dreams have endorsed some form of the indistinguishability argument, which says that dream experiences seem indistinguishable from waking experiences. According to the indistinguishability argument, we do not realize we are dreaming because we can't tell the difference between our dreams and our waking reality—while we are dreaming. (Note: this ignores the special case of lucid dreams.) And, when we are awake, there is no principled way to determine that we are not dreaming. How is that so many thinkers could consider the indistinguishability argument at all plausible unless dreams were extremely realistic? The fact that so many have found the indistinguishability argument persuasive suggests that our visual perception in dreams is very similar to our waking visual perception. Schwitzgebel would reply that we don't know our dreams well at all, so it is not surprising that people make false or unwarranted reports about their dreams, including

thinking their dream experience in indistinguishable from their waking experience, at least while they are dreaming. But much dream science suggests that we can acquire knowledge of many aspects of our dream experience. And color experience may be at least as reliable as other aspects of dream experience we can attain knowledge of.

In his book *Human Knowledge: Its Scope and Limits*, Bertrand Russell ([1948] 2009) writes:

> I dreamed last night that I was in Germany, in a house which looked out on a ruined church; in my dream I supposed at first that the church had been bombed during the recent war, but was subsequently informed that its destruction dated from the wars of religion in the sixteenth century. All this, so long as I remained asleep, had all the convincingness of waking life. I did really have the dream, and did really have an experience intrinsically indistinguishable from that of seeing a ruined church when awake. It follows that the experience which I call "seeing a church" is not conclusive evidence that there is a church, since it may occur when there is no such external object as I suppose in my dream. It may be said that, though when dreaming I may think that I am awake, when I wake up I know that I am awake. But I do not see how we are to have any such certainty; I have frequently dreamt that I woke up; in fact once, after ether, I dreamt it about a hundred times in the course of one dream. We condemn dreams, in fact, because they do not fit into a proper context, but this argument can be made inconclusive, as in Calderon's play La Vida es Sueño. I do not believe that I am now dreaming, but I cannot prove that I am not. I am, however, quite certain that I am having certain experiences, whether they be those of a dream or those of waking life. (Russell, [1948] 2009)

It is commonplace throughout the world and throughout history for people to suggest that dream experiences are indistinguishable from waking experiences. How could the indistinguishability argument seem even at all *plausible* to virtually everyone who has seriously considered the nature of dreams, unless dream experience and waking experience are at least plausibly similar in how they seem to us? And, if dreams are plausibly convincing as indistinguishable from waking experience, that fact supports the position that we experience color in our dreams; otherwise, people would not be so inclined to believe this. In addition to the folk, Plato, Descartes, Bertrand Russell, and numerous other philosophers who have addressed this subject all accept that dreams are indistinguishable from our waking experience, at least in terms of their experiential nature (as opposed to the contents of those experiences). To completely reject so many astute thinkers' claims to knowledge about their dreams and claim that they are all not just mistaken but radically misguided about the nature of their dream experience leaves us with an extreme skepticism about what we can know of our dream experience. In other words, when we are dreaming, we do not (typically) question whether our experience is of the real physical world beyond the bounds of our own body. Throughout the world, much folk wisdom on dreams assumes the truth of the indistinguishability argument. Some cultures will even claim that their dream experiences are *more real* than their waking experiences. How could so many people have such beliefs about their dreams (beliefs which Schwitzgebel suggests are radically false), unless their dream experience really did at least *somewhat* resemble our waking experience in terms of its realistic-seemingness? Could we all really know so little of our dreams? Of course, questioning what others have heretofore taken for granted is the basis for scientific and philosophical insight, but we should be clear about the

enormity of what the skeptic is suggesting. The extremeness of the position is particularly pronounced when we consider that the perspicacity of individual's dream experience is likely to differ quite a lot. To be clear: Schwitzgebel's skepticism suggests that *nobody* knows their dreams very well at all. Nobody. We saw that in the case of people's beliefs about the acuity of their peripheral vision, almost everyone is radically mistaken about the nature of their experience. The same could be the case for knowledge of dreams. But the fact that so many people naively assume the indistinguishable view must count as some evidence in favor of dreams being mostly indistinguishable from our waking life, at least in terms of their experiential nature—the contents of our dreams obviously can become much more bizarre than our waking experience usually is. Just as they do in waking life, people frequently report experiencing colors in their dreams. In order to dispute the accuracy of such reports, Schwitzgebel counsels skepticism about whether we can know our dream experience well at all. But why would anyone put any stock in the indistinguishability argument, the idea that we are unable to distinguish our dream experience from our waking experience, unless our dream experience seemed as real to us as our waking experience?

Again, Schwitzgebel's skepticism about color experience in dreams, based on discrepancies of reports of dreams in color or black-and-white, disputes the indistinguishability argument. Schwitzgebel would say that we can't assume we have accurate knowledge of our dream experience, so we shouldn't be surprised that we have all kinds of false beliefs about it. But if we don't know our dream experience very well at all, why don't we simply have beliefs like "our dream experience is does not seem real to us" or "we don't know our dream experience well at all" or "dreams are always clearly distinguishable from waking reality"?

Instead, people believe they know much about their dream experience, including that they have color experiences. Why are people so sure?

Many people awake from dreams to give detailed accounts of what they believe they experienced while they were dreaming; occasionally these accounts include new insights or the acquisition of knowledge they didn't possess before they went to sleep. Examples of such knowledge acquisition in dreams include Paul McCartney composing the melody for the Beatles song "Yesterday" in his dream; August Kekulé envisioning six snakes swallowing each other's tails in the shape of a ring, thus revealing to him the shape of the benzene molecule; Elias Howe's insight into the advantage of putting the hole in a sewing needle at the tip, after he was captured by a tribe of people with such holes in their spears; or the mathematical genius Ramanjuan devising original mathematical theorems in the course of his dreams. There are countless other such accounts. No doubt many such stories are fanciful and/or apocryphal but evidence suggests that a large portion of them are not. Where do all these ideas come from? Even people who do not make breakthrough discoveries often feel they have hit upon insights in their dreams. (One explanation for this feeling that our dream insights are important could be due to our brain testing out associations between ideas to find what concepts should be linked together—our brain is basically searching for patterns of what is important; of course it seems important to us. This phenomenon may also explain why other people are much less intrigued by others' dreams—there isn't in the listener that unique sense of how the disparate ideas fit together as there is for the dreamer. This process is explained by Matt Walker in Walker, 2008.) Still, either all such people who think they have arrived at original insights are deluded or, more likely, at least some of them arrived at original insights in their dreams. This

means that they have acquired reliable knowledge of ideas that first occurred to them in dreams. Many people are able to wake from their dreams and give incredibly detailed narratives containing apparently new information, and it is implausible to think all this new information is spontaneous confabulation. At the very least it is puzzling that people would have such strong feelings of knowing before even having the insights which they would have to otherwise be coming up with while they were awake, assuming sincere reporting.

And if people do in fact have such original insights in their dreams then that bolsters the likelihood that other reported aspects of their dream experience are an accurate reflection of their cognition during sleep.

Evidence from stimuli induction, lucid dreaming, and REM behavior disorder, of the kind adduced in Chapter Two suggests we have accurate knowledge of our dreams in many ways. One position of the skeptic who discounts knowledge of our dreams would be to argue that awakened dreamers confabulate much of what they experienced in their dreams. And, in doing so, they attribute a realism to their experience that was never there in the dream experience in the first place. Thus, this argument says we shouldn't expect their reports of experiences of color to be accurate reflections of their dream experience. According to this conception, dream reports are largely confabulatory.

David Foulkes studies of children's dream suggests that little children of 3-5-years-old are probably often confabulating when they recount a detailed dream, but we see that tendency go away, and then we see a gradual tendency of children to report more and more complex dreams as they grow older. We might even call these periods stages of the complexity of their dreams. And such complexity seems to be tied very much to visuospatial abilities, as

opposed to verbal abilities, which, arguably, might be more expected in the details of dreams were largely confabulatory. Study of children's dreaming suggests that, as they grow up, children develop the ability to dream simulations of greater and greater complexity. (For more on Foulkes's studies of the development of dream complexity over time, see Chapter Five.) The fact that there is such a clear pattern of the ontogeny of dream discernment suggests that people are accurately reporting aspects of their dreams. To suggest otherwise is to suggest that people go through clear stages of "confabulation elaboration development," such that people become better and better at confabulating, or making up without any basis in past experience, complex cognitive capacities, and they do so in clear stages, in a way analogous to Piagetian stages of cognitive development. It strikes me as implausible that at a certain stage, say, roughly 8-years-old, children would consistently confabulate having had very similar types of dream experiences. Thus, if we accept that children are accurately capturing and relating the nature of their dream experiences in these ways (e.g., active, kinesthetic, with an experience of a dream body being reported at roughly the same age), this finding points to us being able to accurately report aspects of our dream experience. If we accept that we are able to accurately report on these various cognitive capacities we carry out in our dreams, it does not strike me as implausible that we would be able to, in addition, accurately report on our experiences of colors in our dreams.

The weight of evidence would seem to support the position that in many ways our dream experience is indistinguishable from our waking experience. The skeptic of color experience, however, might well accept that we know our dreams well in many respects, but would still not accept saying we know we experience color in our dreams. The skeptic could

point to surveys in which people report dreaming in black and white to counter the view that we experience color in our dreams. I have suggested, though, that, we know our dream experience in many ways, owing to evidence from lucid dreaming, stimulus induction experiments, REM Behavioral Disorder evidence, and results of David Foulkes's longitudinal studies of the developmental of dreaming in children. When we combine these diverse bases for knowledge of our dreams with the scope of the indistinguishability argument, it seems plausible to include color experience in the space of areas in which we know our dreams.

There is an argument to be made against going from claims that waking and dream experience seem indistinguishable to claims that the nature of the experience is the same in some respect, namely experience of colors. One basis for such a counter-argument stems from the fact that, in dreams, our critical faculties are greatly diminished, so we shouldn't be surprised that we could be wrong about the nature of our experiences of dream, for we simply don't have the critical awareness and reasoning skills about our dreams that we have in our waking life. Thus, it is not surprising that most people believe in the indistinguishability argument, because they don't have the cognitive wherewithal to know features of their dream experience. Their experience of the world might be radically impoverished with respect to their waking experience but they have no critical faculties to realize this in their dreams—they assume their dreams are real. And, then, when they wake up, they assume they actually experienced what they recollect themselves to have experienced, not taking into that their critical faculties were radically diminished while they were dreaming. Thus, the argument says, they should not trust their judgments about their dream experience, including that they dreamt in color.

Lucid dreams, however, as we have seen, provide counter-evidence to the view that we always lack critical thinking and reasoning abilities in our dreams. In lucid dreams, we often see a level of awareness, memory, and criticality that is at or near waking levels of such thinking, and we know this because of the diverse and complex ways people have been shown to report while in lucid dreaming state. The variation that we see in such critical faculties in dreams also suggests that we could likely tweak this level of criticality with drugs or biomedical technology, when we have greater wherewithal to manipulate the brain. Sleep states are not absolute borders; especially as neuroscience progresses, manipulation of brain states is likely to make it seem quaint to demarcate brain states using today's terminology. Such intervention might not be safe, but it is hard to see how such intervention would make dreams no longer dreams.

One might ask: How is arguing that the indistinguishability argument is so convincing different from an optimistic induction that uses the consistency of historical reports about dreams as the basis for concluding that our contemporary reports of our dream experience are accurate? For one, it is different to argue that people everywhere (except for one time period, the early part of the 20th Century in the United States (and likely other countries with comparable media)) have always reported color in their dreams than it is to argue that most serious thinkers on dreams (along with the folk) have argued that dream experience is almost indistinguishable from waking experience. In the present argument, the fact that so many have raised and accepted the indistinguishability argument, along with evidence that we attain reliable knowledge of many aspects of our dreams, suggests that another area where we have knowledge of our dreams is that of color experience.

3.4.11.1. Note: My View on the Indistinguishability Argument

I have argued that the fact that most people find the indistinguishability argument convincing, along with other corroborating evidence of the reliability in some respects of our dream reports (see Chapter 2), jointly provide support for the view that we have some kind of color experience in our dreams. Although I have said this, I would not myself accept the statement "dream experience is *indistinguishable* from waking experience" *simpliciter*. A satisfactory analysis of this question would need to go into precise detail about what it means for dreams to be *indistinguishable* from waking experiences. I could easily have written another free-standing chapter solely on this question, but I have chosen not to in the interests of space and also because I think semantic issues loom large here. Still, this being a dissertation on dreams, it seems reasonable to give my view on whether we can distinguish between dream experiences and waking experiences. (Here I am not even attempting to treat the subtleties of the voluminous epistemological literature on the related skeptical question of whether we can know we are not in a dream (or a brain-in-a-vat, or in the Matrix, etc.).)

To answer the question of whether dreams are distinguishable from waking experience we would first have to explain the distinction between dreams and waking experience, which, I have argued, is problematic because of among other things the difficulty of circumscribing what is a dream.

Roughly speaking, some kinds of sleep mentation occur, or at least are reported to occur, in ways that are quite different from our normal waking experience of reality (aside from any kind of manipulation (e.g., neuropharmacology, hypnosis, etc.). For example, hypnagogic

reveries and reported sleep mentation during deep sleep are quite different from anything we experience while in our normal waking state. If these states are dreams, then dreams are distinguishable, at least in retrospect, from waking reality. The problem, of course, is that we don't recognize while we are asleep that the nature of these experience is different from waking reality. So, upon awakening, some kinds of sleep mentation are reported as being quite different. What are typically thought of as dreams, on the other hand, form a category of sleep mentation which people often report as being indistinguishable from their waking reality; hence the indistinguishability argument.

The first point is that we apparently are able to distinguish between dreams and reality in that we are able to know that we have woken up. But, here, epistemological issues abound, because of, among other things, the prevalence of so-called "false awakenings," dream experiences in which we dream we have awoken while, in fact, we remain asleep, only dreaming that we have awoken. Sometimes these false awakenings occur over and over again, a person having been dreaming during every false awakening. This sense of the word "indistinguishable" involves epistemological worries I will avoid here, because the expansiveness of the literature on this skeptical question. The question of indistinguishability raises a question about the nature of our waking and dreaming experience of the world. Because we are able to have lucid dreams, I take it that we are able to reliably tell that we are dreaming, so, at least some of the time, while we are asleep, we are able to tell that we recognize that we are dreaming.

There are types of experiences that we can undergo that we are not able to undergo during our normal waking experience. So if we are able in any way detect that there are

features to our experience that we don't normally experience when we are waking, then we can distinguish whether we are dreaming or not. Features like holding one's breath. Turning off light switches. These are some of the ways that we are able to determine that we are dreaming based on the intentional content of our dreams—when we try to turn a light switch off and on and off and on in a dream it just doesn't work like it is supposed to, owing to some cognitive limitation on our brain's ability to simulate experiences without external stimuli. But, if the indistinguishability argument is trying to get at the subtleties of our perceptual experience, independent of the contents of any experience, then things get more difficult. (In other words, if a person can tell that she is lucid dreaming because she can apparently float up in the air unassisted, this is one form of distinguishing, but she also may have no basis solely in her perceptual experience to judge that this is not simply an extremely rare occurrence happening to her while she is awake. But, usually, lucid dream triggers occur after something happens in a dream that doesn't seem like it could normally happen in waking life. Because of the extreme weirdness of the experience, a person thinks, "I must be dreaming.")

So, to recap, I think that the fact that the indistinguishability argument in some form sounds so reasonable to some people provides evidence that some aspects of our waking reports of our dreams are accurate (and one of those areas would be the fact that we experience colors). So something as basic to our experience as color vision might well occur in dreams. But, strictly speaking, I find it implausible that even in lucid dreams our experience is indistinguishable from our waking reality. Being able to do all kinds of things in lucid dreams we can't do in waking life is an indication of this difference. There are also other subtle differences lucid dreamers notice. In addition, in dreams, based on the reports of expert lucid dreamers,

our experience over time shifts much more rapidly in dreams than in waking reality, because in dreams one's brain is continuously simulating an external reality and one's brain can hardly carry this out in moment-to-moment fashion while keeping the contents of one's experience somewhat fixed, as happens in normal waking reality. Put simply, objects stay somewhat more fixed in waking reality and this stability of the external world results in less dramatic shifts in our experience. In waking life, the constancy of input from external stimuli in the world makes our experience seem much more stable. Why, then, do we not notice this difference in the nature of our experience during dreams? We do—in lucid dreams. As for non-lucid dreams, the reason why we are not able to recognize we are dreaming is because our critical, reflective capacities are off-line. So, because of this difference, we are not apt to notice that our dreaming experience is not the same as our waking experience. Because most dreams are non-lucid dreams, people most likely form the impression that dreams are indistinguishable from, or at least very similar to, waking experience, since people do not remember their perceptual experience in dreams as being herky-jerky. Of course, people do recognize that the contents of their dream experience shift (e.g., strange monsters, weird people, unusual settings). So, again, much depends on the meaning of the word "indistinguishable". At the very least, because lucid dreamers are able to recognize in these various ways that they are dreaming, this provides one obvious way in which dream experience is distinguishable from waking experience.

3.4.12. Lucid Dreamers Report Brighter Colors and/or More Vivid Colors in Their Lucid Dreams. Furthermore, Reports From Lucid Dreamers, Whether From Within the Dream or Upon Awakening, are More Reliable Than Reports of Ordinary Dreams

Other than reports given by lucid dreamers while they are still dreaming, reports from awakened lucid dreamers are the most reliable indicator of the true nature of dreaming experiences. Such reports from lucid dreamers post-awakening from a lucid dream are more reliable than sleep-lab reports from ordinary, non-lucid dreamers, and much more reliable than surveys of the general population. What, then, do (awakened) lucid dreamers report? They consistently report experiencing colors in their dreams. In fact, it is common for lucid dreamers to report that colors are brighter or more vivid in lucid dreams than either their ordinary dreams or in their waking reality. Thus, based on the best source for color experiences—evidence from lucid dreamers—we can conclude that people likely experience colors in their lucid dreams and, most likely, in their ordinary dreams as well. Then, based on the principle that perceptual experiences in lucid dreams are unlikely to be of a radically different kind in lucid dreams than they are in ordinary, non-lucid dreams, at least with respect to experiences of color, we can conclude that not only do lucid dreamers experience colors in their dreams but ordinary, non-lucid dreamers likely do as well.

That people are able to move their eyes in pre-arranged patterns while lucid dreaming indicates a degree of self-reflectiveness and executive function similar to that found during some states of wakefulness, and certainly higher than in ordinary, non-lucid dreams. One might perhaps be misled into thinking that our waking self-reflectiveness is much greater than our self-reflectiveness in even our most lucid lucid dreams. This error stems from a misappreciation for how poor our short-term memory is, even in our waking life. Change blindness and choice blindness experiments reveal that, even in waking life, people are not aware of stimuli they have just seen or decisions they have just made. Outside of contrived experiments designed to

reveal our lack of critical reflectivity even in waking, we typically fail to recognize our lack of critical reflectivity because the physical world surrounding us stays constant for the most part. Things of course move and change all around us, but there is moment-to-moment continuity in our physical surroundings, and thus in the sensory stimuli impacting our senses.

While awake, we are constantly processing a huge influx of sensory information, all of which positions us in a stable physical world. In dreams, on the other hand, that stable source of incoming sensory input is lacking, so we seem to lack reflectivity, but this seeming lack of reflectivity is in large measure due to the lack of background of physical objects onto to which we can stabilize our train of thought. We aren't for the most part able to think criticality about why one thing happens after another in our ordinary dreams, but, in lucid dreams, when we take into account that the dreamer is simulating anew moment-to-moment the world she is experiencing, it does not seem so odd that our train of thought would keep shifting to whatever pops into our mind, making it more difficult to sustain a continuous train of thought. Lucid dreaming reveals to us that there is nothing intrinsically unreflective about dreaming (LaBerge, 1986): we can have quite good knowledge of who we are, we can access all of the same episodic and semantic memory we possess in our waking life, and we can initiate actions in our lucid dreams. (The signaling experiments described in Chapter Two are an indication that we can take such willful action in our dreams.)

I would venture to say that most lucid dreamers would also say they could signal in a lucid dream when they are lucid, and then again, when they see a color in their dream. They could do this all while continuing to dream. We have seen that lucid dreamers are able to make other reports about holding their breath, clenching their fist with their "dream body," and

engaging in sexual stimulation in the dream and indicating the onset of such stimulation and the time of orgasm. That a study in which lucid dreamers signal that they are experiencing a color hasn't been done is more a matter of research priorities and expense, and less a matter of uncertainty about the outcome.

3.4.13. Deaf Persons as a Population Typically Report Experiencing Especially Vivid Colors in Their Dreams

Deaf persons characteristically describe experiencing colors in their dreams as brighter and/or more vivid than their waking experience of colors. Such characteristic reports among a population would be unlikely to occur in such a manner unless deaf persons were actually experiencing colors in their dreams. So deaf persons probably experience colors in their dreams. If we can conclude that deaf persons experience color in their dreams, then this strongly suggests that people who can hear also experience colors in their dreams.

Studies of the dreams of deaf persons indicate that deaf people typically describe colors in their dreams as seeming vivid or very bright (Mendelson et al., 1960; Gilliland and Stone, 2007). How is it that some sub-population of human beings could report such distinctive experiences of colors in their dreams unless there were some basis in their actual dream experience for such reports? It is unlikely to be a matter of chance that so many deaf people would report such similar experiences of color in their dreams. Anytime a distinct population with common neurophysiological features consistently reports unusual types of experiences this fact calls for explanation. The question is why this group (deaf persons) reports experiencing colors as brighter in their dreams than most other groups of people. The standard

explanation would be that deaf persons' visual acuity is heightened as a result of their deficit in hearing. This heightening of a person's perceptual experience along one dimension makes sense. It is well known that, loosely speaking, blind people can develop a greater capacity to derive information from sounds than can sighted people, who rely much less on their hearing to navigate the world. (Whether the ability to develop this capacity is unique to blind people is irrelevant. In any case, this ability is not mere folklore (cf., e.g., Acoustical Society of America, 2012) But, so far as I know, the vision of deaf persons while awake is not much different from the vision of hearing people while awake. Why, then, do deaf people in general report that colors in their dreams are brighter or more vivid than in their waking reality? A through answer to this question would require an in-depth of neuroscientific evidence, and an explanation based on such evidence is beyond the scope of this dissertation; but, even without such an explanation, we can recognize that such reports of vivid or bright colors in dreams need explaining.

One might argue that deaf persons are completely deluded about their dream experience, just as normal-hearing people are, so we shouldn't put any stock in such unusual dream reports. This stance simply questions much if not all of what people report about their dreams, whether deaf or able to hear. I have suggested above that such a position goes too far, because of lucid dream signaling experiments, dream induction experiments REM behavior disorder studies, among other reasons. The skeptic might try a different track. If there were a better explanation for such dream reports, then we might lose faith in reports in general of color experience. Perhaps one might seek to explain these dream reports of the deaf by arguing that it may have become an accepted view among deaf persons that the dreams of the deaf are

especially vivid in color. Thus, this meme would have spread throughout the deaf community, or at least among those who were the subjects in these experiments. The fact that deaf persons report this would be due not to anything distinctive about their visual experience of their dreams but because of cultural beliefs about their dreams. This phenomenon might be analogous to the way people adopt certain stereotypical beliefs about members of a group. According to this way of thinking, deaf persons might overlay their normal visual experience in dreams with a group stereotype that says "deaf persons' dreams involve more vivid or bright colors". I have earlier argued that common knowledge and memory for dreams is quite poor in general, so, one could argue, it would not be surprising if such a meme were to arise and spread through members of the deaf community, including the subjects of the above experiments. Just as we should not be surprised to find that general cultural beliefs about dreams are inaccurate, it would not be surprising to find that certain sub-populations, including deaf persons would have group-specific slightly different, but no less misguided beliefs about their dreams.

Here it would be a question of which is more likely: 1) Deaf persons believe colors in their dreams are more vivid because that is the way they experience them, or 2) deaf persons believe colors in their dreams are more vivid because it is a widely-held belief in the deaf community that dreams are vivid, and members of that community adopt the accepted views about dreams, even though these views have little basis in reality. And deaf persons memories of their dreams are inaccurate. For me, intuitively, the first option seems more reasonable, but I don't know how to settle the question. Perhaps if we had cross-cultural evidence from different deaf communities all saying colors are more vivid in their dreams, then that would bolster the

case that deaf persons are experiencing colors in their dreams, and, thus, by extension, make it more likely normal-hearing people are as well. If other deaf communities reported no such differences in dreams, then that would detract from the argument of this section.

Perhaps there is little motivation for the above counter-argument memetic environment; there may be a much better one. But, having raised the meme argument, I will say I find it implausible that reporting of vivid and/or bright colors by deaf persons is merely a product of memetic propagation: the argument requires a kind of group-think that seems outlandish. The more conservative hypothesis that deaf people are really experiencing such (brighter) colors seems to require fewer assumptions.

Finally, this reported greater brightness of color in the dreams of the deaf supports the view that both deaf persons and hearing persons experience color. It is significant that deaf persons, a population with distinct neurophysiology, commonly describe the same types of experiences. As I have said, that provides reason to think deaf people experience colors in their dreams. But it is implausible that deaf persons should experience color in their dreams and normal-hearing people wouldn't be able to. What deaf people report is only a magnified version of what ordinary-hearing people report, so it is reasonable to conclude that normal-hearing people experience colors in their dreams as well.

3.4.14. Experiments with Red-Tinted Goggles Worn During the Day Lead to Reports Consistent Across Subjects of Red-Tinted Color Perception in Their Dreams

An experiment was performed in which subjects wore red-tinted goggles every waking moment of the day. Subjects reported red-tinted color experiences in their dreams, and these

reports were highly consistent across subjects. This pattern suggests that subjects in the experiments were really experiencing red-tinted perception in their dreams. Experiencing red-tinted vision is a form of color experience.

In the experiment performed by Roffwarg et al. (1978), subjects wore rose-tinted goggles over their eyes during every waking moment of the day for five to eight straight days. As Robert Van De Castle describes in his book *Our Dreaming Mind*, before they started wearing the goggles, subjects in the experiment learned to recognize dozens of shades of colors: they could detect the difference between Coca-Cola red and "interstate highway" sign green, along with dozens of other shades of colors (Roffwarg et al., 1978; quoted by Van De Castle, 1994). The experimenters intended to investigate what effect the wearing of such goggles would have on the subjects' dream reports, particularly subjects' descriptions of colors in their dreams. Not only did subjects describe seeing specific colors, but there was a clear pattern to such reports. Eventually, most subjects described their dreams as pervaded with the rose-tinted glow. What is particularly noteworthy about these reports is that the onset of such reports of changes in color during dreams was highly similar across subjects. The appearance of the consistent pattern described below, which is extremely unlikely to have occurred by chance for all subjects, strongly suggests that subjects were experiencing colors in their dreams.

The reports of the subjects alone provide evidence of experiencing colors in dreams. One subject describes his dream: "On the scene there was a pervading amber tint...The sky was a dark, reddish brown. This is similar to the way things look through the goggles, but not exactly the same" (Roffwarg et al., 1978; quoted by Van De Castle, 1994, p. 253).

The best explanation for such experimental results is that subjects were actually seeing colors in their dreams.

Van De Castle (1994) explains the pattern:

> When the data were analyzed by time of appearance during the night, it was found that the goggle-colored objects appeared almost entirely during the early parts of the night and all but disappeared after the third REM period. (Van De Castle, 1994, p. 253)

This "time of night effect" is extremely unlikely to have occurred by chance. As Van De Castle suggests, the timing of the incorporation of rose-colored objects in the early part of the night and their gradual diminishment over the course of the night reflects a common tendency for information absorbed during the previous day to be relatively likely to be replayed earlier in the night and less likely to be played later in the night. Not only was this pattern found, but there was consistency across subjects in how long it tended to take before subjects started reporting that all of their dreams over the course of the night were tinged with a rose-colored glow. For most subjects it took a few days for this effect to evidence itself. Also supporting the reality of their experience of color in their dreams is the fact that when the goggles were removed and subjects went about their day with normal color vision of the world, they all ceased to report rose-tinted dreams on their first night of sleep. These combined consistent effects across subjects—gradual incorporation of rose-colored experiences, eventual complete incorporation, and immediate washout—all point to the subjects having experienced colors in their dreams.

One might argue that the results of this test could be nothing more than a kind of experimenter-expectancy effect (Carroll, 2009), whereby subjects exhibited just the kind of behavior they thought they were supposed based on the design of the experiment or the

expectation of the experimenters. This remains a possibility; the sample size of the experiment was low—only nine subjects. But I would counter that the specificity of their dream reports and the consistent matter in which they reported them make it extremely unlikely that subjects were completely confabulating.

The standard method of reducing the role of experimenter-expectancy effects, the double-blind placebo experiment, is not possible in this case, as subjects obviously know whether they are wearing red-tinted goggles or not. But, the reason why the results support the subjects seeing red colors in their dreams is that their reports were so highly consistent. I would submit that, if one attempted to explain away the entire results of the study as a product of experimenter-expectancy effects, one would be hard put to explain the specificity of the reports across subjects. It is not at all obvious what the experimenters had expected to happen, and, if the experimenters did expect such results, it is hard to see how such expectancies could have been communicated to subjects in a way that would lead to such information-rich results. All this is not to say it couldn't happen, but it makes far more sense to accept that subjects experienced red-tinted color perception in their dreams.

3.5. Conclusion

I believe that, while no one argument is dispositive, the multiple independent arguments above compel the conclusion that it is common for people to have color experiences in their dreams.

3.6. Postscript on Color Experience in Dreams

As a final note, I'll say that, as a regular lucid dreamer, I believe that I have many times experienced color in my lucid dreams. And I have often experienced the transition from my lucid dream ego to my wakeful ego as seamless—I felt no alteration in my sense of self as I transitioned from sleeping to waking. As Thomas Metzinger might put it, my phenomenal self-model stayed roughly the same (Metzinger, 2009). I felt I was experiencing colors with all of the confidence that I've felt after just experiencing colors in my waking life. I am not aware of any studies on lucid dreaming and color vision, but I would expect lucid dreamers' reports to be similar. And I have heard many anecdotal reports from other lucid dreamers who also are quite confident they experience colors in their dreams. I also believe the testimony of lucid dreamers with respect to their dream experience is of superior reliability to that of non-lucid dreamers, as I have argued above, because of the greater awareness and self-reflectivity we find in lucid dreams. One could easily argue that lucid dreamers are experts in the experience of dreaming in a way some practitioners of the art of meditation are expert in directing their attention and train of thought. Such master meditators seem to be able to attain levels of control of their mind that is unachievable by those who have never meditated. (For illustrations of superior abilities of meditators, see for example, James Austin's book *Zen and the Brain: Toward an Understanding of Meditation and Consciousness* (Austin, 1999) and *Selfless Insight: Zen and the Meditative Transformations of Consciousness* (Austin, 2009).) I think an analogous level of directedness of attention applies to lucid dreamers.

I can recall dreams where a yellow school bus seemed incredibly bright and detailed. I have stood in awe of lush expanses of green grass in my lucid dreams. I have begun a dream

and after I subsequently became lucid I directed my mind to pick up comic books off shelves, looking at the colored pictures change from page to page. In all of these dreams, at many points I felt awe at how mind-boggling it was that my own mind was creating these experiences for me to perceive. It seems almost perverse to then qualify my knowledge of these color experiences by saying, "At least that is the way it I think it seemed to me in my dream." Since I began this dissertation I have had lucid dreams where, after I became lucid, I thought to myself: "Be sure to pay attention to whether I am experiencing colors in my dreams!," since I am writing a chapter on this question. And after having this thought, I then experienced many types of colors: I have looked closely at the interwoven-colored brown and white design on a woman's dress and I have looked at the green leaves on a tree to make sure that I am really seeing green. In some of these lucid dreams I have experienced so-called WILDs, or waking induction of lucid dreams, where it feel as though there is no transition of one's waking consciousness into one's dreaming consciousness. Maybe I am mistaken in my beliefs about what I have experienced. It's possible. The heterophenomenological method counsels me to be open-minded that I may be wrong. I wonder: What role should my confidence that I am not wrong play in my assessment of the truth of the question of this chapter? Before I started writing this dissertation I had experienced such dreams and I have experienced colors in my dreams since I started. Now Schwitzgebel has provided good reasons for being more skeptical about our knowledge of our own dreams. I have tried to respond to his arguments fairly. But, even more so than any of the arguments above, for me, my confidence that dreams involve color stems from my sense that I have experienced such dreams, including many in which I was dreaming with lucidity. Perhaps

more and better neuroscience will allow us to better confirm my and others' subjective impression of seeing colors in our dreams.

Chapter Four

4.The Combinatorial Creativity with Selective Retention and Elaboration Theory of the Function of Dreaming

4.1. Dreams are Functional Adaptations

People in all known times and places have reported hallucinatory experiences of a simulated world during sleep. The question is: Why? Why do we have such experiences during sleep? Why do our brains become so active in sleep, using up precious neurochemical resources in order to allow us to hallucinate things that don't actually exist? The question itself might be ill-posed. Some thinkers, such as the philosopher Owen Flanagan (2000), have cogently argued that dreaming is a spandrel, a concomitant trait that coexists alongside an adaptive trait that was actually selected for, but the spandrel itself was not selected for. A classic example of a spandrel is the sound of a beating heart (Flanagan, 2000): while a heart that pumps blood was selected for in the process of evolution, no selection pressure acted specifically on the *sound* a beating heart makes; nothing about the sound of a heart beat makes those with a loud heart beat more likely to survive than those with a soft beating heart; a heartbeat just comes along for the ride when you get selection for a muscle that pumps blood.

My thesis in this chapter is that dreaming is not a spandrel; instead, we dream because dreaming serves an adaptive function that was selected for by evolution. To say that some dreaming as a cognitive faculty serves an adaptive function in the human mental economy is

roughly to say that some features of dream cognition arose in humans because those features provided an evolutionary advantage, meaning that those organisms who exhibited those features reproduced at rates greater than those without such features. Ultimately, this cognitive faculty spread to include all homo sapiens, because it provided some selective advantage. Put differently in biological terms, I argue that genes contributing to phenotypic traits specifically involving dream cognition (and not merely sleep per se insofar as the two can be distinguished) were selected for in the process of human evolution. I suggest multiple reasons why dreaming exhibits the features it does. We would not expect these features to occur purely as a result of selection for sleep and sleep cycling. Here I point to numerous scientific studies that show how dreaming per se (and not just sleep) provides an adaptive benefit. And I argue that the tinkering hand of evolution is likely to have resulted in our genetic variations exploring the space of the adjacent possible, so to speak, and dreaming was co-opted as part of this process of natural selection, because it provided a selective advantage to organisms that developed the capacity. One might argue, however, that dreaming as a mental process in humans exhibits the properties it does simply because features of dreaming are concomitant features of some other cognitive functions that evolution has actually selected for. According to such an understanding, sleep and sleep cycling might provide an evolutionary function in humans (as they do in other species), but dreaming as it exists in human beings today is *solely* a product of selection for the benefits of sleep and sleep cycling. Thus, dreams, some might think, are similarly epiphenomenal features of sleep and sleep cycling. Dreams might be interesting, perhaps, even revealing of our psyches, so the argument goes, but they are not adaptive. Thus, according to this opposing argument, sleep and sleep cycling provide an

evolutionary function, but dreams do not. In this chapter, I critique such arguments against an evolutionary function for dreaming. Flanagan's argument for this thesis is the most prominent. I believe Flanagan's explanation of the nature of dreaming to be inaccurate, and this understanding of dreaming leads him to draw erroneous conclusions about the function of dreams, and thus to argue that dreams are not adaptations. I argue that dreams are exaptations, meaning that, once the adaptive process of sleep was in place, natural selection co-opted sleep for many cognitive benefits. In biology, an exaptation is just another sort of adaptation, as Daniel Dennett has pointed out in *Darwin's Dangerous Idea* (Dennett, 1995). One of the ways in which sleep was co-opted was in our capacity to have dreams. Experiments performed since Flanagan's book was written provide what I take to be compelling evidence that the process of dreaming provides demonstrable cognitive benefits and those benefits are ones that would not otherwise occur in wakefulness or sleep without dreams of the appropriate kind.

In this chapter, I first explain the difference between sleep and dreaming. Then, I explain what it means for sleep to have an (adaptive) function. I point out the conceptual difference between arguing that *sleep and sleep cycling* serve a function and arguing that *dreaming* serves an adaptive function. After making this distinction, I analyze some of the proposed functions for dreaming that have appeared in the literature on dreaming. Finally, I outline my own position on the adaptive function of dreaming and I defend my position against various objections. Although I touch on the evolution of sleep as it applies to other species, my focus throughout will be on *homo sapiens*. It is my hope that, in the model of Flanagan (2000), a philosopher can

step into a neuroscientific debate and synthesize the core points and lay out the conceptual foundations of the issue, all while doing so on the basis of our most current science of dreaming

Note on usage: In this chapter, I use locutions such as “A person dreamt about x.” Whenever I use expressions of this kind, it should always be assumed that I intend the following more precise way of stating things: “A subject (in a scientific experiment) was awoken from what was demonstrably sleep; the subject was then asked to report on what was going on in his or her mind just previously; the subject, upon awakening, reported a dream in which x (some content) was verbally described and the person’s description of x was precise enough for scientists conducting the experiment to reasonably conclude that the content of a person’s dream cognition in some way involved x; thus, one could say he or she “dreamt about x”. An example of how this would work: “While she was awake, a subject was presented hundreds of pictures of flowers for her to look at. When awoken from sleep in the lab, the subject verbally reported a dream which contained the following statement: “I was planting a flower in my garden.” In this chapter, I will omit this roundabout way of putting things, because, unlike in earlier chapters, I am less concerned with the otherwise important distinction between “having dreamt of x” and “having, upon awakening, given a report in which they describe an x of some kind in some sufficiently similar way”.

4.2. Distinguishing Sleep From Dreams

There is a clear sense in which dreaming is not the same thing as sleeping. I take it that every dream state is a mental state occurring during sleep. But not every sleep state is a dream state.

The above distinction might seem to be the end of the matter. What could be more obvious? We go to sleep and during the night for some periods of time we have dreams. So one might think that once we having determined that dream states are a subset of the set of sleep states, one can then go on to analyze the neurophysiological markers of dream states, and thereby distinguish dream states from other non-dreaming states of sleep based on what is known about different stages of sleep. One might further think that we could match up states from which people report dreams with certain states from the standard classification of sleep stages (consisting of Stages, 1,2,3,4, and REM sleep). This existing classification system offers a robust framework for understanding sleep, and it is a system that has been in place for decades, providing a foundation for most of clinical sleep medicine.

The key discovery for explaining human sleep architecture was the discovery of REM sleep in the 1950's. When scientists discovered REM sleep, many of them believed they had found the underlying neurophysiological markers for dreaming. It was thought: we dream when we are in REM sleep. And, conversely, when we are sleeping in some other stage of sleep, we are not dreaming. But the relationship dreaming and sleep stages is vexed. Although the identification of dreaming sleep with REM sleep persisted to varying degrees for a couple of decades, an accumulating body of evidence suggested that dreams occur in sleep stages other than REM sleep (cf. e.g., Foulkes, 1962; cited by Solms, 1997). Much of the data on sleep reports and the corresponding sleep stages is complex and depends on multiple factors. All of

the following affect the dream reports people give: idiosyncrasies of a particular subject's sleep architecture, the time of night in which the person awoke from sleep, how well a person typically remembers her dreams, among other factors. But, here is where the difficulty arises: if we cannot say dream states track well onto neurological sleep states, then how are we to point to some biological function for dreams? The crux of the issue is this: people report very similar kinds of dreams despite having awoken from quite different underlying neurological states.

To obviate the difficulty created by our current ignorance of the neuroscience of sleep, herein I type dreams based on the phenomenological reports awakened dreamers give. But, if we accept the conclusion of Chapter Two—that lucid dreamers can make reports while asleep and dreaming—we should accept that in principle complex reports could be given while still asleep and dreaming. There is no doubt, however, that for the most part, reports of dream phenomenology arise after a person has awoken from a dream, and virtually all of the dream report data will be of that nature.

But does typing dreams based on their phenomenology (as opposed to their neurological correlates) present a problem for any attempt to find a function for dreaming in general? First of all, it is not the case that the kinds of simulatory dreams people report occur anytime a person is awakened, no matter what sleep stage they are in. Some types of waking reports are strongly correlated with certain sleep stages. When someone is awoken from REM sleep, at least 90% of the time a person is likely to report having just experienced a simulatory dream, one, in other words, where they were essentially hallucinating people and objects in a simulated world of their own devising. But the key point is that such reports occur quite often

when a subject is awakened, particularly if they have just had a recent REM period. What seems to be most critical to whether or not a dream is reported is *the general level of activation of the brain*, and the brain is generally but not always most active in REM sleep; but high levels of generalized activation can also be found in NREM sleep, particularly stage 2 sleep, especially at the very end of a night's sleep. One can imagine, though, that if we had a more sophisticated understanding of the underlying neurological states of the brain, we could determine exactly what neurological states corresponded to which kinds phenomenological reports. Then we could detect not only commonalities across phenomenological reports but also subtle differences between types of dreams, even within the same stage of sleep. We already can notice tendencies but the differences in reports from different sleep stages are a matter of percentages—there are still some reports that, based on the report alone, neither the dreamer nor the analyzer of the report could predict with surety whether the dreamer awoke from, say, REM sleep or stage 2 sleep late in the night.

It just may be that our current EEG-based method of typing sleep stages is too crude, necessarily missing crucial aspects of the underlying states of the brain. For example, we already know that EEGs have many limitations, including that EEGs only pick up electrical potentials detectable on a person's scalp. Thus, EEGs are only able to detect the outermost portion of the brain, the part directly next to the skull. EEGs are also a poor tool for picking up changes in the brain on a short time scale. In addition, EEGs of people during sleep are limited by the fact that, except in unusual set-ups, subjects are for the most part unresponsive to any inputs impinging on their senses, or if not unresponsive, at least not amenable to manipulation in a way that is very revealing about the overall state of a person's brain during sleep. For

example, it would currently be very difficult based on EEG alone to make any determination about a person's mental content, except perhaps in special lucid dreaming experiments that have used EEG data to provide a glimpse into a person's mental states during sleep. Thus, due to above limitations and other limitations of EEG measurement, it might be unreasonable to put too much stock in EEGs as a method of ascertaining the nature of mental states during sleep. Scientists continue to develop other real-time brain scanning technologies and no doubt some of these will someday be applied to the study of mental content during sleep.

The limitations of currently available brain scanning technology present an obstacle to our understanding today, but, as science and technology continues to advance, and even the rate at which breakthroughs occur increases, I think it overwhelmingly likely that we will arrive at better scanning technology, or, we will be able to be able to make finer distinctions between types of dreams using existing technology, thus allowing us to say, based on the evidence, that there are distinct sub-types of dreams, and these sub-types all correspond to quite different underlying neurophysiological states. Given what we know about the subtleties of our mental processes (during sleep or otherwise), and how minute changes in brain states lead to changes in phenomenological reports, it would be surprising if, even on an extremely fine-grained level, we found that people reported indistinguishable *types* of experiences when awoken from quite different types of neurological states. It may be that an identification of sub-types of dreams awaits a more sophisticated neuroscience. For right now, though, it is still a puzzle that somewhat similar phenomenological reports arise from subjects awakening from what, using current techniques, appear to be quite different underlying neurological states. Perhaps, however, because of the above-mentioned limitations of EEG technology with respect to

mental contents during sleep, we shouldn't be so surprised that we are unable to distinguish completely between dreams in one neurological state and dreams in another, since so much of our heterophenomenological judgment of the nature of a dream is based on a textual analysis of a subject's verbal reports.

4.3. The Function of Dreaming and the Function of Sleep

4.3.1. The Function of Dreaming and the Function of Sleep

What does it mean to say that dreaming serves a function that is distinct from the function of sleep more generally?

For dreaming to serve some function we would expect first of all that all human beings would dream (except perhaps for exceptional individuals with some pathology). And that is what just about what we find. All, or almost all, neurologically healthy individuals seem to dream. There are cases where individuals don't seem to dream and yet suffer no ill effects. There are, also, however, known cases of exceptionally rare individuals who don't *sleep* at all and yet who are otherwise completely healthy (and are not taking any medication). Allan Rechtschaffen has said, "If sleep doesn't serve an absolutely vital function, it is the greatest mistake evolution ever made" (Rechtschaffen, 1978 [attributed]; quoted by Walker, 2009). I don't know of any sleep scientist who argues that sleep serves no adaptive function whatsoever, and yet there are these exceptional individuals who don't sleep. Similarly, if there

are exceptional cases of people who don't dream and otherwise suffer no neurological deficit we cannot necessarily conclude from such exceptional cases that dreaming serves no function. (Of the few known cases of complete cessation of dreaming, almost all seem to suffer some deficit.) Still, if there are such exceptions to the rule that everyone healthy dreams, and these would need to be accounted for in some way, then that some people don't dream clearly represents some evidence against dreaming serving some crucial function.

Given that many people report having little or any recall of their dreams, how common is dreaming? Almost everyone probably dreams, even those who do not report good memory of having dreamt. We can infer this, because, when even those who claim extremely poor recall of their dreams are woken up immediately under experimental conditions and then asked to report on what was just going on in their mind, the vast majority of them report some kind of dream activity. Quite often, such subjects are very surprised to recognize that they do in fact dream. Most likely, typically their memories of their dreams simply fail to be encoded, so they have forgotten any dream mentation they may have had by the time they have fully awoken from a normal night of sleep in their bed. And there are many other factors that can affect dream recall, everything from amount of sleep to alcoholic drinking.

4.3.2. Some Desiderata for a Function of Dreaming

In saying that we are looking for a function for dreaming, what are we looking for? If found, the following criteria would provide support for the position that dreams provide some evolutionary function:

1) We can provide some scientifically plausible story about what function the adaptation serves. Our explanation at least initially might be only a convenient just-so story, but we at least need to posit some function that dreaming might serve; if we are unable to come up with any function dreaming serves, then we have little reason to adopt an adaptive explanation for why dreaming arose and/or why it exhibits the features it does.

Of course, a just-so story does get us very far; we need some reason for thinking these cognitive features of dreaming are actually adaptive, but, if we can't even construct a scientifically plausible story for why an adaptation has occurred, there is no basis for looking for how some dreaming-related gene or genes could have been selected for by evolution.

2) the function is a feature of human cognition that could have been selected for in the environment of our evolutionary ancestry.

Flanagan says,

> [A]n ideal evolutionary explanation is launched when we explain (1) how the trait in question is or at least was fitness enhancing, and (2) how it is that the particular ecological niche that creatures with the trait occupy, or occupied when the trait evolved, makes sense of why it is that the trait is, or was, fitness enhancing. (Flanagan, 2000, p. 116)

For example, there is no plausible way of arguing that the ability to read itself was selected for, because no writing existed for hundreds of thousands of years of the history of our species. Thus, the ability to read could have been no basis for selection. Of course, the ability of humans today to read could no doubt be a result of other mechanisms that were actually selected for, as was almost certainly the case. I will address why dreaming is fitness-enhancing in Section 4.5. In section 4.6, where I take up objections to the Combinatorial theory, I respond to concern that dreaming fit appropriately into its ecological niche.

3) It should be the case that is reasonable that the function of dreaming could have evolved incrementally. It might be the case that there is some single gene mutation that conferred significant selective advantage for the organism that carried it, but, when we look at the evolution of other human phenotypic traits, we find that phenotypic traits, especially ones as complex as dreaming, do appear magically on the scene in a one-off fashion. Instead, what evolutionary biologists typically find is a succession of genetic changes, each conferring some tiny adaptive benefit, thus allowing the genes for those traits to be selected for. The classic example is the adaptive function of the (human) eye: it is much more plausible that something as complex and functional as the human eye could have evolved if each step of the way a single genetic change provided a slight selective advantage. It is a feature of a theory for it to be plausible that the capacity arose in a stepwise fashion through a series of gene mutations over millions of years, as is the case in the evolution of the human visual system. Here we see that those who argue that dreaming in no way provides an adaptive function are effectively arguing that there has never been an allele selected for purely on the basis of its effect on dreaming. If

there were such an allele, that would mean that a gene that contributes to dreaming (and not sleep and/or sleep cycling) provided some selective advantage and, thus, dreaming is in some sense adaptive. Given the timeframe we are talking about (millions of years of evolution) and the minuteness of the change (a single allele selected for), I take the null case—no gene has ever been selected on the basis of any contribution it makes to dreaming—to be an extraordinarily strong position. One problem with Flanagan's account is that he is looking at dreaming as solely the kind of phenomenological froth on the top of the cognitive processes underlying sleep. Dreaming is epiphenomenal for Flanagan. But, Flanagan (2000) fails to account for how the cognitive process of dreaming is not simply the forebrain making the best of a bad job, trying to make sense of activation from the brainstem. Rather, the process of dreaming, and the adaptive function it serves stems from the very thought processes, some of which are conscious, that cause the pattern of dream thoughts. (This critique of Flanagan will be fleshed out in Section 4.5.) Looked at in this way, we will find that Flanagan's hard distinction between the following two types of genes is untenable: genes selected for on the basis of sleep and sleep cycling alone and genes selected for on the basis of sleep and dreaming. It turns out that the fitness-enhancing properties of dreaming are tied to the way that dreaming reprocesses the information we have encountered during waking and allows us to benefit from the information we have taken in during the day. However, we risk missing the functional advantage dreaming confers if we look for a targeted psychological function along the lines of a cheater-detection mechanism or a predilection for finding mates with certain features attractive. The cognitive-enhancing effects of dreaming are much more pervasive.

4) Ultimately, we need some explanation of how certain genes contribute to certain phenotypes. It is not surprising that we don't as yet have enough information to determine all the genes responsible for sleep, sleep cycling, and dreaming. The genetic basis for most phenotypic traits remains elusive. But, experiments revealing the cognitive benefits of dreaming point us in right direction to look for the genetic basis for dreaming cognition.

4.3.3. General Reasons For Thinking That Dreams Don't Serve a Function

The following are reasons for thinking that dreams do *not* serve an adaptive function. In other words, these are reasons for thinking it *unlikely* that dreaming is a cognitive capacity that was selected for in the course of human evolution. Any theory that posits a function for dreams should address at least these concerns. In answering why these objections can be overcome, I will outline desiderata that we would like any positive theory to have. A positive theory of dreams will either need to explain why either these reasons are mistaken or that they are not in fact a problem. For example, in the case of "Reason 1: We (Often) Don't Remember Our Dreams," the theorist who provides a positive view of the functions of dreams will need to argue either that we do in fact remember our dreams quite well or that, while it is true that we often don't remember our dreams, this point need not concern us, because dreams could still serve a function, whether we remember our dreams or not. Prima facie all of the following reasons present themselves as objections to the position that dreaming serves some function that was selected for in our evolutionary history.

4.3.3.1. Reason 1: We (Often) Don't Remember Our Dreams. (And We Need to Remember Our Dreams in Order For Them to Serve an Adaptive Function.)

How could a dream provide an cognitive benefit, one might ask, if a person has no memory of having dreamt it? How could dreaming play a crucial role in our cognition, when many neurologically healthy individuals apparently have no memory whatsoever of having dreamt, not just on any given night but at any point in their lives? There are no doubt many people who claim not to remember their dreams at all. How do we explain this?

The first thing to dispute about this worry is whether it is necessary to remember a dream in order for it to have a material impact on our subsequent cognition. Whatever adaptive function a dream may have, I argue it will need to have it even if we have no conscious memory of the dream, because it is true that a significant percentage of people do not remember their dreams. The exact percentages of people who remember their dreams vary widely from culture to culture, depending on factors as mundane as the average time spent asleep and the degree of cultural attention paid to dreams. Some cultures, for example, take an active interest in dream interpretation, such that almost everyone actively remembers their dreams. But we cannot assume that this cultural practice would have been in place over hundreds of thousands (if not millions) of years of human evolution, since some cultures throughout history have taken relatively little interest in dream interpretation.

One reason we don't remember our dreams may be because human beings are not consciously aware of their dreams at the time they occur. (I disputed this view in Chapter Two,

but I don't consider it impossible that our dreams are nonconscious.) Unless an individual knows of their experience through indirect means or through inference, most, if not all, of the intentional content we remember from our experiences we were once conscious of. (Examples of indirect means would be looking at one's facial expression on a video clip to detect what emotion they were feeling at the time.) Much of human cognition, though, including much of learning, occurs outside of conscious awareness. We might not remember our dreams because we were not consciously aware of them in the first place. But, why assume that one needs to be consciously aware of some cognitive process in order for it to facilitate our cognition on an unconscious level? Classic studies of priming show how during wakefulness our subsequent thinking and judging can be influenced by stimuli presented to us, whether the stimuli are perceived consciously or not.

Even though our dreams might have produced a lasting impact on our cognition, we might not remember our dreams because we have simply lost a way to access those memories that have already been encoded (Stickgold, 2009). If we had the right memory cue, then we could retrieve the encoded memory. This phenomenon likely happens at least some of the time. It is quite common for people to wake up and not remember a dream but, as they are going on about their day, to experience a sudden recollection of something they have dreamt about. Often a person is quite sure that this has happened—it is not just some vague impression. Because these experiences happen both when a person previously has memory of a dream and when a person does not, this suggests that the recollection is not entirely fabricated, assuming all dream recollections are not entirely fabricated, as some have argued (a view I rejected in Chapter Two).

Matthew Walker (2008) also talks about how in order to learn some kinds of things it may actually be more advantageous to not consciously remember them. There are many skills that are learned best consciously while many others are best learned unconsciously. We might think of what makes it consciousness as something that occurs on a "need to know basis". The vast majority of mental processing occurs outside of awareness. And, given the bandwidth of human conscious awareness, we could never be conscious of all of what we are thinking or perceiving at a given time. A good rule of thumb is that when our minds can perform some task or carry out some cognitive process without being conscious, we won't be; consciousness occurs primarily in cases where information needs to be globally available to multiple systems in the brain. It may be that the brain has effectively deemed it more efficient to carry on a process unconsciously—there is no need to add another level of representation of a thought in order to make it conscious, to take one construal of how thoughts become conscious.

Another reason why we might not remember dreams is that evolution has designed us so that we don't confuse our memories of what happened in our waking life with memories of our imagined exploits in dreams. For example, one of the proposed functions of dreaming is to simulate threats to our survival. By simulating such threats "off-line" while we are sleeping, it has been proposed, we might be better able to handle such threats were we to encounter them in real life. But, although it might be advantageous to simulate such threats in our dreams it might not be advantageous to have memories of such dreamt threats, because we might confuse the threats we actually face with the multifarious threats imagined in our dream simulations (Anissimov, 2008).

But the more basic point is that it is not at clear that it is necessary for a person to have conscious recollection of their dreams in order for their dream to have provided a cognitive boost. In fact, we see studies in which people have gained the ability to solve a problem, but have no conscious memory of having dreamt about the problem. But, in similar experiments, subjects are awoken at various times during the night and they report having dreamt about the problem. And those who report having dreamt about the problem do better than those who do not so report. Of course, the problem with such experiments is that we cannot, given current technology, know whether a person would remember if they were not intentionally awakened, and being awakened in this manner could bias a person towards remembering the idea or skill that is being tested. So we have a combination of two groups of people: the people in one group who get better at a skill after having studied it and then slept some time. And another group who, presented with the same skill task, show evidence of having dreamt about the skill during sleep. When we put those two groups together, it provides some support for the idea that dreaming about the skill may have added to their ability to perform the task.

4.3.3.2. Reason 2: Dreams Seem to Be Nonsensical

If dreaming has provided such a crucial selective advantage for homo sapiens, an advantage that has enabled them to survive and reproduce at greater rates, than why don't dreams make more sense? One might wonder: Why are dreams so weird?

First of all, a thorough study of the content of people's dream reports across all stages of the night reveals that dream reports are often much less weird than is commonly supposed. Many of our waking concerns are replayed in not too different form during our dreams. In

addition, we often remember the dreams that are most unusual, simply because they are the most unusual. One of the main reasons why people have the notion that dreaming is so weird is that most of the time one remembers a dream the dream one remembers is the one that has just occurred during the final moments of a night's sleep. Dreams at the very end of a night's sleep are the most likely to seem weird or fanciful to our waking mind. The longer a dream goes on, it seems, the more likely it is to evolve in a more peculiar fashion, as if successive iterations of dream thoughts are building up levels of weirdness. And dreams tend to be shorter at the beginning of the night, roughly getting longer as the night progresses. But, when people are woken up at different times throughout a night's sleep, we find that dream reports are often much more normal and prosaic than is commonly assumed (e.g., Domhoff, 2007). Apparently, much of our dream experience is quite similar to our everyday experience. Thus, we can determine the "relative weirdness" of dreams by waking people up at various times during the night and comparing the content of their dreams. To make the point that dreams are often quite ordinary is not to deny that dreams can often be quite odd, nor to deny that dreams even early in the night can be quite different from our waking concerns. But an argument that dreams are non-functional cannot rest on the point that our dreams are always, or even usually, radically different from our waking thought. As a companion to this thesis that dreams are often not as weird as many people think, it turns out that our waking trains of thought, upon examination, are often much weirder than is commonly acknowledged (Domhoff, 2007).

4.3.3.3. Reason 3: Dreams Don't Seem to Provide Any Obvious Cognitive Benefit

Note, that in arguing that there is no cognitive benefit this is not meant to apply to the indirect benefits that may potentially accrue from an exploration and interpretation of one's dreams. When I say indirect benefits, I am speaking of writing dream journals or investigating one's hidden motives and ideation by interpreting mental contents in dreams that arise from oneself but seem to have a different logic from one's ordinary, waking trains of thought. It might well be that such exploration of one's own psyche can provide insights into the inner workings of one's mind, and maybe even aid personal growth and promote recovery from psychological problems, as Freud himself thought. "The interpretation of dreams is the royal road to a knowledge of the unconscious activities of the mind," Freud wrote in his celebrated work" *The Interpretation of Dreams* ([1900] 1965, p. 604). Even philosophers like Owen Flanagan who have rejected the view that dreams serve an adaptive function still accept that engaging with the self-expressive content of our dreams can provide unique insights into our psyches.

But whether or not this indirect route may hold benefits to well-being, it is implausible that such personal dream investigation and/or interpretation could be the basis for the evolutionary selection of dreaming in human beings. Such exploration and investigation would almost certainly have to come after this faculty is in place, and, furthermore, it is even harder to discern a selective advantage to this type of dream interpretation.

This is not a knock-down argument. Science has often found subtleties in nature that are not at all apparent to our commonsense notions of the world. But dreaming does not present us with an obvious selective advantage. When giving examples of the benefits of dreaming, so

often people point to the same exceptional cases of some scientific or creative insight arrived at in a dream. If dreaming is functional, why don't such experiences of insight happen much more often than they do? If they did, it might seem much more plausible to argue that dreaming serves some crucial function in human cognition.

There are many stories that can be given about the evolutionary function of dreaming. But the advocate of adaptation can start with the fact that our ancestors realized some selective advantage because of the kind of dreaming that arose through genetic variation and selection.

4.3.3.4. Reason 4: Any Connection Between a Person's Phenomenological Report of Their Dreams and the Concomitant Neurophysiological Changes is Obscure

One of the most common functions of dreams that scientists point to is some kind of processing and consolidation of memories of experiences that occurred during wakefulness. But, Flanagan argues:

> [T]here is no phenomenological evidence that as electrical patterns are transformed into protein structures the associated mentation involves the activation of the thoughts worth remembering. People remember nonsense syllables better after sleep than if tested right after learning but before sleep. But to the best of my knowledge, people never report dreaming about nonsense syllables. Nor do students of mathematics work through the proofs of the previous day in dreams. It may well be that the proof of the Pythagorean theorem would go in one ear and out the other if we didn't sleep in between. But I would place large bets that one will have trouble getting any phenomenological reports of sophomore geometry students' dreaming through the steps of the theorem in REM sleep (although they may well worry about the imminent

> exam during NREM sleep). The point is that PGO [ponto-geniculo-occipital] waves are causally implicated in the neurochemical stockpiling of amines (serotonin, norepinephrine, etc.) and in setting acetylcholine to the task of bringing stability to what has been learned. But there is no reason, so far as I can see, to think that the content of the mentation initiated by the PGO waves is causally relevant to the process. (Flanagan, 2000, p. 118)

It is not necessary to posit that every single idea or skill can only be learned if it is consciously dreamt of; one need posit only that dreaming about some idea can and often does produce demonstrable gains in cognition. Moreover, those are gains that would not have been likely to occur simply as a result of a period consolidation during wakefulness—a person needs to simulate the experiences in their dreams to gain the full cognitive benefits. So pointing to a couple intuitive cases where dreaming may not have an effect does not establish that dreaming is not an adaptation. Flanagan has argued that sleep and sleep cycling has a function but dreaming per se does not. But if dreaming experiences contribute to significant advantages in cognition then we are well on our way to finding some reason why dreaming as it exists in humans might have been selected for in the process of evolution. Furthermore, Flanagan's example of a student thinking about the Pythagorean theorem, which Flanagan puts forth as a case of unlikely occurrence, actually illustrates a common theme in dreams, a point also made by Deirdre Barrett (2007). The truth is that it is not at all uncommon for math students to dream of math problems during the night. Deirdre Barrett argues as much as well, also pointing out in response to Flanagan's geometry student example that the mathematical genius Ramanujan "says all his mathematical proofs came to him in dreams" (Barrett, 2007, p. 138). (Nothing stands or falls on the truth of this anecdote but it is suggestive.) And this should not be taken to indicate that it is only genius mathematicians who dream about math. Roughly

speaking, the more a person thinks about mathematics during the day the more likely he or she will dream about it at night. (The chances of math occurring in a dream are presumably much lower for a high school sophomore who daydreams throughout class than they are for a graduate student working on her dissertation, but the point remains: math students dream about math quite often; and, of course, the vast majority of dreams are not consciously recalled, but that doesn't mean that the process of dreaming about them hasn't had a material impact on our cognition concerning certain ideas. Tests show that dreaming about something often does have quite a big positive impact on a person's cognitive abilities in some areas. And, sometimes, there are likely pieces to the puzzle that are dreamt but that don't fall under the case of having, strictly speaking, dreamt about the experimental topic per se. Once again, the vast majority of dreams we have no recollection of. And, this forgetting may have been designed by evolution so that we would not confuse real experiences with our dream experiences (Anissimov, 2010). In addition, some things we learn quite well without ever being consciously aware of the process of learning them. It might well have been advantageous in some respects to remember dreams, but it may have been that many pieces of knowledge were best learned without the same kind of encoding of memories that occurs for us in waking life. I will say more about the cognitive benefits of dreaming in section 4.5., where I put forward my positive view of the adaptive function of dreaming. Finally, the most relevant experiments to illustrate this point occurred some years after Flanagan wrote his major work on dreams. (And I am not aware of an update to his position in print.)

Antti Revonsuo argues for the threat simulation theory of dreaming. Dreaming evolved as a means of simulating threats that a creature could face in real life. There is some evidence

to support this theory. A significant percentage of dreams involve the simulation of such threats, broadly construed. And Flanagan's point that high-school geometry students are unlikely to dream about the Pythagorean theorem does nothing to discount the possibility that we may be enacting species-specific threats, or other kinds of stimuli if appropriate.

4.3.3.5. Reason 5: Some Drugs People Take Result in Them Experiencing Little or No Dreaming

How can dreams provide such a crucial cognitive benefit, if people can take drugs that seem to result in them ceasing to dream, without the drugs having any ill effects? (Of course, the drugs can even have positive effects, which is the reason for taking them.) In other words, if dreaming is so important, why aren't people harmed when they take drugs that suppress the experience of dreams?

Here I think it warranted to claim that, while evolution might have selected for us to have certain kinds of dreams, evolution could not have anticipated the ways that we would modify our bodies through the use of drugs. Once we introduce foreign, engineered substances into people's bodies, we can no longer assume that bodies are acting according to the way they have been designed by evolution. For example, we know that surgeons can administer immunosuppresants to diminish the chance that a person's body will reject a transplanted organ. It is the natural role of the body to activate the immune system in order to fight infection by bacteria, but that natural and healthy response, which was no doubt designed by evolution, can be suppressed for the benefits of an organ transplant. Analogously, we can imagine a drug being invented that removes the need for sleep. The United States Defense

Advanced Research Projects Agency is hard at work trying to come up with such drugs in order to improve soldiers' stamina. And, current drugs such as modafinil have been shown to allow soldiers to function at normal levels despite being deprived of a night or more of sleep. Through the taking of modafinil, we see neurochemical engineering of the body's responses. If DARPA were to devise an extended version of a drug like modafinil, and this drug allowed soldiers to essentially go without sleep indefinitely long, then we would have a case of a drug that subverted the naturally designed functions of sleep, apparently without ill effects. It may be that dream-suppressing drugs like SSRIs (selective serotonin reuptake inhibitors) are analogous to long-lasting versions of these sleepiness-suppressing drugs. These drugs are suppressing the need for sleep, despite it being clear that sleep performs some necessary function. But, even with drugs such as SSRIs, the effects on dreams are complex. Some people on SSRIs report stronger and more intense dreams on the drug, an illustration of why it is hard to say with surety the effect on dreams of any particular drug.

The fact that such a drug could be discovered and implemented with the above results does not negate the fact that sleep provides some functional benefits that were selected for by evolution. Once artificial drugs are put into the equation of human neurophysiological processes, we cannot be certain of what conclusions to draw about what is necessary in the body.

In the case of dreaming, it may be that the brain is able to derive the same benefits that come from dreaming, but it does so without needing to dream in the typical way engaged in by drug-free individuals. There are precedents for such results.

It could be that these drugs are having ill effects that we don't realize they are having. But, a review of the literature indicates that many people on drugs that suppress dreaming seem to be doing just fine. Although people can continue to live apparently healthily despite taking dream-suppressing drugs, it is nevertheless not uncommon for them to experience a severe rebound in dreaming as soon as they go off the drugs.

4.3.3.6. Reason 6: Some Rare Individuals Don't Seem to Dream At All. And in at Least a Few of Cases These People Seem to Suffer No Neurological Ill-Effects

I have maintained that it is likely the case that even those who say that they don't remember their dreams probably do in fact dream, since it is common for people who say they don't dream to be able to recall their dreams when they are woken up in the sleep lab under the right conditions. But, there do exist extremely rare individuals who don't seem to dream at all, and yet they appear to suffer no ill-effects. If such people exist, and if they in fact suffer no ill-effects, then these facts speak against dreams providing some essential function in human cognition. Why don't such people exhibit serious cognitive deficits as a result of not dreaming? Or, even if dreams do not provide some essential function, how do we explain how almost everyone benefits from dreams while at the same time there exist those who fail to dream and suffer no ill effects?

Here I would appeal to some of the same considerations as the drug cases above. In almost every known case where an individual suffers from loss of dreaming, the person experiences some cognitive or emotional impairment along with the cessation of dreaming. Of

course, some third cause might be responsible for the loss of dreaming and the loss of the cognitive capacity, but the cognitive deficit could also derive in some cases from the inability to dream.

4.3.3.7. Reason 7: Dreams are Non-Functional Spandrels

The argument that dreams are non-functional spandrels, as opposed to functional adaptations is more subtle than the previous reasons for doubting dreams serve an adaptive function. Flanagan puts forward the following argument:

> My thesis is this: Sleep and sleep-cycling is an adaptation for the multitude of reasons given—it restores, conserves, and builds; and we can specify some of the specific things it does and the mechanisms these are done by. But there is good reason to be positively dubious about the adaptive significance of the phenomenal experiences that supervene on REM and NREM sleep. Dreaming, broadly construed, is pleiotropic, an automatic sequela, a spandrel. It is doubtful that dream consciousness once in play as a sequela of causal processes originating in the brain stem that tickle the visual areas producing REMing was subjected to positive selection pressures and modification. That is, it is doubtful that dreaming is an exaptation.
>
> So dreaming is not an adaptation, and it is not an exaptation. What then is it? There is only one possibility. Dreaming is a spandrel. Dreams are the spandrels of sleep.
>
> Perhaps I can put the point in a kinder, gentler way. The brain-stem is designed to activate the visual system to finish building it during the first year of life. All the evidence from animals like humans that REM a disproportionately

> large amount of time as newborns points to some sort of developmental function: dedication to the project of completing the visual system. However, once the system is built, the continuation of the activation of the visual system serves no obvious further developmental function. Furthermore, whereas the PGO waves of REM sleep are implicated in the processes of stockpiling neurochemicals for the next day's work, for making what is learned more stable so that it can be remembered, and possibly for trash disposal, there is no reason to believe that these jobs require mentation of any sort. (Flanagan, 2000, p. 117)

There are two problems with this account: first, it rests on an outmoded understanding of the neurological processes underlying dreaming, and, second, it fails to take into account recent experiments that have demonstrated a cognitive benefit that accrues exclusively as a result of having dreams with certain intentional contents (e.g., subjects dreamt that they were navigating a video game maze). And, importantly, this benefit was not found over the same period of time for the group who remained awake throughout (even when the waking time included time spent thinking about the task). And, furthermore, most importantly, this cognitive boost was also not found in those who spent roughly the same amount of time asleep but who reported no dreams with the relevantly similar intentional content.

When we study whether people's dreaming about some puzzle or task from their waking life has any cognitive benefit, we find that it often does. It is only through controlled experimental tests on dreaming that we can ascertain whether there is reason to believe dreaming has an adaptive function. Although many scholarly studies of dreaming have been done, all too often the study of dreaming has been a catalogue of what happens during dreaming. These kinds of analysis are fascinating but they do not advance research on the

question of the adaptive function of dreaming. Many more of the most potentially revealing kinds of experiments should be performed. Here I am thinking of experiments where some intervention (e.g., a video game) is introduced during waking, and subjects go to sleep and are then awoken to see if they dreamt about the intervention. Then subjects should be tested to see if those who dreamt about the intervention performed better than subjects who did not. But, as I said, the studies of this kind that have been performed have found cognitive benefits. In section 4.5. I explain why these finding cognitive benefits make sense and also why in some cases we find such large effects. I also explain why it is reasonable to expect that under the right experimental conditions we would find even larger effects. If Flanagan is right about dreaming being a spandrel, I submit that we wouldn't find such significant cognitive benefits as a result of subjects dreaming about some tasks when we don't find such benefits when subjects just slept without apparently dreaming about the tasks. But we do find such effects, so dreaming is not a spandrel.

Flanagan rightly points out that Mark Solms has shown, via his investigation of 112 patients with global cessation of dreaming (Solms, 1997; Flanagan, 2000), that dreaming and REM sleep are doubly dissociable, meaning that REM sleep can occur without dreaming and dreaming can occur without REM sleep, but Flanagan has not recognized another component of Solms's clinico-anatomical research: the process of dreaming is driven by forebrain activation mechanisms, and, thus, the content of dreams is not driven by "dream consciousness once in play as a sequela of causal processes originating in the brain stem that tickle the visual areas producing REMing" (Flanagan, 2000, 117). Solms and Turnbull describe Solms's research:

> The method involves systematic correlation of mental functions that are changed (clinically) with (anatomical) damage to particular areas of the brain. The goal is to establish lawful (clinico-anatomical) correlations between the different mental functions and the different parts of the brain. Such correlations…teach us a great deal about the underlying organization of the mental apparatus. (Solms and Turnbull, 2002, p. 59)

Even J. Allan Hobson, principal advocate of the updated version of the model of dreaming Flanagan is advocating, has changed his stance to accommodate the crucial role played by forebrain activation of the goal-seeking systems in the brain driving the process of dreaming. Once we accept that dreaming is driven by forebrain seeking systems in the brain we can begin to get a very different picture of the selection pressures that have been acting on dreaming over our evolutionary history. Further evidence of this new understanding of the cognitive processes underlying dreaming comes from Solms's evidence about the neuroanatomical basis for dreaming. Brogaard writes:

> Patients who have suffered damage to the ventromesial quadrant of the frontal lobe (this is the part of the brain responsible for motivation, the part that initiates goal-oriented behavior) do have REM sleep, but have lost both the ability to dream and the motivation to do anything.
>
> The ventromesial quadrant contains the dopamine pathway that transmits the neurotransmitter dopamine from the middle of the brain to higher areas. Dopamine is a reward chemical required for motivation. Without dopamine people don't do anything on their own, even though they can do almost anything you ask them to do. Mark Solms ("The Interpretation of Dreams and the Neurosciences," 1997) noticed that the two areas of the brain that underlie dreaming are both in the cerebral cortex, one (as just mentioned) is

> responsible for goal-directed behavior and the other is responsible for spatial cognition.
>
> Further evidence that dreams don't originate in the pons: People who are given dopamine or other drugs that stimulate the dopamine pathway (such as the drug L-DOPA used for people with Parkinson's disease) have more vivid and more frequent dreams. But these drugs have no effect on REM sleep. (Brogaard, 2011, p. 29)

When we add to this updated account of the nature of the process of dreaming the extensive evidence showing that certain kinds of dreams produce cognitive benefits, we can see how, far from the forebrain "making the best of a bad job," as it was once put by Hobson and McCarley (1977) in their classic exposition of the activation-synthesis model of dreaming, the process of dreaming is driven by the same kinds of goal-seeking, motivational areas responsible for the same in waking. Hobson and McCarley wrote:

> the forebrain may be making the best of a bad job in producing even partially coherent dream imagery from the relatively noisy signals sent up to it from the brain stem. The dream process is thus seen as having its origin in sensorimotor systems, with little or no primary ideational, volitional, or emotional content. (Hobson and McCarley, 1977)

Although we know now this model of dreaming to be inaccurate, owing to neuro-anatomical findings by Solms, Flanagan's arguments rely on this flawed understanding of dreaming. And it is an understanding that makes it seem more plausible that there would be no selection pressures on dream cognition. In order to argue that dreaming is a non-functional spandrel, Flanagan needs to argue that dreaming is an evolutionary sequela of adaptations for sleep and sleep cycling. Take away the above basis for understanding how dreaming works and we have

much less of a reason for thinking dreaming to be a non-functional spandrel, especially given the scientific evidence supporting the cognitive benefits of dreaming about certain tasks.

4.4. Potential Functions of Dreaming

4.4.1. The Functions of Dreaming

Despite the above obstacles to establishing a function for dreaming, many theorists have proposed such functions. Here, as Flanagan (2000) points out in this context, "function" here means adaptive function, meaning that dreaming cognition has been selected for in the evolutionary history of our species; it is not simply that dreaming plays some role in our cognition, but rather that our ancestors evolved the capacity to dream in the way we do today because doing so allowed them to reproduce at greater rates than those who lacked the genes responsible for this faculty. Any explanation of the function of dreaming that fails to account for dreaming as an evolutionary adaptation in this way will be severely limited in its explanatory purchase. Having said that, little is known about the genetic underpinnings of dreaming. Still, we can provide rational scientific and philosophical arguments for why we should or should not expect to find that genetic selection specifically for aspects of dream cognition has occurred.

My treatment of the proposed functions for dreaming can hardly be exhaustive. Some hypotheses about the function of sleep and sleep cycling are obviously intimately tied to the nature and function of dreaming, but, to limit my purview, I am looking at cognitive gains that

are likely only to have accrued as a result of having dreamt about certain skills or ideas. My focus aims to counter Flanagan's worry that the intentional content of our dreams just doesn't seem to be of the right kind. I aim to present an up-to-date reference for the strongest arguments for theories of the function of dreaming. I will address the theories in outline fashion and point out inconsistencies in the arguments and places where the evidence does not justify the conclusions that have been reached. In some cases, the theories are suggestive, but more evidence is required to justify belief in such theories.

After explaining the current proposed explanations for the function of dreaming, I will explain why the Combinatorial Creativity with Selective Retention and Elaboration theory of dreaming is the most well-supported theory of an adaptive function for dreaming. The theory offers itself as the best explanation of the scientific evidence available to us concerning the function of dreaming. As I have said previously, some of the theories of the function of dreaming are not mutually exclusive: the combinatorial creativity with selective retention and elaboration theory may be true, but so might other theories as well. I only consider that, given a proper understanding of the question of the function of dreaming (and not simply the function of sleep and sleep cycling), the combinatorial creativity theory is a consistent and accurate part of the picture of human dreaming and one that helps explain the adaptive function of dreaming.

4.4.2. The Default Position: Dreams Do Not Serve an Adaptive Function

Unless we can prove why dreaming provides some selective advantage, we can only assume that dreaming is a spandrel. The term spandrel is used to describe a trait that exists as a concomitant feature of some other trait that *was* selected for, but that itself was not selected for. Classic examples are the sound of heart was not selected for but rather only came along with the adaptive function of the heart: to pump blood (Flanagan, 2000). I'll reiterate that all I can provide at this point are compelling arguments for why dreams serve an adaptive function, arguments consistent with the scientific evidence. The true, underlying genetic basis for dream cognition is not presently known. But philosophical and scientific arguments—ones that go beyond just-so storytelling—can show us why we should expect there to have been selection for dreaming in the course of evolution.

4.4.3. Memory Consolidation

The idea that dreaming serves a role in memory consolidation sounds plausible so far as it goes, but this hypothesis needs to be focused. Numerous scientific studies of sleep have shown the benefits of improved memory consolidation after a night of sleep (e.g., Walker, 2009; Walker and Stickgold, 2004; Stickgold, 2005; Stickgold and Walker, 2005; Walker and Stickgold, 2010; Diekelmann and Born, 2010). Different gains are evidenced depending on what stages of sleep a person passes through and for how long, But even naps, whether they contain NREM sleep or NREM and REM sleep, have been shown to aid memory consolidation. In the most basic form of the experiment, subjects learn some new skill or facts and they are tested again on those facts after some period of time. Typically, there are two groups of subjects. Both groups of subjects

learn the facts or skills at the same time; then, one group is retested after a fixed period of time over the course of which they have slept, while the other group stays awake. There are variations, but typically the time is fixed. For example, in an experiment, one group of subjects (the waking ones) is tested at 10am and then again at 10pm, whereas, the sleeping group might be tested at 10pm and then again at 10am the next day. To account for circadian effects, in some cases, subjects learn a task at night and are sleep deprived so both groups have to take the test or perform the tasks at the same times in the beginning and the end. In numerous cases, those who slept after being exposed to information recalled it at higher rates than those who were awake for the same amount of time between learning and retesting. There are numerous permutations wherein sleep provides memory consolidation benefits, whether from a night of sleep or even short naps. And different gains are evidenced depending on whether subjects entered REM sleep or not.

For our purposes, though, we are most concerned with cases where subjects report dreaming about certain kinds of experiences. And, more specifically, the most significant studies are those in which subjects who slept but don't report dreaming about the topic fail to improve, whereas the subjects who report dreaming about the topic report as much as a 10-fold improvement in their ability to do some task, in the case of this study, to navigate a video game maze. To say again, those subjects who dreamt about what they had learned performed 1000% better on a task than those who did not report dreaming about the task (Walmsley and Stickgold, 2010). Often the results are not as dramatic, but the gains are still significant.

So one question is: Despite these robust effects for sleep on memory consolidation, does it make sense to say that sleep performs myriad critical adaptive functions but dreaming is a non-functional spandrel? Often, the scientists themselves claim to have found a function for dreaming, but wherever they have done so, Flanagan (2000) deems such cognitive benefits to be a result of sleep and sleep cycling but not dreaming. A distinction central to Flanagan's argument is that dreaming is a concomitant feature of adaptations that were actually selected for. For example, the sound a beating heart makes was itself not selected for, but the actual adaptive function of the heart, namely to pump blood, was selected for. I take it that we can only attribute a function to dreaming per se (as opposed to just sleep or sleep cycling, or even REM sleep) when we can say that we have reason to believe that dreaming *about* some intentional content provides some adaptive benefit. So memory consolidation may be a good start for theorizing about the function of dreaming, because there seem to be clear cases of improved memory as a result of sleep, with different gains derived from NREM sleep as opposed to REM sleep, and in contrast again to a whole night of sleep, which for typically healthy individuals would consist of several periods of cycling through NREM sleep stages 1-4 followed by REM sleep, the cycles continuing throughout the night.

Simply pointing to some gain in memory as a result of sleep, though, is not enough to be decisive about a function for *dreaming*. Finding a function for dreaming per se says that a person experienced dreams with intentional content of a certain kind, and, by doing so, gained some cognitive benefit as a result of dreaming certain thoughts. And this cognitive benefit might reasonably have provided a selective advantage over the course of evolution. And,

furthermore, it should be a benefit that wouldn't reasonably accrue without having fallen asleep and dreamt of the relevant content.

We might think that we could say that if a subject underwent a period of REM sleep, then they almost certainly dreamt, since subjects report a dream over 90% of the time when they are awoken from REM sleep. While I think this could provide evidence of a function for dreaming, I intend to argue for the stronger position that dreaming specifically with some intentional content provides a cognitive benefit that wouldn't occur from wakefulness or from sleep with dreams without the appropriate intentional content, even if it were REM sleep. (I will explain in Section 4.5. how several experiments support this position. The problem is that, although the ones that have been done have supported the role of dreaming, not enough of the proper type have been performed.)

4.4.4. Threat Simulation Function of Dreaming (Revonsuo)

In a paper co-written with Valli, et al., Revonsuo writes:

> The threat simulation theory of dreaming (TST) states that dream consciousness is essentially an ancient biological defence mechanism, evolutionarily selected for its capacity to repeatedly simulate threatening events. Threat simulation during dreaming rehearses the cognitive mechanisms required for efficient threat perception and threat avoidance, leading to increased probability of reproductive success during human evolution. (Valli et al., 2005)

Perhaps more than any other theory of the function of dreaming, Antti Revonsuo's threat simulation theory addresses head on the criticism that theories of the function of dreaming do

not explain what adaptive function would have been selected for in the process of evolution. For an organism, if it were able to simulate threats it might experience and thus allow them to avoid or handle such threats, such a benefit fits inescapably into the logic of evolution.

The threat simulation theory of the adaptive function of dreaming is consistent with what Revonsuo plausibly argues is the brain's primary task:

> On the whole, the brain's primary task is to find safe trajectories across the organism's behavioral space and to guide the organism along those trajectories to goals that promote survival and reproductive success. (Revonsuo, 2006)

In the major studying testing the validity of the theory, it was found that children living in the threatening environment of Palestine had more dreams involving the simulation of threats than did Finnish children of the same age (Revonsuo, 2000). But this study is open to the criticism that simply finding correlations in the degree to which individuals (children or otherwise) dream about threatening events, while consistent with the theory, doesn't provide clear evidence that dreaming about threats offers some measurable cognitive benefit, especially a benefit that actually makes individuals more reproductively fit. One might even think that the children might even be *more* rather than less traumatized by having such horrible dreams. (I believe I may have come across this point in the literature on the threat simulation theory, though I can't recall where.) All in all, the theory makes some intuitive sense given that the most common emotion in dreams is anxiety and that threats are a common theme in dreams, but I am not aware of any studies that have shown some measurable boost in ability to handle threats, or even a cognitive boost of any kind, as a result of simulating any threats. Admittedly, this is one

area that is difficult to test because of the ethical issues involved in testing peoples abilities to encounter threatening environments.

4.4.5. General Simulation Theory

To my knowledge, the psychiatrist Jonathan Winson (1985) is the first person to have developed the theory that the adaptive function of dreaming is to simulate experiences that would provide an organism an advantage should it ever encounter relevantly similar experiences during its waking life. I am not sure why Revonsuo does not make mention of Winson's earlier theorizing about the simulatory function of dreams, but we might interpret Winson's theory of the function of dreams as a more general simulation theory of the function of dreaming. Revonsuo's threat simulation theory of the function of dreams could be seen as a special case of the more general function of simulating species-specific drives during dreaming.

Winson's theory relies heavily on the role of the theta rhythm, which occurs during REM sleep and which is thought to play an active role in learning and memory tasks. The theta rhythm is a oscillatory rhythm of brain waves function detectable on the EEG with a frequency between 4 and 7 Hz (Vertes and Eastman, 2003).

As has been recognized by Christos (2003), Winson's theory is limited by its identification of dreaming with REM sleep, two processes we have that Mark Solms has shown to be doubly dissociable. Much more research needs to be done on determining what the cognitive benefits are of dreaming and how these might differ irrespective of whether the

dreaming occurs in REM or NREM sleep. Also, dream phenomenology does not jibe well with a purely simulation-based account of the function of dreaming. Human dreams often don't involve simulating species-specific drives in a way that would seem to make people more straightforwardly reproductively fit as a result of doing them.

4.4.6. Problem Solving (Barrett)

Deirdre Barrett has put forward arguments that dreaming serves an adaptive function. The function of dreams, according to Barrett, is "problem solving" (e.g., Barrett, 1993, 2007). I am sympathetic to many of Barrett's considerations. The differences between her theory and the combinatorial theory are somewhat a matter of emphasis: I believe the combinatorial supports a theory of the function of dreaming that would not be restricted to "problem solving," as that usage might be taken to mean solving well-defined puzzles of the type so often pointed to by Barrett in her accounts of dream creativity.

Barrett points to numerous studies that have shown that people can gain scientific insights after having been exposed to problems and then "sleeping on them". Much of her theorizing, however, is open to the criticism that she hasn't sufficiently distinguished between the cognitive benefits of dreaming as opposed to sleep in general. It seems a mischaracterization to call the various gains achieved as a consequence of dreaming as all "problem solving". It seems to me mistaken to take as the null hypothesis that dreams never solve problems. Barrett writes, "The idea that dreams never solve problems has never been disproven" (Barrett, 2007). This strikes me as erroneous reasoning, committing the fallacy of

appeal to ignorance and a bit of a straw man. Almost no serious dream researcher would deny that cases occur in which a person sets his or her mind on a specific problem and has a dramatic insight during the night. Such cases abound. But saying that there are dreams in which a problem solving insights occur is quite different from saying that the function of dreaming is to solve problems *simpliciter*.

In reply to the criticism that dreams are often not remembered, Barrett writes:

> One common objection to the idea that dreams contribute to any kind of thinking, much less problem solving, is how little of their content is remembered. But it may be that the most important dream insights wake us up and, therefore, are retained. It is at least the subjective perception of many people describing breakthrough dreams that the dream content awakened them much the same way nightmare suffers [sic] believe nightmares do. (Barrett, 2007, p. 145)

I believe the function of problem solving fits into a larger pattern of generating and testing ideas, with selective retention of further associated ideas, with further elaboration. All of this occurs in some narrative format with an associative process we don't as yet at understand. Barrett focuses on the rare breakthrough insights of scientists and artists, but most people don't set out to solve problems like these extraordinary individuals, although they may be capable of doing so. I believe Barrett's formulation focused as it is on a kind of conscious rehearsal and motivation to "solve problems," especially the kind of intellectual problems she often points to, is unlikely to have been the driving force behind the process of the evolution of the function of dreaming. She also points out, though, that dreaming could still serve a function without being remembered, a point with which I agree.

4.4.7. Different Proposed Functions for Dreaming are Not All Mutually Exclusive

There is an obvious sense in which many of these theories of the function of dreams overlap—they are not mutually exclusive. So, in giving my own view about the adaptive function of dreaming, I can't say that, if my position is correct, that this necessarily knocks out the truth of one or more of these other theories. Threat simulation, for example, might be one of the functions the brain is performing during sleep. I have chosen the above theories out of numerous others because I believe they all offer pieces to the puzzle of the adaptive function of dreaming.

I have unfortunately had to omit some theories that present plausible arguments, but I don't believe these other theories are as well supported by the data as the Combinatorial theory is. For example, a preponderance of evidence suggests that sleep as a whole plays an important role in emotional processing and recalibration. Rosalind's Cartwright's work in *The Twenty-Four Hour Mind: The Role of Sleep and Dreaming in Our Emotional Lives* (Cartwright, 2010) is suggestive: she shows evidence that, for example, divorced people who dream about their ex-spouses seem to exhibit therapeutic benefits as a result of such dreams, but it is difficult to disentangle cause and effect here, and emotions in general are a difficult area of study. It is difficult to disentangle what specific role is played by experiencing dreams with certain emotions, as opposed to simply showing that sleep as a whole has a therapeutic effect.

4.5. The Combinatorial Creativity with Selective Retention and Elaboration Theory of the Function of Dreams and the Arguments For It

4.5.1. Cognitive Benefits of Dreaming

Here are some considerations that we might take into account in considering whether dreaming serves an adaptive function

1) When a person dreams a dream with some reported content, does their cognition in some respect improve after having reported a dream with that content?; the improvement should occur only when a person dreams about that content and should not occur after an equivalent time awake.

Here the combinatorial theory does quite well insofar as it has been tested.

2) When a subject doesn't dream about the specific content, insofar as this can be ascertained, the subject should not show improved cognitive ability with respect to the task.

The combinatorial theory passes this test as well.

3) The more a person has dreams with certain content the greater cognitive benefit might be demonstrated.

Here there is not enough data to support this desideratum. But, it is an area of study that we should pursue: it might be that not only does dreaming about some specific content result in an appropriate cognitive benefit, but the greater amount of dreaming

with the appropriate content, the greater the cognitive benefit (again insofar as this may be ascertained, which, given current methods is not feasible). On the other hand, a confounding factor is that it can often be the case that those who dream *more* about certain contents might be *less* skilled than those who don't dream about such contents (e.g., Stickgold et al., 2000). Individuals who are already skilled at, say, a video game task are less likely to dream about the video game than those who are new to the game and find it challenging. This kind of additive effect of more dreaming will be hard to gauge. What does it mean to dream *more* about some content? It might mean a greater number of appearances of certain content in dream reports over the course of several awakenings or, perhaps, better scanning technology could eventually reveal on a more fine-grained level the contents of certain dreams even without a waking verbal report. Of course this last scenario is more speculative, but it is perhaps a reasonable long-term extrapolation from reconstruction of perception using current scanning technology (e.g., Nishimoto et al., 2011). So far as I know, though, there is no evidence of more dreaming resulting in more learning.

As mentioned previously, the gold standard for scientific experiments concerning the function of dreaming are experiments in which subjects are presented with certain kinds of controlled stimuli in experimental conditions and then they are woken up to see whether they report dreaming about the same or closely associated stimuli.

Scientists have performed many studies where they presented specific stimuli to subjects and the only test has been to see if subjects incorporated such stimuli into their

dreams. Often stimuli presented during wakefulness appear in dreams, but not enough tests have been done to determine whether subjects get a cognitive boost from dreaming about tasks. I suspect a lot depends on how interesting, exciting, challenging etc. the stimuli presented are. Too often in early studies of dreaming, tests were done where subjects recapitulated certain stimuli in their dreams but there was no sound theoretical basis for concluding what this fact meant. Such tests revealed relatively little about why people might dream about certain waking thoughts from the previous day or days. (Often subjects will not dream about some stimuli until after a time lag anywhere from a day or two up to a week—no one knows why exactly.)

Many studies have been performed where subjects were presented some specific puzzle or task and were then tested to see if they performed better after having *slept*, but most of these have not looked at whether subjects dreamt about anything specific. But scientists have performed relatively few studies in which subjects are presented some experimentally controlled task (e.g., a video game) and then they are awoken to see whether they dreamt about the task, and, furthermore, then subjects are retested some time later on the task, and, most importantly, the abilities or knowledge of those who report dreaming about the task are compared with those who slept but do not report dreaming about the task.

As always in dream studies, there is always the problem of determining when and to what degree people have actually dreamt about the appropriate content. Currently, scientists can only wake people up at various times during the night and ask them. Inevitably, certain dreams will be missed. We can only extrapolate, based on observed data, at what rates

dreamers are likely to be dreaming about certain intentional contents. Any fine-grained understanding of their exact thoughts during sleep remains elusive. (Most likely, scientists will in the future explore such tasks during lucid dreams.) Video games, especially certain kinds of video games, show up in people's dreams quite often. It is also not hard to imagine that we have yet to hit on the most compelling stimuli for the brain to redramatize again in some form while we are asleep. Now that we understand that the goal-seeking mechanisms in the forebrain are what drive the process of dreaming, it makes sense that exciting video games—where a gamer is constantly excited and challenged to achieve some goal—are exactly the kinds of stimuli most likely to be incorporated into dreams. It is also nice that video games, given their levels and point systems, are ideally suited to testing whether a cognitive benefit has accrued as a result. These considerations suggest that the use of such games will be an exciting area of research in the next decade and beyond.

Of course, related to the above question of ascertaining whether a person actually dreamt about the game, there is the added question of how well reported contents of the game in the dream match the content of the gameplay. But, often, at least in the case of some of the video game experiments, there seems to be a tight connection between the waking stimuli presented and the dream contents reported. We even find cases of amnesiacs who have no memory of playing games (e.g., the video game Tetris) who report dreams with exactly the same kinds of falling block figures seen in the game Tetris. They describe these figures with a specificity and a frequency that is extremely unlikely to occur by chance alone (Stickgold et al., 2000). These amnesiacs don't have any memory of playing the game, so they have no sense of why it should be predictable that they would dream of objects moving in the exact same way

the objects move in the game. (In the game Tetris players are tasked with rearranging falling objects to fit before they hit the bottom of the screen. The falling objects consist of various arrangements of colored blocks.) We don't yet have enough of a basis to explain why certain types of video games are more likely to be incorporated into dreams than others. But we could learn a tremendous amount out about how dreaming works and how the mind in general functions if we could figure out which types of games are most likely to be incorporated into dreams. Added to this knowledge, it would be exciting to find out based on this information what kinds of cognitive benefits are most likely to accrue as a result of dreaming about how to perform well in the games.

4.5.2. Dreams and the Power of the Generate-and-Test Model

As Stickgold (2010) has emphasized, the work of the dream is not only on working on consolidating the memories of the day or the week. During dreams, it is clear that there are rich patterns of associations. The quest for an interpretive theory of dreams has been to try to uncover the nature of the links between those associative patterns. I don't believe that we have enough information to explain the nature of those associative patterns. We do know that the mind engages in more extensive associative thinking in REM sleep, a state out of which people report dreams over 90% of the time. Well, according to the Combinatorial theory, that is exactly what we would expect to see as the brain tries to fit new information into the larger space of concerns, making connections between disparate concerns. The "combinatorial" in the

combinatorial theory comes from the way the brain tries out ideas during sleep. The combinatorial theory of dreaming has a lot in common with the way Dennett describes "Gregorian creatures" in his book *Kinds of Minds* (Dennett, 1996, p. 83-93).

In Dennett's book, he puts forward a framework for understanding "the various design options for brains, to see where their power comes from. He calls it "the Tower of Generate-and-Test. As each floor of the Tower gets constructed, it empowers the organisms at that level to find better and better moves, and find them more efficiently." Andy Clark explains the framework quite well:

> Intentional systems, however, come in a variety of shapes and forms. In particular, Dennett likes to distinguish among what he nicely dubs "Darwinian," "Skinnerian," "Popperian," and "Gregorian" creatures. Darwinian creatures come in many forms. The most basic are the simple, hardwired variety, whose ecologically adjustable, survival-enhancing responses are fixed by evolution. Next up is the Skinnerian variety, able to learn new strategies and responses by the reinforcement (via reward) of behaviour...Popperian creatures, however, are able to deploy an additional (and mighty handy) resource. Such creatures exploit a kind of inner model of their world, enabling them to try out moves in their imagination in advance of committing their physical bodies to the act. This strategy sounds fancy, but it is one deployed, Dennett suggests, by most animals whose sophistication exceeds that of the simple invertebrates...Minds like ours, Dennett finally suggests, use all the tricks just mentioned but add a final, language-and-culture based twist. For we are (in addition) Gregorian creatures: creatures "whose inner environments are informed by the *designed* portions of the outer environment" ([Dennett,] 1996, p. 99). The idea here is that "tool use is a two-way sign of intelligence: not only does it *require* intelligence to recognize and maintain a tool (let only [sic] fabricate one) but a tool *confers* intelligence on

> those lucky enough to be given one" ([Dennett,] 1996, pp. 99-100). (Clark, 2002, pp. 187-205)

Although Dennett doesn't mention sleep and dreaming in his discussion, Dennett's model of Gregorian creatures fits well with what seems to be going on during sleep, as described by the Combinatorial theory. I submit that, far from the brain relying on the will of agents to decide to review material of the right kind, in the right away, and for the right amount of time during wakefulness, the brain has decided that it will handle offline how to take over these functions during sleep and dreaming. And part of the role of simulating these functions can only be done safely and effectively "offline". It just wouldn't do for an organism to be trying out things to see what works while it was going about its business in the waking world. To take the example of threat simulation, it could be dangerous to simulate live threats willy-nilly when there are real threats around. Once evolution has already selected for the restorative benefits of sleep variation and selection will occur within that framework, including on the types of dreaming that will be more advantageous for reproductive fitness. For the same reason that simulations are so effective for learning for people like pilots, the simulatory environment constructed during dreaming provides an environment within which to generate and test ideas. It might even be the case that the more reflective, rational areas of the brain such as the dorsolateral prefrontal cortex go off-line , similar to the way that transcranial magnetic stimulation is so effective in promoting creative insight, because these areas are actively inhibited by TMS.

Not only does this model of the function of dreaming make sense, but, as I explained above, it is consistent with several experiments that have been performed that directly tested

for cognitive benefits as a result of specific dreams content (and not just as a result of sleep more generally). Part of the benefit of the neoteny of homo sapiens is that we can build up this rich inner environment that Dennett describes as obtaining for Gregorian creatures. And, furthermore, this picture of the cognitive capacity to dream fits well with evidence from Foulkes about how much later than is commonly assumed the adult form of active, complex, simulatory dreaming develops in an individual's ontogeny. (The best synthesis of Foulkes's evidence comes from his monograph *Children's Dreaming and the Development of Consciousness* (Foulkes, 1999). I discuss this work briefly in Chapter Two.)

As a suggestion for further research, it would be particularly interesting to see in what sense and to what degree our inner simulatory environments are a reflection of these Gregorian mind tools. We might even be able to do a cross-cultural study of how such mind tools are incorporated into dreams in order to determine features of human (dream) cognition common to all humans. There has no doubt been cross-cultural study of dreams, but I am not aware of any study of what kinds of Gregorian mind tools get incorporated and the principles according to which they are incorporated into people's inner simulatory environment in their dreams.

This generate and test pattern fits well with the evidence of problem solving abilities seen in dream experiments, but it also fits a more general picture of how dreaming functions, for aims beyond focused problem solving. Just like creative artists who are willing to pursue ideas further than ordinary, less creative individuals, our cognitive activity in dreaming seems much more designed around continually making associations and connections, even beyond

ordinary ways of thinking. And those associations can be shown to be "looser" than those that exist during waking. For example, when subjects are awoken from REM sleep, a state where most healthy individuals report dreaming, and then they are asked to make novel associations, their ideas are significantly more original than the same kinds of associations the brain makes during waking (see also Walker et al., 2002). I think it reasonable to believe there could have been selection pressures, making cognitive activity during sleep and dreaming more discursive, more likely to take "random walks," because, during sleep, there is no new incoming stimuli to work with, the brain sets to work on making connections and associations with previously known information. In addition to this generate and test pattern, we see that when the brain hits on something of interest it engages in elaboration around that theme. This picture meshes with the phenomenological account of dreams people give.

Furthermore, dreams are incredibly fascinating to a dreamer, but, often, a recounting of those same dreams is boring to another person. It has been said that there is nothing more boring than listening to another person tell you their dreams. And yet people so often are completely fascinated by their own dreams; to them they seem packed with meaningful connections. Matt Walker (2008) explains a reason why people find their dreams so fascinating. In a dream, a person searches through the space of their semantic and episodic memory for the most meaningful connections they can come up with. Those connections are intensely meaningful to a person, but it is because those connections are unique and personal that they often aren't so clearly important to other people; other people just don't get the connection a person finds between elements of her dream. I don't think we know enough to interpret a dream to say decisively "what it really means". But most neuroscientists today accept that

dreams can reveal very personal aspects of one's self. A dream helps a person make sense of their world, connecting things they find important to other meaningful aspects of their life.

Since I have raised the issue of the interpretation of dreams, it is worth noting why this dissertation spends so little time discussing Freud's theory of dreams. Freud believed that the dream represents "a wish fulfilled". In other words, for Freud, wish fulfillment is the raison d'être of all dreams. Freud says of children's dreams:

> The dreams of little children are simple fulfillments of wishes, and as compared, therefore, with the dreams of adults, are not at all interesting. They present no problem to be solved, but are naturally invaluable as affording proof that the dream in its essence signifies the fulfillment of a wish. (Freud, [1900], 2005, p. 297)

David Foulkes, who has spent decades of careful work running experiments to investigate the subtleties of children's dreams, would no doubt disagree with Freud's paragraph summation of the nature of children's dreams. In Foulkes's monograph *Children's Dreaming and the Development of Consciousness*, Foulkes, like a good scientist, builds theories based on the data and runs numerous experiments first to uncover what kinds of dreams children even have, and only then begins cautious speculation about why the different kinds of dreams should occur. Children's dreams are extremely complex! Furthermore, even Foulkes himself would admit that his decades of experience, even with tools of information from modern neuroscience, have only begun to pry open children's mental life during sleep. No doubt adults are even more complex than children. But this quote of Freud's and many others like it reflect a level of unwarranted certainty that is completely disproportionate to the evidence available to

him. I stand in wonder at Freud, asking: How could he possibly know this? Freud simply wasn't a rigorous scientist of dreaming. And, in this example, that which he claims to be quite certain of is so poorly defined as to be meaningless from a scientific standpoint and a far cry from anything even approaching an adequate explanation of the complexity of dream experience. Every dream is the fulfillment of a wish, says Freud. But when one thinks about dreams such as nightmares of being chased by a monster and eaten alive, in intense agony, it defies explanation that children or adults would wish such things, a point that has often made against Freud's theories, and one to which I have seen no satisfactory reply. Freud was quite selective in his investigations. Nightmares are commonplace. Do people really wish such things to happen to them? Any such objection to this theory or the theory that dreaming is always at root a function of the libido can overcome, says Freud by positing that yes, a person does wish to be crushed by a monster, or, if a theory does not seem to be about sex, well that is because the censor has disguised the content. What is the evidence of such a censor? How would we determine whether or not the censor is acting. I admit this remains mysterious to me. No doubt, I have been too quick. It is a fascinating and vexed question how our desires reveal themselves in dreams. And Freud's theories involve interesting observations and speculations. But I have purposely limited by approach because I think we just don't know enough to answer these questions with any degree of confidence, certainly not with the assuredness that Freud claims in The Interpretation of Dreams. Many of Freud's ideas in the book are dependent on extremely complex interpretations of a select few dreams. There is simply no way to know what the true meaning of "Irma's dream of injection" really is. As I have said above—this difficulty in studying dreams in a rigorously scientific manner doesn't mean it can't be fun and profitable to

try to interpret one's dreams. But we shouldn't kid ourselves into thinking we have anything approaching a comprehensive theory of why dreams have the content that they do. In this chapter of this dissertation, I am just trying to find some concrete experimental evidence to resolve the basic controversial question of whether dreams even have a function; we simply don't have enough evidence about the workings of the dreaming mind that we would need to explain the logic of dreams with the specificity Freud maintains. I hope this chapter shows how hard it is to even determine whether dreams provide some functional benefit. In any case, even if Freud has some good intuitions about dreaming, which I think it is fair to say he might, his scientific method is so fraught with perilous thinking that I think we do ourselves a disservice if we feel the need to provide a complete critique of Freud's interpretations of dreams. It is far better, as I have indicated, to work in the manner of the best science today, to try to pick off one circumscribed question at a time, like the question of whether dreams serve a biological function, and then build the case for that position. This methodology is better than attempting to build all-encompassing theories of why dreams have the contents they do without the requisite evidence or methodology to support one's contentions. No doubt much more could be said on the question, but I have chosen to be selective in how I approach the evidence about the dreaming mind.

Having said my peace about Freud, I now return to the excellent scientific work of Robert Stickgold. Stickgold's experiments in which subjects play the video game Alpine Racer II present one of the clearest examples of a controlled study of a dreamer making connections between their waking experience while dreaming, and this activity being beneficial to cognition. Alpine Racer II is a stand-up video game where the player's visual field is filled with a video

game version of what skiers would see if they were skiing in a downhill race. The race is engrossing for players during the day, and players often dream about it during the night, and, furthermore, those who dream about it show greater improvements in gameplay on subsequent days than those who do not. But, in addition, in the subjects' dreams, we see elaboration around the theme of skiing: many subjects report scenes like trudging through the snow on snowshoes, or something similar (BBC Horizon, 2009). Our minds don't simply replay the day's events. We process them, but elaborate around them, as Robert Stickgold has pointed out (Stickgold, 2010). The Combinatorial Theory owes its existence to the work of Robert Stickgold who has developed the broad outline of the theory, although I have not seen him flesh out the theory anywhere, nor have I seen him defend the theory against objections in the manner of this dissertation.

Perhaps Stickgold's most famous dream experiment is the Tetris experiment. When people dreamt of playing the game Tetris, they dreamt of key features of the game, but not any other parts of the testing room for example. Furthermore, subjects extracted the key patterns of the game from the day's gameplay and then replayed it in dreams, and then associated the game patterns with ideas nearby in conceptual space. For example, one subject connected the version of Tetris she was playing with a previous version of the game that had different design features.

When presented with the right kinds of engaging stimuli people are likely to dream about it on subsequent days, but in addition to dreaming about the specific contents of, say, the video game, the brain is making clear associations between the game and related ideas.

These associations are harder to quantify and measure scientifically, but this is rich area for further study. If we could uncover the pattern of such associations using careful experimental techniques it would perhaps better allow us to disentangle the kinds of rich associative networks that fascinated dream interpreters such as Freud and Jung. For right now, though, I submit that there are just too many variables intersecting, and it remains too difficult to do controlled experimental studies for us to explain the nature of these associative patterns. But, the scientific data available are suggestive. A particularly interesting question for future research would be to try to figure out universal patterns for all humans, while also ascertaining the individual differences between people within those patterns, but, given our current level of understanding, scientific research on such problems remains far in the future.

To illustrate the way that REM sleep allows the brain to make connections between associations that are not obvious to the waking brain, we can see an experiment performed by neuroscientist Jeffrey Ellenbogen et al. (2007). In the experiment, MIT students were tested so that they could come to understand the arbitrarily created relationships between certain fractal patterns. The experiment was set up so that there was an A, B, C, D, and E pattern. Students were shown while awake the relationships between the different patterns. For example, A was presented as "greater than B". While awake, subjects became skilled at detecting whether A was greater than B, C was greater than D, D was greater than E, etc.—the first order relationships between patters. But, when tested while awake, or after an intermediate period of waking, they were still quite poor at detecting second-order and third-order relationships, that is, for example, whether A was greater than D, or whether E was greater than A, etc. Here is an abstract of the paper about the experiment:

> Relational memory, the flexible ability to generalize across existing stores of information, is a fundamental property of human cognition. Little is known, however, about how and when this inferential knowledge emerges. Here, we test the hypothesis that human relational memory develops during offline time periods. Fifty-six participants initially learned five "premise pairs" (A>B, B>C, C>D, D>E, and E>F). Unknown to subjects, the pairs contained an embedded hierarchy (A>B>C>D>E>F). Following an offline delay of either 20 min, 12 hr (wake or sleep), or 24 hr, knowledge of the hierarchy was tested by examining inferential judgments for novel "inference pairs" (B>D, C>E, and B>E). Despite all groups achieving near-identical premise pair retention after the offline delay (all groups, >85%; the building blocks of the hierarchy), a striking dissociation was evident in the ability to make relational inference judgments: the 20-min group showed no evidence of inferential ability (52%), whereas the 12- and 24-hr groups displayed highly significant relational memory developments (inference ability of both groups, >75%; $P < 0.001$). Moreover, if the 12-hr period contained sleep, an additional boost to relational memory was seen for the most distant inferential judgment (the B>E pair; sleep = 93%, wake = 69%, $P = 0.03$). Interestingly, despite this increase in performance, the sleep benefit was not associated with an increase in subjective confidence for these judgments. Together, these findings demonstrate that human relational memory develops during offline time delays. Furthermore, sleep appears to preferentially facilitate this process by enhancing hierarchical memory binding, thereby allowing superior performance for the more distant inferential judgments, a benefit that may operate below the level of conscious awareness. (Ellenbogen et al., 2007)

Although it is important to state that this experiment reveals the effects of sleep in general (and not dreaming per se), this pattern fits into the paradigm of sleep as being necessary not only for offline processing, but for making connections between different associations. These associations and connections can then be captured and studied. And we

have seen that there types of connections made during sleep that aren't made during waking. It is also easy to see how in a case like this understanding these inferential chains could have cognitive benefits across a wide range of areas.

One would like to see experiments performed that test chains of inferences but do so using testing methods that engage people in the same way games like Alpine Racer II do. Such experiments could test in a rigorous way for the kinds of organized associations that have been seen in the Ellenbogen et al. (2007) experiment, but could be focused specifically on dream content.

4.5.3. Argument From Bayesian Reasoning

What would we expect dreams to look like if my theory were NOT true? I submit that we would not expect to see the degree of replay we find for appropriately challenging stimuli. If replaying the stimuli had no effect whatsoever, why would people experience replaying the game so frequently? That we do find cases where the majority of subjects are replaying tasks or imagery from the experiment thus provides evidence that dreaming provides a cognitive benefit, because, if it provided no benefit there would be no reason to replay it in dreams so frequently. I suggest this cognitive benefit may have been selected for in the course of evolution. This argument assumes that there is a certain dream logic driving the process of cognitive activity in dreams that is not just a matter of stockpiling neurochemicals, which presumably could be done independently of the specific content replayed in dreams.

Furthermore, if dreaming provided no cognitive benefit, I suspect we would not necessarily expect there to be storylines to dreaming. There is clear evidence, however, that dreams often have a narrative logic. In addition, people are sometimes surprised by what characters in their dreams say and do. That other characters in dreams even speak and act at all indicates there is complex ongoing mental activity guided by some thread of a storyline. Studies have been performed that show the elements of a dream are not just randomly cobbled together. When third parties examine in jumbled order transcript snippets of dream reports, they are quite often able to assemble them into the actual narrative thread as it occurred in the dream. I submit that we would not expect this if dreaming provided no functional value. There would be no benefit to replaying dreams in such an ordered fashion. Much is made of the incoherence, the psychosis of dreaming. It turns out that dreaming is often more prosaic than commonly assumed (e.g., Domhoff, 2007). Dreams are quite often about mundane concerns that the person is concerned with. If dreams did not serve some function we would expect there to be less coherent activation of storylines, a point I believe Domhoff himself has made. Instead, we quite often find incorporation of the day's themes into meaningful narratives, suggesting that the brain is reprocessing memories from the day. That we get better at certain tasks as a result of dreaming about them clearly adds to the picture of dreaming as containing an ordering and replay of crucial information. All of this ordering could actually be considered quite surprising, given that our senses are largely cut off from the external world in dreaming

In effect, I submit that many of these features of dreaming that we find, if we were to do a Bayesian calculation, would be much less likely to be found if dreams served no adaptive function. Of course, it is not easy to quantify just how ordered or disordered dreaming is. But, a

complete breakdown of typical dreams reveals that dreams are often quite orderly. If we add to this argument the, admittedly rare, phenomenon of lucid dreaming, which also reveals how coherent and organized dreaming can be, we get a picture of dreaming as much less chaotic, and thus likely more to be "purposeful" than is commonly assumed. That the lives of the average citizen of a developed country today is, in a matter of speaking, so boring, may be one reason why subjects in experiments might replay some kinds of engaging stimuli so often in their dreams, while people often don't replay the day's events in their dreams. We might replay much more of our day if we spent the day in a virtual reality world (or even the real world) hunting for our food and escaping predators than we do when we spend all day in a drab office doing spreadsheets on a computer at our desk, followed by watching television for a few hours. These are not exactly the kind of activities our brain would pick out as necessary to make sure that we reprocess in order to further our reproductive fitness.

In addition, if dreaming provided no cognitive benefit, we would not see the dramatic cognitive benefits accrued from dreaming about the playing of certain video games. As I have said, the few video games that have been studied are unlikely to be the only cases where such tremendous gains are possible. If playing a video game of certain kind were to have no impact on dreaming cognition, then I suspect we would see wide variation in whether or not individuals dreamt about the video games. It seems plausible that the same kind of stockpiling of neurochemical resources that Flanagan talks about as the function of sleep could have occurred with varying types of dream content. Again, we would have no reason to expect these exciting video games to show up so much in our dreams if they didn't provide some benefit. But they do show up in dreams a great deal, and add to that the dramatic cognitive benefits from

dreaming about them, and we have the reasons for thinking dreams have been selected to play some adaptive role in the human mental economy.

4.5.4. It May Be Misguided to Think of Dreams As Serving a Targeted Function

Deidre Barrett, in arguing for her own theory of the function of dreaming as problem solving, makes a point that seems obvious in retrospect, but the point goes against the grain of 99% of discussion on the potential function(s) of dreaming. She points out that it may be a mistake to try to stereotype sleeping and dreaming cognition into some pigeonhole of "what task it is for," when we when never think the same way about what waking cognition as a whole is *for.* Waking cognition is designed to carry out a host of different cognitive abilities, and we should not expect to find some narrow, targeted function for waking cognition as a whole; similarly, says Barrett, because of the complexity of dreams, we shouldn't expect to find some narrowly targeted function for dreaming. (Ironically, perhaps, I believe Barrett's targeting of problem solving, even generalized problem solving, as the function of dreaming is too narrow, but the issue is somewhat only a matter of emphasis.) Almost every aspect of the brain that is active in wakefulness is also active to some degree during sleep and dreaming. Thus, it may not be surprising if we couldn't find clear-cut findings that show why exactly what cognitive effect accrues from dreaming. So the fact that we are often able to discern some cognitive benefit at all needs to be understood against the larger backdrop of all the cognitive functions that likely take place during sleep and dreaming. So separating out dreaming as simply the conscious froth on the top of an underlying neurological and neurochemical base misses how the cognitive

processes that drive the restorative function of sleep are part and parcel with the psychological processes involved in dreaming. And, as the experimental evidence discussed above suggests, it is the psychological dream logic, still yet to be deciphered, driven by goal-oriented motivational systems in the brain that drives dreaming processes, not bottom-up chaotic signals originating in the brainstem.

4.6. Objections to an Adaptive Function for Dreaming Addressed to the Combinatorial Creativity with Selective Retention and Elaboration Theory of the Function of Dreams

We have seen some of the following objections above, but now we can see how these and other objections apply specifically to the Combinatorial theory.

4.6.1. Objection 1: Any Connection Between a Person's Phenomenological Report of Their Dreams and the Concomitant Neurophysiological Changes is Obscure

The force of this objection is negated by the results from the maze video game experiment (Walmsley and Stickgold, 2010), the Tetris video game experiment (Stickgold et al., 2000), the skiing video game experiment, and the rose-tinted goggles experiment (Roffwarg et al., 1978), and other experiments. In all of these experiments, we have examples of a tight connection between the stimuli presented during the day and the contents dreamt about on subsequent nights. These effects are outlined in the paper "Incorporation of Waking Events into Dreams"

(Walmsley and Stickgold, 2009). In the case of the Tetris and maze experiments, we have clear cases where having dreamt about the video games resulted in improvements in subjects' ability to play the video games. More such experiments obviously need to be performed but, given the huge number of known benefits accruing from sleep more generally, I think it is likely that we will continue to find similar results when more of these kind of engaging video experiments are performed. Or perhaps scientists might even devise engaging real-life activities that could be studied in a rigorous manner.

4.6.2. Objection 2: Quite Often People Don't Dream about Anything to Do with the Previous Day's Events. We Would Expect That They Would Under A Theory Such as the Combinatorial Theory

One point: typical studies of dreaming often only study the night after some stimuli is introduced. We see in the red-tinted goggles experiment (Roffwarg et al., 1978) and other experiments where subjects are tested over a number of days that subjects can report the relevant mental contents as many as seven to ten days after the initial presentation before a night's sleep. In some cases, no subjects report dreams with the relevant content for a week, but then many report the same content on the seventh night. In some cases we see replaying of specific contents of experiences in dreams consistently between subjects on the 3rd or the 7th day, depending on the type of stimuli (Nielsen et al., 2004). I submit that we wouldn't expect to find the consistent replaying of such contents in dreams many days later if dreaming about a video game was just a matter of "noise in the system" from the day the stimulus was

presented. The specificity of the replay suggests that there is an internal logic to the replaying of contents, although it is a logic we don't yet understand.

Second point, in many experiments (and we would expect many more, if more of the right type were performed), large percentages of subjects do dream about experimental stimuli from the day before (e.g., Stickgold et al., 2000; Walmsley and Stickgold, 2010). The fact that stimuli from some experiments show up in such a robust fashion suggests that much of the result could be a matter of selecting the right sorts of stimuli to test. Walmsley and Stickgold explain:

> Is the so-called 'replay' of memory in the sleeping brain related to the conscious experience of dreaming? Recent evidence from a variety of sources suggests that the answer is 'yes'. Particularly during early-night NREM sleep — when memory reactivation in animals is at its strongest — dream content is very likely to reflect recent learning experiences. Work from our laboratory and others has experimentally demonstrated this 'cognitive-level memory reactivation' by observing the impact of highly engaging or emotional learning tasks on the content of thought and imagery in subsequent periods of sleep. The impact of such experiences on dream content is often dramatic: after extensively playing the downhill skiing arcade game *Alpine Racer II,* a third of participants' sleep onset dreams contained task-related thought or imagery, for example "I keep seeing all the places where I fall — like, hit the walls. It's kind of annoying; and then my legs fly up in the air". (Walmsley and Stickgold, 2010)

So the argument that we don't dream about events from the day should be rejected. Under the right conditions we do—quite often in fact, and likely would a lot more, if we had the right kinds of experiences or scientists hit on the right kinds of tasks to test.

4.6.3. Objection 3: Some of the Drugs That People Take Result in People Seeming to Experience Little or No Dreaming

My reply to this objection remains the same as above in the section on general objections to a function for dreaming. Radical changes in neurophysiology can occur as a result of pharmacological intervention. These changes could result in some individuals no longer reporting having dreams as a direct result of taking these dream-suppressing drugs, but this finding cannot be considered a conclusive reason for thinking dreaming has not served some adaption function in normal, healthy people for hundreds of thousands of years. In addition, these pharmacological agents might allow people to gain benefits that would allow them to function without the benefit of dreaming in the natural way that has occurred in human evolution.

4.6.4. Objection 4: Truly Creative Dreams Represent an Extremely Small Sample From the Space of All of Persons Dreams.

Someone might suggest as an objection to the Combinatorial theory that creativity theories are unsupported by the evidence. While in one sense we are incredibly creative in coming up with all the imagery and the storyline of dreams, one could argue that creativity theories are simply a instance of the availability heuristic, wherein certain pieces of evidence or examples stick out prominently in our minds, thus fooling us into the thinking that such noteworthy examples are

representative of the class of dreams as a whole. I take it as given that we don't consciously remember the vast majority of our dreams. That people who have deliberately set about pursuing creative solutions to problems have often quite successfully done so points to dreaming having the potential for great creative insights. Also, I believe it is awe-inspiringly creative simply to improvise anew over and over again every night new storylines with completely new characters and settings and actions. We hardly know what the mind is capable of until we tap the richness of our dreams.

4.6.5. Objection 5: The Experiments Apparently Supporting the Combinatorial Theory are Not Representative of Dreaming in General and Thus Do Not Constitute Sufficient Support for Attributing an Adaptive Function to All Dreams

The first point to make would be that, if there are any dreams that provide an cognitive benefit for having dreamt them, and that benefit wouldn't otherwise have occurred if one had not had the appropriate dreams, then we have thereby found a non-zero cognitive benefit as a consequence of having dreamt. This alone provides compelling evidence that dreaming has an adaptive function. This argument is not, however, conclusive. Under certain understandings of the origination of the process of dreaming, the psychological content of dreams could still be epiphenomenal; but I have suggested that a better understanding of what drives the process of dreaming suggests that the psychological logic of dreams, much of which is conscious, has a benefit that transcends stockpiling of neurochemical resources. And this benefit does not accrue from sleep alone without the appropriate kind of dreaming, or even from dreams without the appropriate content.

Another consideration is the fact that, if the right kinds of engaging stimuli are not present people will not have dreams about the targeted experimental stimuli. It is reasonable to suppose that eople dream about playing video games because they are so exciting and engaging. When thinking about what people do and do not dream about I think it is important to keep in mind how engaging the relevant stimuli are in the first place.

Often without, for example, engaging video game technology it becomes hard to see what the brain would consider important enough to make sure to dream about it that night. For rats, their "proto-dreams" are very concerned with spatial navigation as through a maze. I say "proto-dreams" because it hard to know whether rats experience anything like what we experience in our dreams. But, rats brains during sleep clearly have fundamental biological similarities with human brains. Just what it is that confers survival value for human beings is no doubt more subtle than it is for rats.

4.6.6. Objection 6: The Experiments Supporting the Combinatorial Theory Could Just As Easily Be Used to Support Other Theories of the Function of Dreaming. So the Combinatorial Theory Adds Nothing.

To some degree this objection is accurate, in that many of the experiments I have referred to as support of the Combinatorial Theory could also be used to support other theories of the function of dreaming. But I believe the Combinatorial theory is the best fit for the evidence.

Memory consolidation as a theory of the function of dreaming is a very broad theory that is surely right in some respects. And here we wade into neurophysiological issues of sleep that are no doubt divorced from the phenomenological experience of dreaming. But, however we explain the degree and kind of memory consolidation that occurs as a result of sleep and/or dreaming, this explanation alone doesn't explain as well the combinatorial creativity theory the phenomenological aspect of dreaming, in the sense of what it is we are most likely to dream about. The combinatorial theory starts us toward an explanation for why we have the dream contents that we do. At least the combinatorial theory, with its model of generate-and-test, begins to explain the associative nature of dream logic. Without an attention to the nature of the rich patterns of associations that people experience their dreams to have, we have only explained one dimension of the function of dreaming.

I have made criticisms of the threat simulation theory which I see as too limited in its explanation of the function of dreaming. I believe the experimental evidence I cite doesn't fit well with the threat simulation theory. The general simulation theory, too, is incomplete in that it doesn't explain the phenomenological features of dreaming and it doesn't explain why species-specific behaviors would need to be recapitulated in dreams. The combinatorial theory better makes sense of the heterophenomenological evidence of people's dreams.

We have also seen how the combinatorial theory indicates how the dreamer accomplishes problem solving tasks, but I disagree with the approach that targets problem solving as the precise function of dreaming. Unlike simply trying to find a solution to a problem per se, dreams as described by the combinatorial theory involve searching the state space of

ideas in a much more exploratory fashion: it is less about posing a problem and trying to solve it, though that can happen. The following kinds of case is relatively rare: someone going to bed with a well-defined problem and finding a solution to it in a dream, and then consciously remembering and implementing that solution. Such occurrences of dream problem solving is also most likely to have been even rarer in our evolutionary history. Of the different theories, the problem-solving one is probably the closest the combinatorial theory, and some may see the combinatorial theory as simply a matter of difference in emphasis, but I see the combinatorial creativity with selective retention and elaboration theory as providing the most complete general picture of the function of dreaming, because, unlike the problem solving theory, it does not attempt to explain the function of dreaming as a whole in terms of serving of well-defined problems and finding solutions.

4.6.7. Objection 7: The Functions That are Attributed to Dreaming Could Just As Easily Be Attributed to Waking Cognition. There is Nothing Special About Dreaming Cognition.

The Walmsley and Stickgold (2010) (video game maze) and other experiments belie the notion that the same kinds of gains that accrue after dreaming could just have easily been achieved after a comparable period of wakefulness. We see clear benefits as a result of dreaming about some task that we don't see after an intervening period of wakefulness.

Even if one doesn't find the evidence from experiments run so far compelling, I think there is a persuasive reason to believe that it makes sense that the brain would allocate time during sleeping and dreaming replaying and reprocesses some tasks and kinds of experiences.

Matthew Wilson's lab has demonstrated in numerous experiments that rats are replaying experiences of maze running and more in their sleep (e.g., Lee and Wilson, 2002; Louie and Wilson, 2001; Ji and Wilson, 2007). We know this because we find highly specific similar patterns of brain activation between a rat's brain when running a maze while awake and when it is exhibiting highly similar neural firing patterns while asleep. The best explanation, because of the unlikelihood of such similarities occurring by chance, is that the rat brain during sleep is replaying and reprocessing its memories of running the maze when it was awake. In many instances, one can literally predict with high accuracy the next few moments of rat's dreaming brain solely based on the pattern of activity it exhibits while running a maze in its sleep. Yes, our ancestors could have taken the time to think over important skills for them to master or facts for them to know, but one is not able to direct one's attention optimally to those thing one most needs to learn and know. Instead, we see this simulatory ability far down on the evolutionary ladder and it is reasonable to conclude that there have been continual elaborations of that ability in the manner suggested by Dennett's Generate-and-Test model.

5. Conclusion

What can we conclude from this investigation of dreaming? First of all, I think we should proceed to study dreaming with an appreciation for the complexities of the human mind and with an eye to the unique properties of the dreaming mind. The dreaming mind is fascinating partly because it operates according to principles so different from those underpinning our waking thought and behavior. Second, we should recognize that studying the dreaming mind raises characteristic types of questions that must be answered if one is to proceed to study the *dreaming mind*. These questions include: What definition of dreaming is one using? How is this definition related to neurobiological properties of the brain? How are dreams reported? By what means are dreams recorded? What influences might be affecting the recording of dreams? What population of dreamers (e.g., children, lucid dreamers, non-literate people) is one studying? How do people wake up when they are dream? How can one study the mental activity of lucid dreamers while they are dreaming? Many other such questions need to be addressed in a proper study of dreams. I have tried to bring these concerns to light in order to show that one can do a rigorous, philosophical investigation of the dreaming mind. But, I think we always need to be mindful of the lesson of Freud. Freud, based on little evidence, determined that he had an all-encompassing theory of human dreaming. Not only that, he thought he could explain the true meaning of any individual dream in the context of a person's psychic concerns. My sense is that even now such grandiose visions are premature. I believe that it will be some time before we can attempt to construct an all-encompassing theory of dreaming, let alone a means of producing justified interpretations of individual dreams. We

should accept the lessons we learn from science—true insight is won by painstaking collection of individual pieces of evidence so that we can construct more powerful explanatory theories. One must do experiments if one wants to understand something as complex as human sleep and dreaming. Furthermore, one must collect a tremendous amount of data in order to be sure that one tendency one detects actually reflects a more general picture of human minds. I have treated some basic questions about human dreaming because I wanted to show that it is not at all obvious that we are conscious in our dreams or that we dream in color. But, after having answered such questions, we can then proceed along the road of developing more comprehensive theories of human dreaming.

I conclude in this dissertation that we can know certain features of the dreaming mind. We can know, for example, that people experience conscious states during dreaming. It is also plausible that people experience colors in their dreams. I have outlined the reasons for thinking so. I also think that recent experimental evidence suggests that dreaming serves a adaptive function. On this question, I think there is much more room for debate. But I think that if scientists continue to do the right sorts of experiments (e.g., like the video game experiments of Robert Stickgold), we will see more and more evidence accumulate that corroborates the functional picture of dreaming I have outlined here. Clearly, though, much more study needs to be done before we can definitively conclude that dreams serve an adaptive function, and even more research must be done if we are to figure out the true nature of that function. But dream science is one of the most exciting research agendas in science. I hope that my methods and arguments in this dissertation might be the basis for more detailed investigations of the philosophical issues that arise when we try to understand our sleeping minds. Science is making

tremendous progress in opening up ways to study our minds during sleep. It would be a mistake to try to understand our sleeping minds without taking note of the rapid advances being made in neuroscience.

Dreaming is an essential part of who we are as human beings. We should always remember that if we want to understand the human mind in all its complexity, then an explanation of what dreaming is and why we do is a necessary part of any such understanding.

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