

Dreams and Creativity

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Glossary

Creativity The English word creativity is linked, historically and etymologically, with the Latin word *creare* (to make) and the ecclesiastical Latin word *creator* (Creator); therefore, both refer to the concept of origin itself (consider the related term *originality*). One of several useful psychological definitions was given by Csikszentmihalyi in 1996, when he suggested that the term creative could be applied to “any act, idea, or product that changes an existing domain, or that transforms an existing domain into a new one.” A more subjective, but also useful, definition was given by Martindale, who wrote that a phenomenon is creative if it is novel and, in some manner, useful or appropriate for the situation in which it occurs. The noun *creativity* is used if a process or phenomenon is being discussed, while the adjective *creative* is used if a behavior, an experience, a product, a person, a group, or an environment is being described. In all these instances, there is the assumption that something is both novel and culturally appropriate to a given task.

Dream A series of images, reported in narrative form, that occurs during sleep. These images are usually visual and kinesthetic, but they can also be auditory or even gustatory or olfactory. They can be recalled spontaneously upon (or somewhat after) awakening, or can be evoked if someone is awakened from REM (rapid eye movement) sleep or even from non-REM sleep.

Dream interpretation An attempt by someone (often the dreamer) to attribute meaning to the content of dream reports for purposes of counseling, psychotherapy, or personal/social growth. Various approaches to dream interpretation exist, many of them contradictory; and some investigators insist that dream images are randomly evoked and dream content is essentially meaningless.

Electroencephalogram (EEG) A graphic depiction (voltage vs. time) of the brain’s electrical potentials recorded by scalp electrodes and usually delineated by ink tracings (as are the electromyograph (EMG) and electro-oculogram (EOG)).

Hypnagogia The pattern of phenomenological properties immediately preceding sleep. Hypnagogic reports typically include imagery (visual, auditory, kinesthetic, etc.) but little narrative.

Hypnopompia The pattern of phenomenological properties immediately preceding awakening. Hypnopompic reports typically include imagery (visual, auditory, kinesthetic, etc.) and are more likely to contain narrative than are hypnagogic reports.

Lucid dream reports Characterized by claims that the dreamer was aware that he or she was dreaming during the

ongoing dream. Several techniques exist that purport to cultivate dream lucidity.

Nightmares Reports of anxiety-provoking dreams, marked by confusion, fear, horror, and other types of unpleasant affect.

Non-REM sleep Consists of four sleep stages that occur in a cyclical pattern. Stage 1 sleep occurs immediately after sleep begins, with a pattern of low amplitude and rapid frequency EEG tracings; Stage 2 sleep has characteristic EEG tracings of 12 to 16 cycles per second known as sleep spindles; Stages 3 and 4 have progressive, further slowing of EEG tracings, and an increased amplitude. Over a period of about 90 minutes after sleep begins, most people have passed through the four stages of non-REM sleep and have emerged from them into the first period of REM sleep. Non-REM sleep is also referred to as orthodox sleep or S-sleep (because of its characteristic synchronized EEG tracings).

Primary process In psychoanalytic theory this term refers to unconscious mental activity that operates without regard to logic or consensual reality, but provides for wish fulfilment, governed by the ‘pleasure principle.’

Rapid eye movements (REMs) Conjugate, coordinated horizontal or vertical eye movements, occurring rapidly during sleep and, less frequently, during napping, daydreaming, and hypnotic imagining, and at other times when one’s attention is turned inward rather than toward the external environment.

REM sleep A recurring stage of sleep, characterized by rapidly occurring conjugate eye movements, loss of muscle tonus, and desynchronized EEG brain wave activity. REM sleep is also referred to as Stage 1 REM sleep, Stage REM, D-sleep (because of its characteristic desynchronized EEG tracings), and paradoxical sleep (because its EEG tracings resemble wakefulness). REM sleep recurs in ~90- or 100-minute intervals in humans; it also occurs in nonhuman sleep, for example, among most mammals.

Sleep The recurring period of relative physical and psychological disengagement from one’s environment characterized by cyclical brain/body activity.

Sleep terrors (or night terrors) Episodic conditions usually occurring during Stage 4 sleep, marked by panic, confusion, and poor recall. Characteristically, the reports of sleep terrors do not include imagery or narrative. They occur developmentally, peaking by two years of age, but sometimes may occur later.

Wakefulness The recurring period of relative physical and psychological engagement with one’s environment and the presence of various patterns of phenomenological properties.

Creativity, Dreams, and Culture

From the perspective of Western psychology, *creativity* is a term that can be used to describe the process of bringing something new into being by becoming sensitive to gaps in human knowledge, identifying these limitations, searching for their solutions, making guesses as to a potential resolution, testing one's hypotheses (sometimes modifying and refining the results of these examinations), and communicating the final product. However, the creative process is imperfectly understood; these steps may be linear or may overlap, they may occur in a planned sequence or spontaneously, or they may be intentional or operate outside of one's awareness. It could also be said that people, groups, or cultures are creative during those periods of time when they exhibit activities, innovative for them, that yield concepts, objects, or behaviors that address human needs (e.g., for survival, for enhanced work performance, for enjoyment, for aesthetic satisfaction, for enriched quality of life) in ways considered valuable by a social group. These novel concepts, objects, and behaviors (e.g., a scientific discovery, mathematical theorem, philosophical insight, an artistic masterpiece, technological product, military victory, or diplomatic accomplishment) can be termed creative, although one social group might arrive at a different consensus from that of another group. In other words, the term *creativity* is a social construct used to describe various processes and outcomes.

The word *creative* has several possible meanings. To most observers, this adjective describes something new that has been brought into existence. Definitions of *creative* and *creativity* range from simple problem solving to the full realization and expression of all an individual's unique potentialities. There appear to be at least four aspects of creativity: the creative process, the creative product, the creative person, and the creative environment.

Dreams may play a role in the creative process, identifying problems, searching for solutions, testing hypotheses, and communicating the results to the dreamer. In 1996, Strauch and Meier discussed how the creative transformation of memories is an expression of human consciousness that can take place during both wakefulness and dreaming.

Ullman, in 1965, listed four reasons to explain why dreams partake in a creative process. All dreams are original; no two are alike. Dreams combine various elements to form new patterns. Like many creative processes, most dreams are involuntary experiences. Dreams contain metaphors and symbols that have creative potentials. Many non-Western societies have also appreciated the creative aspects of dreams. Among Australian aborigines, the Laws of the Dreaming were laid down during what they call the Creative Period. Each species has its own set of laws, and all of these laws are a part of the Dreaming, the ground of all existence. Humans can obtain new information (e.g., new songs and rituals) from the Dreaming; thus the Dreaming is dynamic, not static, in nature.

In *The Tempest*, Shakespeare wrote about "such stuff as dreams are made of." Many of the images that appear in dreams can be symbolic in nature. Images are mental representations of objects or persons not physically present. Whereas an image directly represents the object it pictures, a symbol is an image that stands for something else. In much the same way,

activities in dreams may be metaphorical, a metaphor being a narrative or an activity that stands for something else. Sometimes dream content makes no sense if the dreamer presumes that the images refer directly to the people or objects they depict. In those instances, the dream might make more sense if allowances are made for the possibility that its images are referring to something other than themselves. Freud complicated this issue by asserting that the symbols occurring in dreams differ radically from other symbols because dreams express, in disguised form, wishes the dreamer has repressed. However, this assertion implies a sleep/wakefulness discontinuity. Most contemporary dreamworkers believe that the symbol-making process in dreams exhibits more commonalities than differences with the symbol-making process in waking life. This emphasis on the continuity between waking life and dreaming life can be found even in the writings of Thomas Aquinas, who wrote, "Those things that have occupied a man's thoughts while awake recur to his imagination while asleep."

This continuous, cognitive-psychological position has also been taken by Adler, Hall, and Foulkes, all of whom described dreams as meaningful but not as containing preplanned encoded messages that need to be translated the way a linguist would work with a foreign language. According to Foulkes, the dream is "knowledge-based" and "bound to reflect some of the ways in which the dreamer mentally represents his or her world." Indeed, almost anyone awakened after a dream is able "to identify *some* events as having rough parallels in her or his waking experience." A body of research indicates that dreams often are characterized by complex thinking processes. Some differences between waking cognition and dreaming cognition exist, but they are continuous rather than discontinuous. In 1979, Rycroft mused that, if dreams are poetry, their creative efforts are imperfect. Poets and artists need to cast their meaning in metaphors and symbols that are a part of the shared legacy of their culture. But dream imagery tends to be too dependent on the dreamer's personal experiences to convert easily into works of art with wide appeal. Some dream theorists urge the dreamer to accept dream images and stories as creative experiences in their own right. However, writing from a neuroscience perspective in 1983, Crick and Mitchison proposed that dreams function to purge unnecessary, even parasitic, brain cell connections produced during wakefulness; dream content, therefore, is best forgotten.

On the other hand, Hobson, also taking a neurophysiological and neurochemical perspective, wrote in 1988 that, since virtually everyone dreams, the dream report stands as testimony to the universality of the artistic experience. In dreams, all become writers, painters, and film makers, combining extraordinary sets of characters, actions, and locations into strangely coherent experiences. Hobson concluded, "I strongly object to any implication that the artistic experiences of waking or dreaming are fundamentally pathological, defensive, or neurotic," adding that the brain is so determined to find meaning that it creates dreams out of images that have been randomly evoked by its own neurochemical activity.

It can be seen that dream specialists do not speak with one voice on the topic of creativity and dreams. But non-Western traditions lack uniformity as well. Among pre-Columbian Native American dream traditions, some saw dreams as having the same meaning for every member of the tribe, whereas

others felt that dreams conveyed meanings personal to the dreamer; some believed that dreams served problem-solving functions, whereas others felt that they forecast the future; some believed that dreams dictated actions that needed to be taken in daily life, whereas others believed that dream events took place in the spirit world. In some tribes, dream messages were direct and undisguised, whereas for others they required interpretation. However, few North American tribal groups neglected dreams; they were seen as sources of knowledge, power, inspiration, and what today would be called creativity.

Research on Creativity and Dreams

Weisberg, in 2006, stated that creative problem solving has occurred when a person produces a novel response that solves the problem at hand, but then he went on to debunk many highly publicized accounts of problem solving in dreams and other altered states of consciousness. A critical perspective needs to be taken regarding not only anecdotal accounts but also formal research programs. These phenomena are difficult to investigate for several reasons. Even if a useful definition of *creativity* can be implemented, an investigator never works with a dream, but rather with a dream report. These reports, whether obtained from archives, from field research, or from laboratory research, are subject to so many vagaries of memory, unconscious distortion, and deliberate omission or elaboration as to pervade the field with a well-deserved sense of modesty when even tentative results are announced.

Anecdotal Data

Keeping Weisberg's caveat in mind, many instances of creative breakthroughs in dreams have been well documented. They include Mendeleev's conceptualization of the Periodic Table of the Elements, Howe's invention of the lock-stitch sewing machine, Blake's development of a process of copper engraving that he later used to illustrate his songs, Tartini's composition of his most celebrated sonata, and famous fictional works by Robert Louis Stevenson and Daphne du Maurier, among others. Some dream-inspired books are nonfictional; the mathematician Jerome Cardan had a recurring dream that ordered him to write *De Subtilitate Rerum*, which was to become his most celebrated book. Whenever Cardan became lax in his writing habits, the dream returned with great force. Many creativity researchers have discussed creativity within the framework of preparation, incubation, inspiration, and verification, although these four stages may not always develop in a predetermined order in creative work and problem-solving, and some stages may not occur at all. It has been suggested that, when the problem-solver's deliberate efforts to evoke solutions are abandoned during sleep, dreams can impart clues and novel approaches that elude individuals during wakefulness. Many researchers cast doubt on the credibility of anecdotal reports of this nature, noting that many of them were made long after the event; hence there is the risk of distortion and elaboration. Even in cases that appear to be credible, a period of considerable preparation is required; however, simply taking a break from the problem is a more likely explanation than unconscious

processing, because during the break people typically mull over a solution. Many of the most frequently cited cases of dream creativity did not take place in dreams at all, but actually occurred in transitional states of consciousness, not sleep. Rarely do dreamers record their dreams and secure them in such a way that their creative potential can be assured.

Formal Research Data

Several investigators have used tests, questionnaires, and interviews to obtain information about creative problem solving in dreams. Some representative studies demonstrate the direction that formal research has taken; the journal *Dreaming* is an excellent resource for those who are interested in following developments in this field.

Barrios and Singer, in 1982, queried 48 volunteer subjects about their creative impasses, finding that most had been blocked for more than three months. The subjects were divided into four groups and randomly assigned to one of four conditions: exposure to either a waking imagery or to a hypnotic induction procedure, participation in a focused and collaborative examination of their projects in which task-irrelevant thoughts were avoided, and a control group encouraged, in a nondirective fashion, to discuss their projects.

Results indicated that the waking imagery and hypnotic imagery conditions were most effective in promoting the resolution of creative blocks.

An experiment reported by Brodsky, Esquerre, and Jackson in 1991 asked students, while they were awake, to apply an operational definition of dreaming to four problem-solving tasks. All proposed solutions were rated on a five-point creativity scale by raters, working independently. No gender differences were noted, nor was frequency of dream recall associated with the creativity ratings. However, students who attributed considerable importance to their dreams received higher creativity scores, as did students who reported having had lucid dreams. It was suggested that dreaming consciousness is a permission-giving format for eliciting active imagination, bypassing typical goal-oriented thinking processes.

A series of experiments reported by Cartwright in 1984 demonstrated that problem solving in dreams probably is more successful when the material to be processed is emotionally or personally meaningful.

Other studies have shown that dream reports of highly creative people exhibit more primary process thought than less creative individuals but also show greater symbolism and more unusual combinations of dream content elements.

Highly creative individuals also endorse beliefs that dreams have hidden and symbolic meaning, can produce inventions and artistic creations, can sometimes predict the future, and can be programmed (or 'incubated') more so than less creative individuals. The creative people also claim to make a greater effort to remember their dreams than the other group. Highly creative persons relax more easily and fall asleep more rapidly, and more of them claim to be able to solve problems in dreams than do less creative individuals.

The association between nightmares and creativity has long been a matter of conjecture. A questionnaire survey of college students found that art majors report the most nightmares,

whereas physical education majors report the fewest, with mathematics and science students in the middle. Furthermore, students with frequent nightmares tend to report more visual imagery during awakening, become easily absorbed in aesthetic stimuli, and score higher scores on a hypnotizability scale than do other students.

Other studies have found a close relationship between the frequency of nightmare reports and psychopathological scores on personality tests for dreamers reporting frequent nightmares. Furthermore, these high nightmare individuals have more primary process material in their dream reports than low nightmare individuals.

Cross-Cultural Considerations

It is not the dream itself that is available for interpretation, but the individual's or group's report of the dream experience. The visual, sensory, and emotional aspects of a dream are often lost in Westerners' accounts of dreams, but indigenous dreamworkers generally consider these qualities to be among the most important.

Remembered dreams and performed myths are both forms of production that bridge the verbal, logical characteristics of rational thought with the visual-sensory-spatial-emotional images that reach their most elaborate level of integration in art. The recounting of a dream brings the nonverbal, nonrational imagery of the dream to awareness, and begins to link it with logical reasoning.

Possible Mechanisms

Contemporary sleep and dream research has demonstrated the elaborate, entirely intrinsic mechanisms of *state* control. In other words, a change in the brain's state while asleep causes a change in the dreamer's mental state. Sensory input can be internally controlled so that even the transforming mechanisms do not operate alone to protect the system from overload. Three features of the modern conception of the nervous system – its intrinsic plasticity, its autoregulation, and its creativity – give us a very different set of operating principles on which to construct a scientific psychology. This model depicts a nervous system that can turn itself on and off, regulate the flow of internal information in diverse ways, and control external information's access to the system. It is in the context of this model that the incorporation of presleep stimuli, dream incubation, and lucid dreaming assume importance for the understanding of creativity and dreams.

Incorporation of Presleep Stimuli

The influence of presleep stimuli in dream content has been successfully attempted in experiments using hypnosis, subliminal stimulation, emotionally arousing films, and real-life stress situations. The results indicate that it is relatively easy to influence dream content in predictable ways. It has been suggested that dreams may serve the purpose of assimilating emotionally arousing information into problem solutions that are already embodied in existing memory systems.

Dream Incubation

If it is possible for an experimenter to influence the course of a subject's dreams, then it should also be possible for dreamers themselves to influence their dream content.

Dream incubation was common among the American Plains Indians, among artists in ancient China, and in the practices of ancient Egypt, Greece, and Tibet. Foulkes and Griffin moved from the anecdotal level to more rigorous types of inquiry, teaching 23 subjects 'dream control' methods, and asking them to dream about randomly selected topics. The subjects kept daily records of their dreams for 10 nights. Judges attempted to match dreams with the suggested topics; their matching did not exceed what would have been expected by chance.

The same investigators designed a second study using 29 highly motivated subjects who claimed some previous success in dream control or an interest in the topic. They spent ten nights attempting to dream about assigned topics, but in this case they were allowed to select the nights on which they felt they could successfully control their dreams. Again, judges were unable to match the dreams with the topics. Other studies have reported more encouraging results in projects in which incubated dreams focus not on abstract topics but on real-life concerns. Some people expect too much when they assume their dreams will become springboards for feats of artistic creation. Nevertheless, such former presidents of the International Association for the Study of Dreams as Barrett, Delaney, and Garfield have cited case studies indicating how dreams can help many people live more fully integrated lives and augment their capacity for adaptation and personal growth.

Lucid Dreaming

When a dreamer realizes that he or she is dreaming, the dream is considered to be lucid. The Tibetan Buddhist practice of 'dream yoga' focused on the ability to retain awareness and lucidity during night time dreaming. However, the Hindu yogic dream tradition eschewed such dream manipulation in favor of a waking meditation practice described as 'merging with the light.'

Aristotle wrote about lucid dreams, noting that when one is asleep, there may be something in one's awareness that declares what is presented is a dream: "The sleeper perceives that he is asleep, and is conscious of the sleeping state during which the perception comes before his mind." In the second edition to *The Interpretation of Dreams*, published in 1909, Freud noted that some people are clearly aware when they are dreaming and are able to direct their dreams.

First hand reports from lucid dreamers have produced a list of methods thought to be useful in facilitating dream lucidity. Presleep reflection is frequently mentioned; in other words, one can often incubate a lucid dream. Asking such critical questions as 'Is this a dream?' and 'Am I dreaming?' during a dream will often produce lucidity. Some dreamworkers encourage people to ask these questions during the day at regular intervals, with the expectation that these questions will later arise during the night. External stimulation is sometimes incorporated into a dream and triggers lucidity; again, this can be deliberately programmed.

Gackenbach has estimated that about 58% of the population experience a lucid dream at least once, while about 21% report one or more per month. Instruction in lucid dreaming has been used therapeutically, especially to help people who suffer from chronic nightmares. Studies have shown that lucid dreaming can be 'learned' by those who wish to use it for creative problem solving. There are anecdotal stories of more specific skills being learned as a result of lucid dreaming.

Neurophysiological and Neurochemical Mechanisms

Several studies with animals indicate that the frequency of time spent in REM sleep increases as a result of new learning, such as finding the way out of a maze. This relationship is evident in work conducted with cats, mice, rats, and newly hatched chicks. Therefore, rapid eye movement (REM) sleep may play an important role in the consolidation of such cognitive activities as learning, memory, and problem solving for both humans and other organisms that engage in REM sleep.

The role of learning in REM sleep production may be connected to an underlying biological process. It has been suggested that new protein structures are being synthesized in the brain during REM sleep. Evidence indicates that the initiation of REM sleep does come from the brain stem, and then extends itself over the entire brain cortex. Because animal experiments indicate that protein synthesis is present in new learning, it has been hypothesized that it also takes place during REM sleep.

Some theorists have used computer analogies to describe REM functioning as akin to 'off-line processing.' The acquisition of input information is placed in temporary storage, until processing components are available. Information about the day's events is gathered and stored until the onset of REM sleep, when it can be 'processed' (i.e., integrated with memories and formed into strategies for the future).

The spiny anteater, or echidna, is an early mammal whose sleep pattern shows no REM activity. The echidna's brain has a large prefrontal cortex, presumably to integrate new experience with older experience. The mammals that evolved later were able to handle this task more efficiently during REM sleep; as a result, their brains were smaller – a more productive direction for evolution to follow. This problem did not exist in the earlier reptilian species; their behavior was largely reflexive, and this activity was adequately handled by a small brain with a neo-cortex. Dreams, then, can serve as a window on the neural processes whereby – from early childhood on – strategies for behavior are being set down, modified, or consulted. This process and the mechanisms involved, which were termed the 'unconscious' by Freud, can be used advantageously in the clinical setting by both Freudian and non-Freudian psychotherapists and other dreamworkers.

A model that has tried to be inclusive in regard to incorporating physiological discoveries about dreams is that proposed by Hobson and his associates in 2000. They proposed that during both waking and dreaming states there is an *activation* of the brain, a source of *information* that is evoked during the waking or dreaming process, and a biochemical *modulation* that differs radically from wakefulness to sleep. Dream experiences are, in part, a product of self-organizing tendencies in

the brain during which the randomly evoked informational data are creatively patterned into a narrative to which meaning can be attributed. The cells deep in the pontine area of the brain stem are *activated*, generating REM sleep and randomly stimulating the forebrain, which then evokes *information* by using stored memories to make sense of the incoming neural firing. On the one hand, Hobson and his associates have connected dreaming to a *modulation* of biochemical events in the brain, but, on the other hand, they have evidenced a keen understanding of dreams as imaginative creative events.

In 1988, Hobson pointed out that Freud insisted that wishes and repressed desires caused dreaming, but that this notion has been discredited due to data that it is brain stem mechanisms during sleep that cause dreaming. Even though brain mechanisms trigger REM sleep (and dreaming), wishes may be expressed and may even shape dream plots, but they are in no sense causative of the dream process. Hobson concluded that dreams are not the result of an attempt to disguise repressed wishes but are a direct expression of a synthetic effort. One's memories are scanned for images that will match these internally generated patterns. This model sees dreaming as the pre-programmed running of an internal system. The bizarre features of a dream are naturally associated with the mode of operation of the system during dreaming sleep, and there is no need for a mechanism that would transform information. Since the system is capable of selecting what computer scientists would call the 'store' or 'no-store' modes, there is no need to postulate an active energy-consuming mechanism for the restoring of dream material in the unconscious. It can simply be the no-stored mode that is unremembered.

For once, wrote Hobson, contemporary scientists can agree with Freud's assertion that dreams are the 'royal road' to a scientific understanding of consciousness. Hobson's model is seen as unduly reductionistic by those researchers who hold that REM sleep and dreaming are two separate but related processes; indeed, dreams can be obtained from non-REM sleep as well as from REM sleep. Krippner and Combs have noted that in both REM and non-REM dreams, the formal analysis of activity patterns in complex neural networks can be carried out in terms of chaotic attractors. In 2002, they proposed that the dreaming brain 'relaxes' into natural patterns of self-organized activity that often reflect the residual moods, stresses, and concerns of waking life.

During dreaming, the brain is immersed in something like a sensory isolation tank, cut off from the influences of external sensory input. In this situation, patterns of brain activity can slip into forms that are primarily dependent upon internal considerations. This environment, they maintained, is especially conducive to the production of novel associations, as *chaotic attractors* produce unusual but potentially valuable dream narratives.

In the creative process, small changes in cognition or behavior can trigger an avalanche of new insights or novel creative products. Krippner and Combs have found this 'butterfly effect' to characterize many dreams that lead to a creative solution of an ongoing problem.

The human brain with its many chaotic patterns of activity is subject to the butterfly effect; the introduction of 'noise' into such a system can produce a response too small to be

ordinarily noticed. However, the presence of this 'noise' or 'vibration' keeps the system in motion, following the signal, rather than allowing it to become stuck. Termed *stochastic resonance*, this seemingly paradoxical effect has been demonstrated in electronic signals as well as in nerve cells. On the other hand, the dreaming trajectories may be more under autopoietic (displaying both divergent and convergent thinking) control than it is in those systems attempting to follow a repetitive signal, as in most examples of stochastic resonance. As in problem solving, they have a goal in mind, and use divergent trajectories and bifurcations to solve it.

Further Research

Future research studies need to identify the genetic markers for creative behavior, reconcile personality and cognitive research data in creativity, evaluate the part played by the dreaming process in creative ideation, determine the role of mental illness in blocking or facilitating creative expression, and specify what home and school variables are key factors in the development of highly creative individuals. The study of dreams can play an important role in each of these agendas; dreaming appears to have been adaptive in the evolution of the brain, and dream content can provide cognitive and affect clues in the understanding of creative processes.

It is apparent that individual differences exist in dream creativity, and that there are cultural differences as well. The vast preponderance of studies in the field are devoted to the neurophysiology and neurochemistry of sleep and dreaming as opposed to the psychosocial variables in dreaming; of the latter, only a handful concern themselves with creative aspects of dreaming despite the near-consensus of dream researchers that the two phenomena are linked in several ways. The unanswered questions posed by existing research data are legion: for example, why is color spontaneously reported in the dreams of half of art students studied, 16% of the science majors, and virtually none of the engineering students? Why do research participants, in general, tend to report color in their dreams more frequently if they claim to place greater reliance on feelings than on thinking? What is the nature of dreams in which color is greatly intensified, radiating with phosphorescent hues? What are the mechanisms that determine shifts in dream color when people wear colored goggles during every waking moment for a week? Why do recurring post-traumatic nightmares differ so radically in dream content from other dreams?

The answers to these questions can be sought from psychosocial, neurophysiological, and neurochemical investigations, as can the answers to dozens of additional questions relating to creativity in dreams. In the meantime, for the Australian

aborigines, the Amazon Kagwahiv, and other tribal people, the Dreaming still exists. They believe that, if other human beings would begin to make their own dream journeys, re-establish their links with nature, and creatively invoke Dreamtime songs and dances, many of the world's current dichotomies and discontinuities could be accommodated and transcended. For both the mind/brain and the individual/group, this has been one of dream's creative functions over the millennia. The need for creative solutions to the world's many social, economic, and environmental problems reflects the importance of creativity and of the researchers and dreamworkers who see creativity in dreams as a critical frontier in understanding and assisting human development in a world – and a species – currently at risk.

See also: Altered and Transitional States; Definitions of Creativity; Memory & Creativity.

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Relevant website

<http://asdreams.org> – International Association for the Study of Dreams.