The Science of Dreaming

Introduction

The sections that follow are based on, or extracted from, some of the latest research findings related to dreams and dreaming. Much of the following information is from the book *DREAM LANGUAGE: Self-Understanding through Imagery and Color* by Robert Hoss, MS, with foreword by David Feinstein, PhD. The book includes additional information, along with examples and explanations, of how understanding this research, along with psychological theories and practices, helps you understand and work with dreams for personal growth and therapeutic applications. This site may also include research updates that will appear in later editions of the book. Note that the material contains various conclusions and hypothesis based on the referenced research. Where a conclusion is not referenced, it is generally that of the author.

Click on Your Areas of Interest

Section 1 - Sleep and Dreaming

1.1 Do We All Dream?
1.2 Sleep Cycles
1.3 Do Dreams Have a Function?
1.4 Are Dreams Meaningful?
1.5 Dream Recall

Section 2 - Dream Content

2.1 The Dream Experience
2.2 Content Analysis
2.3 Nightmares
2.4 Color
2.5 Effect of External Stimulus
2.6 Paranormal or Extraordinary Content
2.7 Dream Content as we Age

Section 3 - The Neurology of Dreaming

3.1 The Dreaming Brain
3.2 Neurological Influence on Dream Content
3.2.1 The Dream Experience
3.2.2 Dream Communications – an Internal "Language" ?
3.2.3 The Focus of Dreams (Daily events, Self, Anomalies, Conflict)

Bibliography

Section 1 - Sleep and Dreaming

1.1 Do We All Dream?

Research has shown[1] that REM (rapid eye movement) sleep is prominent in humans and other terrestrial, placental mammals, with minor exceptions.[38,79] It is known that humans dream during the REM stage because when awakened during REM sleep, laboratory subjects reported dreams or dream-like experiences an average of 82% of the time.[39] Domhoff[77] states that there are four conditions required for dreaming: 1) an intact fully mature neural network for dreaming; 2) a mechanism for activating the dream; 3) exclusion of external stimulus; and 4) loss of self control or shut down of the "cognitive system of self." It is uncertain what animals experience during this stage, since the "network for dreaming" in the animal brain is uncertain.

Early thought was that dreaming was initiated by REM activation. However, the dream or dreamlike state is now known to occur also at the onset of sleep, during NREM sleep and even in some waking states. Dreaming occurs to a lesser degree between REM cycles, with the average rate of dream recall being only about 42%. There is also a marked difference in the dreams recalled from these two states. According to the research findings compiled by Hobson,[39] reports from REM states are typically longer, more vivid, more animated, more emotionally charged, have more dream elements in them and are less like waking life events than NREM reports. NREM reports are more thought-like, and contain more representations of actual waking life events than do REM reports. Krippner et. al.[67] reports on a study by Hobson (performed on 146 dream reports by 73 subjects) using an equal number of REM and NREM dreams. Hobson applied a standardized "Bizarreness Scale" to the dreams. The results indicated that about 70% of the REM dreams were reported as bizarre, compared to 20% of the NREM dreams.

The time spent in dream sleep varies with age. Adults spend about 25% of their sleep time in REM, children about 50%, and in premature infants it has been reported to be as high as 70% to 80%.[37] In older persons, REM sleep may reduce to about 15%. Art Funkhouser[69] indicates that dreaming continues as people age, but the themes they dream about change, as do their daily concerns. It seems there are fewer nightmares, less frequent aggressive dreams, shorter average length of dreams and less frequent dream recall. While shorter dreams and lower dream recall can be partly explained by the fact that memory no longer functions as well as it used to, research into aging and dream recall has shown that there are other factors involved since the largest drop-off in dream recall occurs at a relatively young age, around 26 (especially among males).[70] As we age, the content may eventually evolve into concerns about death. Research on this subject can be found in a book by Mary-Louise von Franz.[71]

1.2 Sleep Cycles

Figure 1 illustrates the cycles of sleep in a normal human that occur every night.[1] The horizontal scale is sleep time in hours, and the vertical the stages of sleep. In simple terms, it shows that we cycle between deep NREM sleep and shallow dreaming REM sleep multiple times per evening. These cycles continue throughout the night, in approximate 90-minute periods. We typically go through four to six dream periods in an eight-hour night, which might be surprising since we are often unable to recall even one of these dreams.

Figure 1
Sleep and Dream Stages

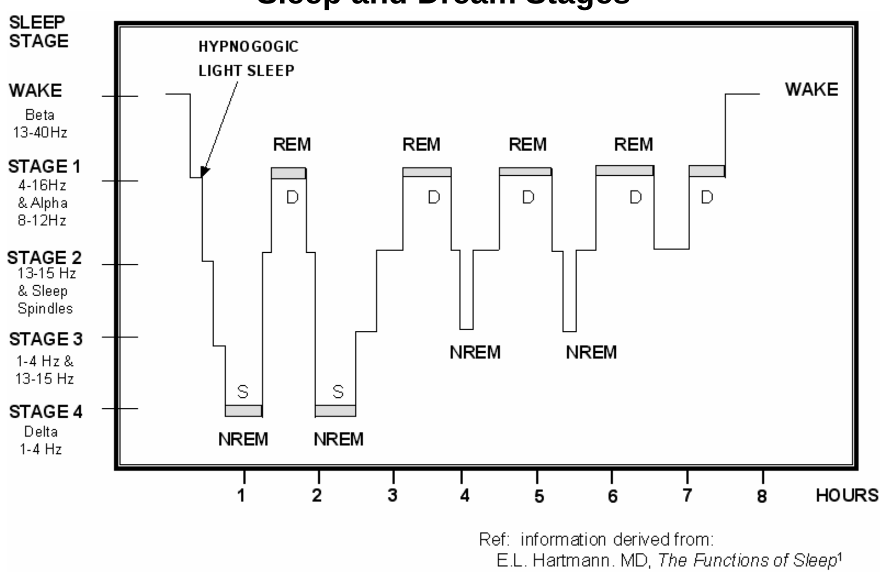


Figure 1 illustrates a night of sleep. Dream sleep or REM sleep is also known as D (for desynchronized or dreaming), stage 1 sleep, or "slow wave" sleep. Non-REM or NREM sleep is also known as S sleep (for synchronized sleep) or stage 4 sleep. Often at sleep onset we awake with a jerk, sometimes recalling some dream-like images. This is known as a period of hypnogogic sleep, or light sleep where we have entered REM sleep and re-awakened. Normally at sleep onset there is a rapid movement from stage 1 sleep to stage

4, i.e., we go right into the deep NREM sleep. Pulse, respiration rate and blood pressure are lowered and no eye, facial or body movements are noted. The brain waves are more regular and lower frequency (1 to 4 cycles per second). Muscles relax, although whole body jerks may be observed. In this deep sleep stage it becomes more difficult to arouse the person. If awakened, dream reports, if any, tend to be more thought-like and devoid of imagery.

About 90 minutes later, the sleeper will begin REM sleep and vivid dreaming. As we continue through the night, we enter deep S sleep less often, and after about 6 hours remain between stages 1 and 2. The REM sleep stage is characterized by: eye movement, small movement in the muscles of the face, faster and more irregular pulse and respiration, and higher blood pressure. An EEG reading, called a PGO spike, often marks the onset of REM and many of these spikes appear during REM. Resting muscle potential is almost non-existent (we can't move). It is easier to arouse someone from this stage. When aroused, dream reports are full of vivid imagery and content, more so at the end of the sleep period than at the beginning.

In addition to the differences in dream reports, there are differences in brain activity observed between NREM and REM sleep. The medulla of the brain appears to regulate NREM sleep, whereas it is the pontine brain stem that regulates REM.[1] Single neurons in the brain have been seen to reduce their activity during NREM sleep and then increase during REM to a level as high or higher than when awake. During REM, a section of the forebrain is in a state similar to that of alert waking, and high levels of activity are found in the visual associative cortex and parts of the brain responsible for processing emotion. The central brain is also active, suggesting learning and memory processing.

1.3 Do Dreams Have a Function?

Some studies have shown that sleep and dreaming are linked to learning and to repair of the body and mind.[1,38] If we deprive ourselves of dream or REM sleep, the body recovers by increasing dream sleep first, recovering the loss of REM almost precisely. This suggests that dreaming is important. It has been observed that sleep and dream deprivation causes effects such as: waking dreams (visual and auditory hallucinations); interference with memory and learning; a loosening of associations; impaired waking ability to do tasks requiring focused attention; or difficulty maintaining a straight line of thought, creating irritability and suspiciousness. It has therefore been suggested that REM or dream sleep is associated with restoring mental well-being.

Dream sleep seems to play a key role in revitalizing new and old experiences so that they become more permanently etched in long-term memory. Alan Hobson, at the Massachusetts Mental Health Center, shows that dreaming rehearses memory patterns, either to create new memory connections or to strengthen older fading connections (based on brain wave activity in the hippocampus).[38] For example, one study demonstrated that the exact neuronal firing patterns present when rats explored a maze, were repeated precisely when the rats were in the dream sleep.[38] In Israel, researchers at the Weizmann Institute found that consistently interrupting dream sleep in a night completely blocked learning, whereas similarly interrupting non-dream sleep did not.[38]

Different types of memory tasks seem to respond to different parts of the sleep cycles, with visual and perceptual tasks relating more to dream sleep. The Weisman researchers found that "procedural memory," or tasks requiring practice (as opposed to "declarative memory" or fact recall), was directly tied to quantity of dream sleep. Further research by Stickgold and Walker indicated that those learning a task in the evening, who were retested after a good night's sleep, were 15% to 20% faster and 30% to 40% more accurate than those simply tested twelve hours after learning the task at other times of the day. [cited in 66]

There is some evidence of this learning effect in the dream experience itself. On the occasions when we recall multiple dreams from the same night, it is often observed that a similar theme runs through each dream segment, but that each segment approaches that theme with a slightly different storyline, or set of characters and outcome. Could it be that dreams act as our testing ground for practicing various scenarios on a situation, in order to find and reinforce the best solutions (strengthening the best neural paths)?

Some research supports the hypothesis that dreams help us adapt to stressful waking events by activating habitual defense mechanisms, and by integrating the stress situation with earlier solutions to a similar problem.[2] A critical step in the memory cycle is the step that matches representations of new experiences with the representations of closely related past experiences. This is observed to take place during dreaming.[3] It is as if the dreams are helping us adjust to new threats and experiences, by comparing them to an internal model of how we dealt with similar situations in the past, and then making those slight reprogramming or learning adjustments that are needed to better accommodate the experience. Thus the old saying, "better sleep on it." Sleep and dreaming appear to play critical roles in memory and learning, as well as in stress reduction and generally keeping our mental state in good repair.

1.4 Are Dreams Meaningful?

In the dream state, our dreams appear similar to normal waking-life adventures. Upon waking, however, that perception changes dramatically. We notice a lack of continuity between scenes, irrational cause and effect relationships, and a host of bizarre or irrational combinations of dream elements or activities.

We are conscious in our dreams, but it is a different state of consciousness from waking life. The synchronizing signals that are signs of consciousness (firing signatures of the intralaminar nuclei from various neural paths) are present, but unlike the waking state, these nuclei are not firing in response to outside stimulus.[38] Instead, the brain is activating itself purely from within. But to what purpose? Some researchers, such as Hobson and McCartney, [cited in 67] contend that dreams result from our higher brain centers attempting to make sense of the activity in the lower centers that generate the dreams. From this viewpoint, dreams could be simply be an attempt to make a rational story out of random neural activity.

Although not totally certain at this point, some very important processing may be taking place in the dream state. As discussed above, some studies show that dream sleep plays an important role in memory and learning. The brain centers that are active in dream sleep are also active when we are awake, but are processing experiences coming in from the external world. These centers process our perception of the external world in relationship to our internal model of that world. They orient our physical and social perception of self to that external world, so that we can deal with it. They stimulate our emotions in order to draw our attention to what is important and to prepare us for action in the face of a threat. They contribute meaning and inflection to our speech. Could it be that these same brain centers also perform a similar function in the dream state?

1.5 Dream Recall

Earlier it was reported that some studies indicated when subjects were awakened during REM sleep, they reported dreams or dream-like experiences an average of 82% of the time.[39] Assuming that most humans go through multiple REM (or vivid dream cycles) each night, it is therefore quite interesting that most of us spontaneously recall very few, if any, dreams in the morning. Hobson[39] indicates that working memory is off-line in the dream state, and that the mechanisms for storing memories are diminished to non-existent. Hobson also reports that dream recall rapidly falls off, the longer one takes to wake up after the REM period. Dreams do not occur as we awaken, as some early speculation suggested. Dreams occur roughly over the time period we recall them having occurred. The measured length of the REM period has been correlated with both the dream report word count and the estimated length of the dream by the dreamer.[39]

Recall might relate to one's sleeping habits. Webb and Agnew[51] found that people, who sleep longer than 8.5 hours, had 50% more REM sleep than people who sleep less than 6.5 hours. In the morning, sleep tends to be less deep and closer to waking, with longer dream periods as illustrated in figure 1. Based on this information, you would expect more recall and longer dream reports as people sleep longer. There are still mixed results on this, however. Whereas Backeland and Hartmann[52] found it to be the case, Blagrove et. al.[50] did not. The total opportunity for dream recall may be greater as you sleep longer, but spontaneous dream recall still depends on other factors, including the dreamer's interest in recalling dreams and attitude toward dreams (Hartmann[76].) If a person takes an active interest in recalling a dream on a particular night, or during a period of nights, they are more likely to do so.

In a literature review cited by Lynne Hoss,[45] a relationship was shown between dream recall frequency and artistic and imagery abilities. She reports that Schechter, Schmeidler and Staal (1965) tested both dream recall and creative tendencies in 100 students of art, science and engineering. There was a significantly higher proportion of dream recall among art students (assessed as more creative, and therefore using more right hemisphere process as described in chapter 3). Recall was lowest among engineering students (attributed to the more linear, temporal thought process of the left hemisphere). No differences between the sexes were found. Her work also cites research by Cory, Ormiston, Simmel and Dainoff (1975) that found recall to be greater in those with greater memory capability for visual images.[45]

Spanos, Stam, Radtke & Nightingale, (1980) found that in females, dream recall was greater for those who had more ability to become absorbed in imagery and measures of creativity. Cohen[48] found a highly significant difference between dream recallers and non-recallers in ability to form clear, vivid images. Blagrove[50] found that dream recall is related to the personality factor of "openness to experience." Hartmann[76] indicates that there are only a few personality factors that closely correlate with dream recall including: tolerance of ambiguity, openness to experience, absorption, creativity, fantasy-proneness and ability to be hypnotized. He states that these factors also closely relate to "thin boundaries."

Section 2 - Dream Content

2.1 The Dream Experience

Strauch, Meier, and Foulkes (1966)[13] indicate that dream reports are largely dominated by visual content (about 100%) and auditory (about 40 to 60%) where movement and tactile sensations are relatively infrequent (about 15 to 30%) and smell and taste very infrequent (less than 1%). The following set of dream characteristics was based on a compilation by Hobson,[39] with some paraphrasing. Thus it roughly represents a set of characteristics which researchers most consistently attribute to the experience of dreaming:

1. Dreams mainly involve visual and motion perceptions, but occasionally other senses.
2. Dream images can change rapidly (particularly numbers and words).
3. Dreams are often bizarre in nature, but also contain many images and events that are relatively commonplace. Faces are a common feature.
4. We believe that we are awake in our dreams.
5. Self-reflection is infrequent or involves illogical explanations of the events and plots.
6. Dreams lack orientation stability. People, times and places are fused, plastic, incongruous and discontinuous.
7. Story lines integrate all the dream elements into a single confabulatory.
8. Dreams contain increased, intensified emotion, especially fear-anxiety that can integrate bizarre dream features and shape the dream story.
9. There is a tendency toward more negative emotion in dreams.
10. There is an increased incorporation of instinctive emotions (especially fight-flight), which also may act as powerful organizers of dream cognition.
11. Dreams are concerned more with emotionally prominent content than current events. Exception: dream incubations which focus on recent emotional events can increase their occurrence in the dream.
12. Control by the will of the dreamer is greatly reduced. A dreamer rarely considers the possibility of actually controlling the flow of dream events, and on those infrequent occasions when this does occur (lucidity), the control may be only for a few seconds.
13. Self-control of thoughts, feelings and behavior is fairly common.

2.2 Content Analysis

In 1966 Calvin Hall and Robert Van de Castle published the book *The Content Analysis of Dreams*.[57] This provided a comprehensive standardized system of classifying and scoring the content of dream reports. With this new tool, a true measure of cultural, gender and other differences in the nature of dreams and dreamers could be achieved.

It was found that women dream equally of men and women, but 67% of the characters in men's dreams are other men (Hall 1984) and the gender difference in favor of male characters appeared in almost every culture (there was one finding from a study in India where the male % was lower than the female %). For both men and women across cultures, dreams usually contain more aggression than friendliness, more misfortune than good fortune and more negative than positive emotions. Men have a higher degree of aggression in dreams than women.[40] Some cultural influences were found. For example, dreamers from small traditional societies have a greater percentage of animals than do those of larger industrial societies. Studies of dream journals reveal continuity between the emotional preoccupations of the dreamers and their waking thoughts.[40] The dreams of older dreamers do not differ much from college students with the exception of a decline in physical aggression and negative emotions, nor does dream content change much according to long-term journaling studies.

2.3 Nightmares

Nightmares can be distinguished from "normal" dreams by their overwhelming anxiety, apprehension and fear. Ernest Hartmann, author of *The Nightmare*[60] and *Dreams and Nightmares* [72] has performed one of the most extensive studies of frequent nightmares. Hartmann states that the dream, especially the central image (CI), pictures the emotion of the dreamer and that the intensity of the central image is a measure of the strength of the emotion. This might be seen in nightmares when there is a single powerful emotion such as in a tidal wave dream following a traumatic event. Although negative content and emotion appear frequently in most dreams, we do not usually report the dream as a nightmare unless it is extremely upsetting. Van de Castle[37] reported that a study by Bixler on sleep problems, which surveyed 1,006 households, found that only 11 percent reported being troubled by nightmares.

Nightmares can fall into various classes regarding their cause, including: a) the result of trauma; b) long-term nightmare sufferers; c) medical problems requiring attention; d) daily events that create heavy stress or a severe threat to one's self-image. Nightmares are different from night terrors, which may be accompanied by screaming before awakening with extended disorientation afterwards.[37] Night terrors occur (if at all) during the first two hours of sleep in deep sleep (sleep state 4) and the dream itself is generally not recalled. Although research has shown that personality factors such as thin boundaries are related to nightmare frequency, Schredl found that there is a greater relationship with current daily stress factors than with personality factors.[53]

Nightmares are often a direct result of extreme trauma. Trauma related nightmares are often a repetitive replay of actual experiences the dreamer had encountered, with only minor distortions. Deirdre Barrett in her book *Trauma and Dreams*[74] indicates that a pattern evolves in which the trauma is dreamed repeatedly, much as it happened, and becomes more "dreamlike" and surreal over time. These begin to change into "mastery" dreams for people who recover from the trauma. "Mastery" dreams show an evolution over time with themes of mastery over the situation in the dream. The repetitive, unchanging replays may continue, however, in those who develop severe posttraumatic stress disorder (PTSD) in their waking life. The book describes how coaching to develop "mastery" dreams can aid in the resolution of PTSD.

Nightmare sufferers are individuals who have a long history of nightmares. Unlike trauma cases, the nightmares do not repeat the same literal event, although the themes might be similar. Frequent nightmare sufferers report their typical non-nightmare dreams as vivid and detailed, filled with very bright colors and distinctive sounds, along with tactile sensations such as pain, taste and smell, which are seldom present in typical dreams.[37] In the Hartmann study, many of the long-term nightmare sufferers had stormy personal relationships, difficult adolescent years, a high suicide attempt rate and many were in therapy.[60]

2.4 Color

Research in the sleep lab determined that the majority of our dreams are in color.[37] Bob Van de Castle reports that when dreamers were awakened during a dream, distinct color was reported in 70% of the cases and vague color in another 13%. Why then do most people perceive dreams as colorless? It appears to be related to recall. Spontaneous non-laboratory dream reports (normal daily dream recall) indicate that only about 25% to 29% of dreamers recall color, based on studies by Van De Castle and Hall respectively. This increased to 50% for art students in one study cited by Van De Castle.

So why don't we recall the color in our dreams? Recalling color is likely subject to the same mechanisms as recalling any image in a dream, or remembering the dream at all! Perhaps the sleep stage prior to waking has something to do with color recall. Hartmann[1] reports that people awakened from REM sleep report more story-like and colorful dreams, whereas reports from the deeper NREM state of sleep are more thought-like with little story line or color. The nature or degree of our dream consciousness may also affect color recall. LaBerge[8] has indicated that the EEG state during lucid dreaming (when you are conscious that you are dreaming), is in many ways similar to the conscious waking state, and lucid dreams are frequently reported in full color. It is possible that we tend to recall dream imagery, and thus color, that contains the more significant emotional content. This is supported in principle by Hartmann's contention that emotional content increases the intensity of a dream image.[72] If this is the case, then the colors that remain dominant in your dream report might be those that are the most revealing when working on the dream.

Elsewhere on this site I have included papers that discuss in more detail an investigation that I performed over about a 10-year period on the significance of color in dreams. The investigation led me to conclude that color in dreams is stimulated by emotional associations that are both collective (instinctive) and personal in nature. Much of my investigation was based on relating a subject's association to dream color to the human response to color in the waking state. Over the last 50 years or so there has been a notable degree of work in the human waking state response to color.[17-35] This research (typically referred to as color psychology) has had its greatest influence on advertising, food packaging, art, style, architecture, decorating and such. Whereas it is not surprising that color evokes feelings and memories, what is significant is that some of the laboratory research with color in the waking state reveals that the human brain and nervous system responds directly to color at an autonomic level, below the threshold of awareness.[25,33] Our autonomic nervous system regulates involuntary functions such as heartbeat, blood pressure, breathing, and digestion.[25] Blue has been observed to have a calming effect on the parasympathetic branch, thus reducing heartbeat and breathing rate. The color red has been observed to have the affect of exciting the sympathetic branch, and causing certain processes such as heartbeat and breathing to speed up and appetite to increase.[25] The experiments of Barbara Brown,[33] which were designed to understand the associations between color and brain wave activity, supported these findings. She determined that the brain's electrical response to red is one of alerting and arousal, whereas the response to blue is that of relaxation.

Color has also been found to affect us psychologically and emotionally. (Hemphill, 1996; Lang, 1993; Mahnke, 1996). Goldstein[35] found that red stimulation corresponds with the experience of being disrupted, thrown out, attracted to the outer world, and being incited to activity, aggression, excitation and emotionally determined action. Goldstein concluded that the color green corresponds with withdrawal from the outer world and retreat to one's own center, to a condition of meditation and exact fulfillment of the task. Evolutionary factors may play an important role in this basic "objective" color response by humans. Many scientists believe that blue and yellow color vision evolved first based both on the physical structure of the eye (these colors are sensed at the extremes of the retinal structure near the more primitive receptors)[78] as well as evidence that most mammals remain dichromats (can only distinguish between bright versus dark and blue versus yellow).[29] Although humans eventually evolved an extra class of photoreceptor enabling us to discriminate between reds and greens, we still exhibit the highest visual acuity for yellow illumination, and the lowest for deep blue (making it difficult for the eye to focus).[31,32] Yellow illumination thus makes activity more possible, whereas blue illumination makes it less so. Thus the human instinctive association with yellow would lean more toward outward activity, and with blue toward the more passive or limited physical activity.

A primary mechanism, involved in the human emotional response to color, may be the role the limbic system plays in associating emotion with sensory input. One role of the limbic system, principally the amygdala, is to assign an emotional "tag" to incoming information and images that we sense, which would include color. When we consider the limbic system and the autonomic nervous system working together, it is not surprising that there would be a meaningful association between human emotional response and color.

Color response has also been used in the development of some early personality testing tools. The Rorschach test, for example, uses associative scoring based on the various ways that a subject names or projects colors, on color and monochrome test cards. Dr. Max Luscher, Professor of Psychology at the University of Basel, created another psychological testing tool, that more directly associates color with emotional experience. His work led to the introduction in 1947 of a testing tool based on color preference, called the Luscher Color Test.[25] It was first based on work by Hering, who established a link between responses in the eye-brain system to color contrast. What is important to note is that Luscher made a distinction between the "objective" (physiological and instinctive) and the "functional" meaning of color (whether we are drawn to it, indifferent toward it or find it distasteful). To Luscher, a person's choice of color, in a particular circumstance, was based on both factors, psychological preference and physiological need. I found the Luscher tool to be useful in studying dream color, possibly because the Luscher color response closely resembles the way the limbic system might respond to color. The Limbic system appears to use both instinct as well as subliminal experience/memory factors to create the emotional "tag" that focuses our attention and our reaction according to the nature and intensity of the emotion (engaging with a colored object or retracting from it).

What is important when discussing or researching the human emotional response to color is to carefully consider this difference between: 1) the "objective" response which is primarily driven by autonomic and instinctive associations that operate below the threshold of awareness; 2) the "functional" response which also may be subliminal but likely originating from memories or experiences; and 3) a third factor, cultural symbols and teachings (black and orange associated with Halloween, red used to symbolize "stop", for example). When we ask a person "how they feel" in the presence of a color we may get a very different response than if we ask them "why" or "what does the color remind you of?" The "how does it make you feel" evokes more of a "limbic" emotional response, the origins of which may lie below our threshold of awareness. The "why" or "what does it remind you of" demands a cognitive interpretation of what is being felt, thus evokes memory associations or cultural symbols which may only have a loose association with the deeper emotions that were invoked. In my own studies with dream color I found it important to focus primarily on "how" a subject feels in the presence of the color, because the resulting emotional associations more closely related to those found when working on the rest of the dream. Sometimes the "why" would provide useful connections, but not as useful as exploring the primary, subliminal emotional response. I found that the "what does the color remind you of" question, least often relates to other information that comes from the dreamwork.

This difference in how our association with color depends on how we ask the question is illustrated in a study by N. Kaya and H. Epps (2004)[44] of ninety-eight college students. Students were asked both "how a color made them feel," then asked "why". For example, questions about red evoked mostly positive (64.3%) feelings such as happiness, excitement, energy and love. When asked "why" red made them feel that way many answers related to love and romance, with one respondent stating that the color red "reminded her of" Valentine's Day and the shape of heart. The "how" response seemed to evoke pure emotion, but the cognitive "why" brought up mostly cultural symbols associated with red (valentines and love symbols) which seem only loosely related to the rich range of deeper emotions. Likewise the color yellow-red was often associated with the color of autumn or Halloween. One respondent said that yellow-red made her happy because "it reminds me of school buses and my childhood." Furthermore, the color blue-green was associated not only with the ocean and the sky, but also reminded some respondents of cool mints and toothpaste. Although the color white mostly evoked positive feelings of innocence, peace, and hope, the "reminds me of" responses included; bride, snow, dove, and cotton – all being culturally related symbols (innocent bride, dove of peace etc.) with only vague ties to the basic emotional response from the "how" question. Cultural or "reminds me of" associations can at times have nothing to do with our deeper emotional response to a color. Sutton and Whelan[24] point out that colors such as purple and white are commonly associated with wealth, not for any physiological reason, but because these colors during much of our history were so difficult to create or maintain, that only the most wealthy could afford them. A study of Asian subjects by Saito (1996)[21] found that although most of the subjects responded positively to white, some Taipei subjects expressed a seemingly negative feeling and association with the image of death; death being associated with white in that culture. Perhaps the most striking cross-cultural difference, and difficulty in cross cultural research, lies in the naming of color. Research by Debi Roberson, PhD, of the University of Essex[28] found that while humans establish a continuum of color terminology the same way around the world (in keeping with the structure of our visual system), the specific names we give these colors are learned relative to language and culture. It has been recently found that the brain maps different wavelengths of light (what the brain interprets as color) together in a stripe formation or grouping of cells. Felleman, Xiao and Wang,[80] at the University of Texas at Houston Medical School found three different groups of cells in the V2 region of the brains of macaques (which are identical to that part of the human brain) having a high proportion of cells interested in color, and are the main source of our color-recognizing abilities. The stripes themselves contain a map for the ROYGBIV color spectrum (red, orange, yellow, green, blue, indigo and violet). Therefore if our mammalian brains map the full color spectrum, it is likely that all human cultures see the full spectrum, the colors are simply named differently based on cultural learning. It is therefore necessary to take into account that naming variation when doing research on color.

In my investigation of dream color what I observed was that, indeed, specific dream colors appeared to relate to specific groupings of emotional associations, similar to our subliminal emotional response to those colors in the waking state. In particular, dream color seemed to relate to a mixture of the “objective” (instinctive/autonomic) response and “functional” (subliminal experience based) emotional associations that Luscher describes. I therefore based my color dreamwork research on the emotional themes associated with color, as derived from studies in the field of color psychology referenced above. In particular I found the Luscher test to be well suited to the investigation since it provided a well studied combination of “objective” and “functional” associations while eliminating cultural symbols (although the color naming convention was of a “Western” culture). In order to establish the emotional content of the dream image, I used a Gestalt based role-play technique, using a standardized script, which had proven effective in revealing emotional content within dream imagery. I then compared the dreamer’s responses as they role-played color imagery from the dream, with the Luscher Color Test associations for the same specific color preference. The correlation was then confirmed with the dreamer as it related to an associated waking life situation.

The result was that the Color Test correlated well with the dream image role-play statements, as well as the dream-related waking life experiences.[22, 23] The results support the notion that dream color relates primarily to emotion or emotional associations that are similar to our waking life emotional response to color – more specifically it is our subliminal emotional response (the "limbic" response) and not so much to our cognitive memories or cultural associations. The research further provided some interesting and surprising insight into how colors combine with dream imagery to create a larger set of meaningfully connected dream imagery associations. A description of the research can be found in the Color in Dreams link on this web site.

2.5 Effect of External Stimulus

The input to and output from the portions of the brain that process external stimulus are blocked in the dream state.[39] Therefore, external stimulus will not find its way into our dreams unless it is fairly strong, with stimulus of a tactile nature having the most effect. Van de Castle[37] reports that of three external stimuli applied during REM sleep, a spray of cold water was incorporated in 42 percent of the recalled dreams, light flashes in 23 percent and an auditory tone in only 9 percent. When there is an external stimulus, the dream generally incorporates it into the ongoing story line, but it rarely becomes the defining plot of that night's dreams.

2.6 Paranormal or Extraordinary Content

Some of the first pioneering scientific work in this area was performed by Ullman, Krippner and Vaughan, who in their classic book, *Dream Telepathy*,[5] discussed the results of scientifically controlled experiments in paranormal dreaming. Much of the work was performed in the dream laboratory at Maimonides Medical Center in New York. The book studies telepathic dreaming (dreaming of what someone else is thinking or experiencing) and precognitive dreaming (dreaming of an event in the future) in a sound and systematic basis. A more recent book *Extraordinary Dreams and How to Work with Them*, co-authored by Stanley Krippner,[67] provides a wealth of knowledge and research into paranormal and extraordinary dreams, as well as a discussion on how to work with the nature of each type of dream to enhance your life. An extraordinary dream of a paranormal nature might fall into one of the following classifications according to Krippner: a) Collective dreams – whereby two persons report the same or similar dreams on the same night; b) Telepathic dreams – relating to the thoughts of another; c) Clairvoyant dreams – perceiving distant events; d) Precognitive dreams – providing information about an event that has not yet occurred; e) Past life dreams – which appear to detail events in a past life we have no way of knowing about; f) Spiritual dreams – whereby we are visited by spirits, deities or those from the other side. G) Out-of-Body – which involves the sensation of leaving your body.

a) Collective Dreams – Sometimes two persons will report having dreams on the same night, with the same identical elements in them. For example, Stanley Krippner[67] cites a dream in which the two dreamers, on the same night, dreamed of being in identical locations, describing the same hotel lobby with its unique pillars.

b) Telepathic – Dreaming of the thoughts or perceptions of other people at a distance has been the subject of a good degree of quantitative research, because it is relatively easy to administer, control and judge, following the experimental process that Ullman, Krippner and Vaughan had pioneered.[5]

c) Precognitive – Evidence that these phenomena can occur in the dream state also comes from a number of research studies at the dream lab at Maimonides Medical Center, reported in the book *Dream Telepathy.* [5] Successfully avoiding an event that appears precognitive in a dream may be difficult, however, since the dream rarely depicts the scene as it is in reality – they appear as metaphors or symbolically and are hard to distinguish from dreams that are simply projecting one's own inner fears. However, Krippner et. al.[67] report on work by Louisa Rhine with 191 apparent precognitive experiences, in which 69% of the people were successful in attempting to prevent the foreseen event.

d) Out of Body – One form of paranormal dream, which is strikingly different than any other, is the out-of-body experience (OOBE). Here, the dreamers perceive themselves consciously present outside their body, perhaps in another location, sometimes as a whole person or as just a ball of consciousness. The OOBE experience is similar to some reports of near-death experiences, which are filled with accounts where persons saw themselves float above their body and were able to accurately report on events at a distance, which were later verified.[6] Ceilia Green, in her book *Out of Body Experiences,*[68] indicates that most of these experiences occur when a person is ill, perhaps in surgery, or is resting in bed. Work has been done to substantiate that the phenomenon occurs,[7] but little is known about the mechanism or whether it is a true separation, or simply another form of the telepathic experience. Krippner[67] reports that it occurs across cultures, and that all six countries included in his 1,666 dream database, reported out-of-body dreams. La Berge [cited in 67] indicates that out-of-body dreams occur at sleep onset (when the sensory input is shutting down) and during certain lucid dreams (he reports a study in which 9% of the lucid dream reports included out-of-body experiences). A popular theory is that when we are asleep, with our body immobilized and essentially paralyzed, and we then become partially or fully conscious with the sleep paralysis remaining, we experience the sensation of being out-of-body. However, this does not account for laboratory reports[5] in which the person in this state was able to perceive a target that they had no way of perceiving from the vantage point of their physical body.

e) Lucid Dreams – This is the dream experience of knowing you are dreaming while in the dream. Often there is enough consciousness that willpower is activated and the dreamer can change the dream by intention. Flying dreams are more likely to be reported by subjects who also report lucid dreams, according to Deirdre Barrett[73] who examined 1,910 dreams from 191 subjects. Contrary to previous anecdotes, when flying and lucidity occurred in the same dream, lucidity preceded flight rather than being triggered by it. The degree of lucidity can vary in a lucid dream. The lowest degree of lucidity can be simply a sense that "this is a dream," without taking action on that awareness. With a higher degree of lucidity, you might take some personal action in the dream or even wake yourself. At the highest levels of lucidity, you may take full control over your actions in the dream, impose your will on the dream characters, or transform the very environment of the dream itself. Deirdre Barrett[72] examined the lucid dreams of 50 subjects for degree of lucidity based on the following corollaries: 1) awareness that people in the dream are dream characters, 2) awareness that dream objects are not real, 3) the dreamer does not need to obey waking-life physics to achieve a goal, and 4) memory of the waking world. Though many were too brief to evaluate on all corollaries, she found that only about half of the lengthier accounts were lucid for any particular corollary and less than a quarter were lucid on all four. Experienced lucid dreamers tended to be lucid about more corollaries. Research by individuals such as Stephen LaBerge, PhD,[8] has revealed that the lucid dreamer is maintaining a high level of consciousness, as if awake, even though the sensory input from the outside is cut off. EEG tracings are similar to the waking state, even though the dreamer is asleep. Stephen LaBerge and Keith Hearne [cited in 67] independently discovered ways that lucid dreamers could communicate with researchers in the outside world, by moving their eyes or flexing their muscles in predetermined patterns. There appears to be a relationship between lucidity and the parts of the brain that are more or less active during the dream. Reports using PET scans[49] indicated a greater sense of control over the dream (lucidity) when the medial frontal cortex (involved in consciousness) was active, and a greater sense of the dream being out of control when the amygdala (involved in emotional processing) was more active.

2.7 Dream Content as we Age

Our dream recall changes as we age. Interestingly, even though children exhibit more REM sleep than adults, the dream recall in children is lower than in adults according to Domhoff.[40] In research studies, the average rate of dream recall is only 20% to 30% from REM awakenings until the child reaches the age of 9 to 11 years. At that age recall rate increases to the adult level of around 79%.

Dream content matures with age, up until 13 to 15 years. Early dreams (ages under 5) are primarily bland with static images and thoughts about daily events. At ages 5 to 8 dreams become more story-like with movement and interaction, but are not well developed. The dreamer only appears as an active participant at around 8 years. The structure of children's dreams do not become adult-like until the ages 9 to 11 and they are noted to have less aggression, misfortune and negative emotions than adult dreams. The length or content don't become adult-like until the pre-teens (about 11 to 13), nor does the dream content show a good correlation to their personality until about this time.

Domhoff speculates that dreaming is a cognitive achievement which, like most cognitive abilities, develops as we grow. In particular, visual imagination may develop gradually and be a necessary prerequisite for dreaming. Young children don't dream well until their visuospatial skills are developed. The part of the brain responsible for visuospatial skills and constructing the dream space (the inferior parietal lobe) is not functionally complete until about ages 5 to 7.[54]

Patricia Garfield,[56] in her book *Your Child's Dream,s* collected 247 dreams from schoolchildren in the US and a few in India. She found that 64% were considered "bad" dreams and the remaining "good" dreams. Of the bad dreams, almost half had a theme of being chased or attacked, and in the remaining dreams about 40% had a sense of danger or some character being injured or killed, even though there was no direct threat. Of the "good" dreams, about half of the themes fell into two categories. The most frequent category was just "having a good time," and the next was of the child receiving a gift or having some desired possessions.

Alan Siegel, another researcher of children's dreams, speaks of the content and evolution of children's dreams in his book *Dream Wisdom*[59] and the book Dreamcatching,[58] which he co-authored with Kelly Bulkeley. He indicates that dreaming begins in the womb and that up to 80% of sleep in premature infants is devoted to REM sleep. He discusses how dream content changes as children grow and experience transitions, from first dreams, through coming of age dreams, to leaving home dreams. Siegel speaks of the appearance of two imposing figures as representing the child's image of the power of their own parents. One of the first dreams recalled by one of my daughters was of two giant hands reaching for her.

In *Dreamcatching*,[58] Siegel and Bulkeley list the most frequent types of dreams among children of all ages as: being threatened by animals or insects; being chased by monsters; flying; falling; being paralyzed or trapped; appearing naked in public; and being tested or examined. He indicates that for toddlers and preschoolers, the most common dream characters are animals. Van de Castle[37] also found this to be true, with almost 40% of young children's dreams at ages 4 to 5 containing animals, a percentage which dropped to less than 14% by the time they were teenagers. Like Garfield, he states that being chased or threatened in dreams, and nightmares with threatening creatures, appear to be the most common negative themes in children's dreams. This indicates that they symbolize a wide variety of early childhood fears and insecurities.

Section 3 - The Neurology of Dreaming

3.1 The Dreaming Brain

3.1.1 Implications of Brain Center Activity

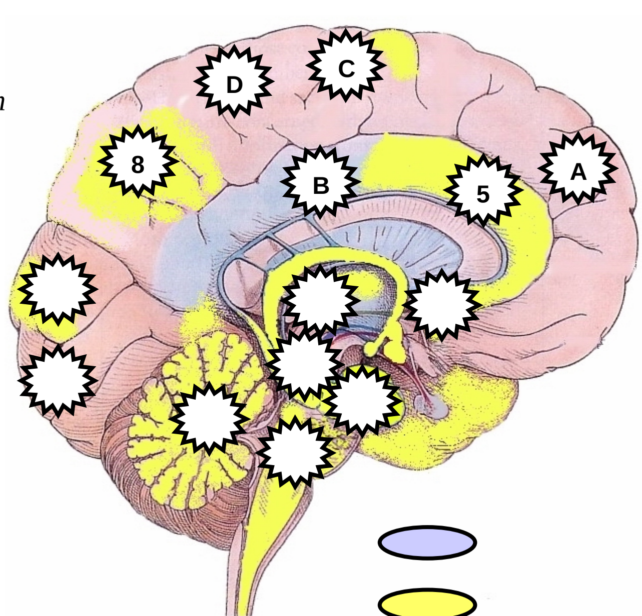
Figure 2 and table 1 is a compilation of various sources of recent research on the state of the brain in dreaming sleep. Figure 2 was derived from the updated Activation-Synthesis model presented by Hobson[39,14] as well as information provided by Schwarz and Maquet.[13] Table 1 uses excerpts from Hobson's work as well as Domhoff,[40] Ratey,[38] Calvin & Ojemann,[41] Kahn,[62] Schwarz and Maquet.[13] to further describe the functions typically assigned to those brain centers. These figures show the centers of the brain that are activated during dreaming, and centers that are less active, deactivated or with input and output disconnected. The centers of the brain in the shaded areas (sites A through E) are either partially or fully inactive or their inputs or outputs blocked. The numbered centers (sites 1 through 9) are active in dream sleep. Based on this data, table 1 is then an extrapolation in the words of this author, based on similar extrapolations by Hobson and other researchers, regarding how the presence or absence of those brain functions might affect the content of the dream.

Note that there is much more involved in the neurology and chemistry of dreaming. However, the information below should provide a brief summary of some of the latest findings. Further information can be found in the references for this section.

This state of the brain in REM sleep lead Braun et al.[cited in 39] to declare, "REM sleep may constitute a state of generalized brain activity with the specific exclusion of executive systems which normally participate in the highest order analysis and integration of neural information." In other words, we are conscious and the brain is operating, but the senses are disconnected (sites D and E). We are essentially paralyzed (site C) and much of the logic we depend on to construct the perception of a rational world is off-line (site A). All input comes from within.

Figure 2
The "Dreaming" Brain

excerpts from *Robert J Hoss, MS*



1 – Pontine Stem (pontine tegmentum)
2 – Thalamus
3 – Rt Hypothalamus
4 – Amygdala, Limbic and Paralimbic
5 – Anterior Cingulate
6 – Basal Ganglia
7 – Visual Association Cortex (temporal-occipital)
8 – Right Inferior Parietal Cortex
9 – Cerebellum (parahippocampal cortex)
A – Dorsolateral Prefrontal Cortex
B – Posterior Cingulate Gyrus and Precuneus
C – Primary Motor Cortex
D – Primary Somatosensory Cortex
E – Primary Visual Cortex

Table 1
Suggested Influence of Dreaming Brain States on Dream Content

ACTIVE

Brain Structure	Function	Dream Content
1 – Pontine Tegmentum	Forebrain Arousal (PGO spikes); REM Sleep Activation; motor pattern generators	Consciousness, eye movement, movement patterns in the dream
2 – Thalamus	Control of sleep cycle; mediates arousal and attention	You are conscious in the dream.
3 – Rt. Hypothalamus & Basal Forebrain	Autonomic & Instinctual functions, motivation and reward; fight or flight; Cortical arousal	Instinctive content (fear, escape, dream emotion), motivation and reward themes
4 – Limbic and Paralimbic Systems (Amygdala in conjunction with Hippocampus, Parahippocampal Cortex, Anterior Cingulate and medial frontal areas)	Emotional labeling of stimulus and movement; influences attention and what is important to be processed; memory storage processing; emotion processing; selective processing of emotional memories during REM[13] goal directed behavior and social processing;	Selected emotional memories stimulate the dream; associates emotion with dream actions; attributes emotional features and anxiety to dream imagery; sense of anxiety; goal directed dream stories; focus of dream on experiences that don't fit the image of self and its relationship to others and life; integration of the resolution into memory
5 – Anterior Cingulate in conjunction with medial frontal cortex, orbital-frontal cortex	reward anticipation, decision-making, empathy and emotional awareness; detects and evaluates the errors, and suggests an appropriate form of action	Produce coherent dramatizations that portray the dreamer's conceptions and concerns in waking life.[63] Dreams focus on anomalies with external world and evaluate and suggest future looking action.
6 – Basal Ganglia	Initiation of motor activity and programmed movements	You perceive you are moving in the dream.
7 – Visual Association Cortex (temporal-occipital areas)	High order integration of visual perceptions; internal information processing of paralimbic projections;[13] face recognition; Color, texture, shape	Visual dream content derived from emotional information being processed, and the associated personal associations and memories
8 – **Right** Inferior Parietal Cortex (BA40) and Bilateral Superior Parietal Lobe	Spatial perception; spatial imagery construction; orientation and movement; spatial self image; pictographs; Metaphor Processing	Perception of an imaginary dream space with pictorial/symbolic imagery; meaningful metaphors in narrative description
9 – Cerebellum and some activation of Motor Cortex	Fine tuning of movement, adds features such as vestibular sensations; motion perception	You perceive you are moving and have bodily senses in the dream.

RELATIVELY INACTIVE or BLOCKED INPUT/OUTPUT

Brain Structure	Function	Dream Content
A – Dorsolateral Prefrontal and Parietal Cortex	Executive functions: attention; directed thought = rationalizing, logic, planning, choice, decision making, anticipation of consequences; Inhibits inappropriate behavior; Working memory. Left Dorsolateral Prefrontal involved in reasoning.	Loss of will, control and reflective awareness (ego is just one dream character); bizarre imagery, irrational actions and alteration of time accepted as normal; material enters the dream freely and "unfiltered"; belief you are awake while dreaming and forgetfulness at awakening; lack of meaningful integration of information with respect to waking routines, rules and conventions.
B – Precuneus and lateral and inferior prefrontal cortex[13]	Recall and processing of visual and episodic memory.	Situations that stimulated the dream are not represented as they happened in waking life.
B - Posterior Cingulate Gyrus	Episodic and Working Memory	Sudden scene changes seem normal, no reflective awareness
C – Primary Motor Cortex	Generation of motion commands	Body is paralyzed while dreaming
D – Primary Somatosensory Cortex	Generation of sensory perceptions	Little to no external sensory input enters the dream.
E – Primary Visual Cortex	Generation of visual perceptions	No external visual information enters the dream.
Inferior Parietal Cortex (except for Right side)	Distinguishing between self and other's perspectives;	Perceiving self as another and self simultaneously;
Left Frontal and Temporal areas (including Broca and Wernicke's areas)	Broca and Wernicke's areas = language association, speech and naming of things	Imagery does not represent its named identity, leaving dreams to speak in metaphor, function, association and pictographs.

The brain stem and limbic system appear to act as "activators" of the REM state of sleep we typically associate with dreaming. They arouse us into the pseudo-consciousness of REM sleep and the amygdala appears to modulate the internally generated cortical input, thus activating the emotion-related processing that stimulates the dream.[13] How the dream forms remains controversial. Hobson and McCarley take the position that the dream is a result of higher brain centers interpreting or try to make sense of the activity in the lower centers. Antrobus argues that higher brain centers, and some cognitive processes, are involved in the creation of dreams at the onset.[cited in 67] Citing data that similar dream characteristics occur in a percentage of both REM and NREM sleep, Solms contends that dreaming is a function of a "dream on" mechanism in the forebrain, considering REM activation independent from dream formation.[cited in 67]

3.1.2 The Dual Brain

The prior section discussed various centers in the brain that are active and inactive in the dream state, and how those combinations might be responsible for the content of the dream story. Another view of brain processing during the dream state comes from a more generalized view of how the two hemispheres typically process information.

The brain is structured as right and left hemispheres linked by several bundles of nerve fibers that establish a communications path between the two halves. The control of our body movements and our senses are divided between these two hemispheres in a cross-wise fashion. That is, the right side of our body is controlled by the left hemisphere and the left side by the right hemisphere. Also it is the left hemisphere that is connected to the right visual field in each eye, and the right hemisphere that is connected to the left visual field in each eye.

At a gross hemispheric level, differences in processing have been observed between right and left hemispheres. Some of these differences were discussed in the prior section as associated with the right and left side of the frontal and parietal lobes. The left hemisphere, or "left brain," has been found to be more involved in understanding language, processing speech and reading, labeling things with words, and in linear logical thinking. It is charged with creating a model or story that makes sense. The right hemisphere, or "right brain," is more involved in processing non-verbal information (music, art, pattern recognition), forming associations and understanding what an object represents (as opposed to its name) and in visual understanding. It also detects and interprets anomalies of experience,[38] a process that is important in understanding the nature of dreams.

These distinct differences between right and left processing, however, are not pure. The more distinct differences lie with right-handed males. It is found that with left-handed individuals and with females, there is more bilateral or reversed representation of function normally attributed to one hemisphere or the other i.e., they might have speech functions in the right hemisphere rather than the left, or right hemisphere functions represented in both hemispheres. Regardless of individual variations with individual brain structure, it remains useful to understand the nature of the information processing differences, since they may hold a useful relationship to differences between waking and dreaming thought.

Some of the most widely cited characteristics[9, 36, 38] attributed to the two hemispheres are illustrated in Table 2. Note the strong similarity between the right brain processing characteristics, and the characteristics of the dream state. Observe how unlike the dream state the left-brain processing is. If there is a strong link between the right brain and the dream state, then perhaps viewing the dream from the standpoint of the thought processes attributed to the right brain provides a further key to understanding dreams.

Table 2 Functions Attributed to Brain Hemispheres

Left Brain	**Right Brain**
Verbal (produce speech)	Non-Verbal (comprehension only)
Temporal (tracking in time)	Simultaneous (no linear time)
Language Processing (speech, words)	Emotion & Social Processing (face and body language)
Categorizing (naming, titles)	Metaphor (relationships, analogy, context)
Sequential	Visuospatial (spatial relationships)
Digital (using numbers to count)	Analog (using values)
Logical (Linearly Linked Ideas)	Gestalt, Holistic (seeing the whole)
Processes peripheral details	Processes central aspects or essence
Analytic (step by step, part by part)	Synthetic (forming the whole)
Deductive	Imaginative
Rational and Realistic (reason & facts)	Intuitive (patterns, insight) and Impulsive
“Western Thought” (Technical, Rational)	“Eastern Thought” (Intuitive, Mystical)

Research associated with hemisphere activity during dream sleep[45] resulted in a variety of theories; including Bakan's early (1977-78) theory[46] that dreaming is primarily a function of the right hemisphere. Drawing on experimental evidence from studies of EEG, brain injury, epilepsy and sleep research, Bakan contended that, "marked similarities exist between dream experience and the kind of thinking which has been ascribed to the right hemisphere, e.g., perceptual, fantasy, affective, primary process.”

Much of the linking of dreaming with the right hemisphere originally came from observations of patients with damage to the right parietal region of the brain. Patients reported that they no longer had dreams and lost the ability to visualize, despite previous abilities in these areas.[10, 11, 45] In 1972, researchers[45,47] found shifts in the ratio of right and left EEG amplitude during changes from REM to NREM sleep. In a sleep laboratory study of right-handed males, they found the right hemisphere to be more active than the left during the dream state (REM). This reversed during NREM (non-dreaming) sleep.

More recent evidence with more specific measurement tools, as noted in table 1, shows that it is more than just the right brain involved in dreaming, but rather various sections of the brain activating and de-activating that make the dream state more like right brain activity and less like left brain activity. This likely occurs because some of the more influential centers that are activated in the dream state, are specific to the right hemisphere, such as the right inferior parietal cortex.[39] This is the visuospatial processing center of the brain perhaps involved in image and dream space construction. Also centers that are deactivated (such as the left parietal cortex, and dorsolateral prefrontal cortex) are responsible for processing functions that are typically associated with left hemisphere. Nofzinger found an increase in activation of the right hypothalamus and the right frontal cortex during REM sleep and a decrease in the left frontal cortex.[39] Marquet found an increase in the right parietal cortex and decrease in the left during REM.[cited in 39]

3.2 Neurological Influence on Dream Content

If we consider the information in table 1 relating to the normal functioning of the centers of the brain that are active and inactive during dream, and table 2 relating to the nature of the processing taking place in the right hemisphere, a picture emerges of why dreams appear as they do. The connections are theoretical assumptions but they do create a good picture of why dreams appear as they do and how they might relate to the waking life experiences and concerns of the dreamer.

3.2.1 The Dream Experience

1) Dreams Originate from Within

Since the sensory cortexes (sites D and E) are blocked, little to no external sensory information is stimulating the dream. External stimuli is usually ignored or incorporated into the dream, rather than interrupting the dream storyline, and it is usually observed to modify the ongoing dream, rather than being the primary initiator of the dream. Dreams therefore originate entirely from within. Hobson[14] and many other researchers conclude that that the forebrain and other associative regions of the brain that are active, responds to projections from the midbrain and limbic system, by surfacing associations in visionary or other sensory forms, which we experience as the dream.

2) You are Conscious in Dreams

Dreams represent a sleeping state of consciousness. Centers that arouse consciousness (sites 1 and 2) become active. Also, the same centers in the brain that process and perceive much of our waking space are active as well (sites 5, 7, 8). Thus, in our dreams we perceive that we are awake. Foulkes [cited in 67] argues that dreams are little more than waking consciousness stripped of most sensory input and freed from the obligation of making coherent connections to the external world. We are not in quite the same state of consciousness as when awake, but we are consciously viewing and moving around in a dream space, which we believe to be real.

3) Time and Linear Logic Have Little Meaning

The Posterior Cingulate Gyrus is inactive, thus episodic and working memory is inhibited, resulting in a dream story that does not follow a strict time sequence. Thus dream sequences can suddenly switch on us, and we fail to even notice or reflect on what changed until we wake up. This switch is perhaps a result of completing one synthesis of associations, and beginning another, as a new unresolved emotional stimulus enters the dream space. Dreams are observed to occur in a series of short segments, often with a common theme, that tend to take off in many directions and end with divergent and multiple conclusions from sequence to sequence. This could be a result of the issue the dream is dealing with, by stimulating many associations and memories all at once. Perhaps the influence of right hemisphere, which perceives and processes issues in a simultaneous holistic fashion, is attempting to resolve the same issue from all its various aspects, sequence by sequence. Dreams appear to synthesize all the emotional content and associations in a holistic manner, looking for a pattern that best accommodates it all.

When working on a dream with one or more sudden scene changes, treat each scene as a separate, but related, dream. Trying to relate it as one dream, with a logical connection between scene changes, rarely works. Also working with the entire dream as a series of related dream sequences is more revealing than working with a single segment.

4) Your Will is Absent or Diminished

This inactive logic center of our sleeping brain (site A) is also the seat of our will, plus decisions and actions based on will. Therefore in our dreams we generally don't think to control our actions or the storyline of the dream, even though the dream is all created within our own mind. We tend to exist as just a character in the dream, which is reacting to, subject to, or following the plot of the dream. The possible exception is lucid dreaming, in which control is possible, but is not always total, and generally lasts for only a short time according to LaBerge.[cited in 39] The knowledge that the dream is not subject to the will of the ego is beneficial to dreamworking. The characters in the dream, which represent feelings, beliefs, disconnected fragments of our personality, threatening emotional memories etc., are free to express their nature in the dream outside the influence of our will.

3.2.2 Dream Communications – an Internal "Language" ?

There remains some controversy among researchers over whether the dream itself actually contains anything of meaning for the dreamer. If we consider the dream in light of how it is typically used in therapy or self-help, however, meaningful experiences can indeed be attributed to dreams. Whether the "meaning" actually comes from within the dream, or how we work with the dream narrative, emotions and personal associations, a constructive "language" seems to emerge from the telling of the dream (dream narrative). If we consider the above neurological findings and their influence on the dream experience and narrative, the specific nature of that "language" also emerges.

1) Dreams Appear Irrational but Only to the Waking Mind

Even though we may be conscious in our dreams, the normal experience of waking consciousness eludes us because much of our brain responsible for rational reasoning (site A) is off-line. Information that is processed in the dreaming brain is therefore not organized by this higher rational level of processing, nor referenced against our waking model of reality. Even though the logical "filters" are not applied, meaningful processing may still be taking place within the dreaming brain. Perhaps we perceive all of the bizarre combinations of events and images as normal in a dream, because the active brain centers are sharing and interpreting information in their own normal healthy fashion, their own internal "processing language".

Dream thought is not totally irrational, and may be making very meaningful rational connections as we will see later. The neural network for dreaming contains enough cognitive processing areas, such as the medial frontal cortex and anterior cingulate cortex, and perhaps the orbital-frontal cortex, to produce coherent dramatizations that often portray the dreamer's conceptions and concerns in waking life.[63]

Even the bizarre imagery combinations in dreams may have a somewhat rational basis. Dreams appear to combine associated material by combining imagery fragments into composite visual images, each fragment perhaps representing a separate association. This is a psychological principle known as "condensation." This tendency to combine associated materials in a meaningful pattern may be one contribution of the right hemisphere. The right hemisphere is involved in matching objects by similar appearance and processing relationships as a whole (in a Gestalt fashion) from many parts.[9] These imagery combinations might therefore be a natural synthesis function of the right brain, which is combining related emotions, perceptions and memories to form a more complete holistic representation of the situation the dreaming brain is dealing with.

A further review of table 2 reveals a processing taking place in the right hemisphere, which is more active in dreaming[40] and seems more "dreamlike" in nature, while the left hemisphere process is more like waking thought. Even though we may be more conscious of the left-brain processes when we're awake, both right and left-brain are active, operational, and influencing our waking actions and thoughts. Edwards[36] describes right hemisphere information processing in the waking state as: visual imagery processing; perceptual awareness of things with minimal connection to words; no sense of linear time; not requiring a basis for reason or facts; relating to things as they are in all their perceptual complexity. The process also includes seeing likeness and relationships between things; seeing metaphors and analogies; seeing how parts fit together to form a whole or gestalt; seeing the whole all at once; insight and intuition; and perceiving many facets of a problem simultaneously which often leads to divergent or multiple conclusions. This processing, which seems apparent as we observe the nature of our dreams, also occurs in waking life but perhaps below our threshold of awareness. The point is that the processing taking place in dreams may indeed be not too far from that of normal waking state processing, thus not something abnormal or bizarre, but something we are not normally cognizant of in the waking state.

2) Emotional Associations May Dominate Dream Imagery

The material which is interpreted as imagery associations by the higher centers of the brain, may result from the processing of selected unresolved emotional events of the day. Emotion is a key factor in Hobson and McCarley's hypothesis that the intensity of dreams is reflected in the dreamer's respiratory rate, heart rate and skin potential.[cited in 67] Hobson[14] states that whereas dreams may appear bizarre, emotion in dreams is never bizarre. This implies that emotion, once triggered, is the driving force of the dream plot – and that the forebrain responds by surfacing associations with those emotions (in the form of dream imagery and actions) regardless of how loose those associations might be. Seligman & Yeller also view dream emotion as the primary shaper of the dream plot, rather than a reaction to it.[cited in 39] Marquet[14] proposes that the function of the apparent orchestration of cortical activity by the amygdala during REM sleep may be the selective processing of emotionally relevant memories. From the standpoint of hemispheric processing, the right hemisphere is also known to be involved in the comprehension of emotions.[38]

Dream imagery (and its hidden meaning) may be a result of what Berne and Savary term "Limbic Logic".[64] They state that the brain operates on at least three different types of logic. 1) Linear Logic, which principally resides in the left hemisphere of the cerebral cortex (off-line during dreaming), is our system for gaining knowledge, problem-solving, making choices, decisions and reasoning. 2) Kinesthetic Logic, which resides in the brain stem, responds to immediate physical sensations with the goal of finding pleasure and avoiding pain. 3) Limbic Logic, which resides in the amygdala and other limbic centers (active during dreaming), has a goal of safety and survival in times of danger, and thus associates an emotion to the sensory data it encounters.

This limbic system, which is highly active during dreams, grasps images and emotions and processes them by association. The limbic system recognizes inner data such as emotions, and associates an emotion to the sensory data it encounters.[64] Whereas in the waking state the limbic system sees a world full of images and links them to emotions, in the dreaming state it is possible that the limbic system recovers emotional memories of our daily events and is instrumental in creating the associated dream imagery.

Dreams also often contain what is termed the "Central Image" or "Contextualizing" image (CI). The CI can be a striking, arresting, or compelling image, which stands out by virtue of being especially powerful, vivid, bizarre, or detailed. According to Ernest Hartmann[75] the dream, especially the Central Image, pictures the emotion of the dreamer. This is most easily seen when there is a single powerful emotion in the dream. An example of this is the frequent vivid dream of being overwhelmed by a tidal wave, in someone who has recently experienced a traumatic event. Hartmann contends that the intensity of the central image is a measure of the strength of the emotion. The more powerful the emotion, the more intense the central imagery of the dream will be. He indicates that central image intensity can be measured reliably, as supported by research, including a recent systematic study of dreams before and after 9/11/01.[75] Hartmann indicates further that dreaming is hyper-connective, that is, the mind (brain) makes connections more broadly in dreaming than in waking (where we operate on linear, over-learned logical connections). However, the dreaming connections are not random. They are guided by the emotion of the dreamer. Dreams picture, or contextualize, the underlying emotion. For Hartmann, emotion is at the core of the language of the dream.

3) Dreams – a Language of Association

What we see as the dream are the active “consciousness” centers of our brain, responding to and interpreting processing taking place at the deeper levels. As indicated above, Hobson[14] states that that the forebrain responds to projections from the midbrain by surfacing associations (in the form of dream imagery and actions) regardless of how loose those associations might be. Note from table 1 that it is the Visual Association cortex which is active in dreams while the visual cortex remains inactive. Visual images in dreams are therefore associations. Therefore the resulting dream is not seen as a linear storyline of rationally defined images and experiences, but rather as a holistic sequencing of visual associations resulting from the projections of material being processed at a deeper level.

Carl Jung,[4] a pioneer of basic theories upon which certain modern dreamwork is based, indicated that the various elements in a dream are “symbols’ that represent a complex combination of emotions, precepts, and thoughts. A dream representation can therefore be considered a “language” of sorts, if we consider that the dream images are “symbolic” of internal associations, derived from a meaningful processing of information, and that these dream “symbols” are combined in meaningful patterns and relationships. These meaningful combinations of dream “symbols” might be considered a language just as individual letters (symbols) and words are combined to form meaningful sentences in our spoken and written language.

4) Dreams – a Language of Metaphor

According to Domhoff[40] there is a simple explanation for the extensive use, by the human mind, of metaphor in speech and dreams. It occurs because metaphors provide a cross-modal mapping of well-understood basic experiences (such as warmth) to more difficult concepts (such as friendship) - ex: "we had a warm relationship.” They map physiological processes (sweetness) to more complex emotional experiences (pleasure) - for example: "what a sweet deal that was!" He states that each person learns a system of conceptual metaphors, as a result of repeated experiences in the course of childhood development.

As table 1 indicates the right inferior parietal cortex (area BA40) is active in dreaming. The inferior parietal cortex is also involved in spatial perception, orientation and movement, or creating a spatial perception of our waking world and our relation to it. It thus likely plays a similar role in the formation of a dream space composed of imagery and movements placed in relationship to their respective associations.
V. S. Ramachandran at the University of California San Diego[55] has also found that the inferior parietal lobe is a cross-modal processing area responsible for processing speech metaphors. This cross-modal processing creates links between such things as images and

sounds. In particular, Ramachandrans research illustrated sharp shapes linked to sounds with "sharp" components, and rounded or soft shapes being linked to sounds with "soft" components. If the right side (which is active in dreaming) is included in the inferior parietal cortical region that Ramachandran studied, this may be a reason that when we tell the dream, we often use metaphors to describe the actions, feelings and imagery in the dream. These metaphors are figures of speech that not only describe the dream, but link it to similar events and feelings in our waking life. The dream is a pictorial metaphor.Thus dreams stories become a collage of emotionally significant associations and pictorial metaphors with meaningful relationships to waking life concerns.

5) Dreams – a Language of Context

As we discovered above, dreams are processed in a part of the brain that talks in a non-verbal language, one that deals with relationship, properties and pattern. The right hemisphere tends to identify an object by its relational and emotional context and the left hemisphere by its title or name.[9]

One of the early cures for certain seizure conditions was the surgical separation of the corpus callosum, the nerve paths connecting the two hemispheres. What resulted was an individual with two distinct brain halves, processing and perceiving independently [12]. A test was done where a subject's left visual field (connected to the right hemisphere) was blocked so that only his left hemisphere could see. He was shown a fork, which he correctly identified as "a fork." Then the right visual field (connected to the left hemisphere) was blocked so that only the right hemisphere could see. He could no longer identify the object as a fork, but rather called it "something I eat with." The right brain could not title the object; it could only identify its context or function.

Knowing that the right brain identifies an object by <u>function or purpose</u>, or its contextual role, is an important key to understanding the language of dream imagery. In order to identify a dream image (a largely right brain creation), we simply reverse the process. Ask the dreamer to describe the "function" or "purpose" of a dream image, and you will learn a little bit about what it represents to them on a personal level.

6) Words Rarely Convey a Literal Message

So what about dreams that contain speech and written or spoken words? With some exceptions, words in dreams, whether written or spoken, seldom convey literal meaning or "messages." The language centers in the left hemisphere (that communicate with words) are inactive in the dream state. The language processing of the right hemisphere (that of meaning, emotion, visualization, context, memory and association) may be represented in dreams. This "right brain" speech processing however does not represent meaning with terminology that follows a set of rationally dictated rules. This perhaps explains why written words in a dream morph or change as we try to read them. Most often, words that appear in dreams are strange combinations of sounds and phrases that have no rational meaning, but that have a very direct symbolic meaning.

In waking life we communicate by forming messages from combinations of words and letters which follow a set of culturally learned rules of logic. In contrast, the dreaming brain communicates by forming messages from combinations of images which follow natural rules of association. In waking life we combine word symbols to form meaningful verbal stories composed of sentences; while in dreams we combine symbolic images to form meaningful dream stories of images, and metaphors.

3.2.3 The Focus of Dreams

1) Dreams Deal With Daily Events – but Omit the Event Itself

Dreams appear to be associated with recent waking life events and concerns, even though the event itself is not played out in the dream. This "continuity principle" is supported by evidence that dreams contain content that is continuous with daytime events or "day residue." Studies by Fosse, Fosse, Hobson and Stickgold (2003)[13] found that 65% of dream reports contain residues of previous waking activity, but only 1.4% of them represented a replay of the full waking episode. Day-residue is generally found in dreams from the prior day, falling off significantly after a few days. A dream-lag effect has also been observed, which shows a surprising incorporation of daytime experiences that occurred approximately one week prior to the dream.[42] Most therapeutic dreamwork supports this principle, in that it generally shows the dream to be related with some recent situation, or unresolved past traumatic event, in the dreamer's waking life.

Although dreams appear to be stimulated by a recent waking life event, the dream rarely contains the event. But if so, only as vague fragments of the feelings, actions and characters involved. The event, or waking episode, seems "hidden" which is perhaps the source of most confusion about dreams in relationship to waking life. This is because the link between the parts of the brain responsible for episodic and visual recall becomes inactive during the REM stage of sleep (the communication link between the dorsal lateral prefrontal cortex and the precuneus). Further, a number of researchers believe that the reason that we cannot recall episodes during dreaming is because of the change in the direction of information flow. In the waking state, information flows from the hippocampus to the cortical areas. Short-term memories are thereby transferred to longer-term memories and episodic memories are recalled when the flow is in this direction. During dreaming, however, it is reversed. Information flows from cortical area to the hippocampus.[65] In contrast to this, the centers responsible for recall of emotional memories (the limbic region) are very active. As described above, it appears that the emotional context and memory associations stimulated by the waking event are represented in the dream, but the event itself is not, all due to the unique way in which memory is processed during sleep.[61] This may also be because the unresolved emotional impact of the event is being processed in the dream state, not the memory itself. Therefore, representing the event is of no consequence to what the dream is dealing with.

2) Dreams Focus On Self

The typical dream appears to focus on concerns about self. According to Panksepp,[43] dreams are laden with self-referential configurations and permutations of emotional problems to be solved. Revonsuo states that threat perception and harm avoidance lie at the heart of many dreams.[cited in 39] This may be a result of the activation of the Limbic system, Rt. Hypothalamus & Basal Forebrain which is involved in instinctual functions such as attaching an emotional association to imagery, motivation and reward, and fight or flight in the face of threat. Ratey states that the function of the Limbic system and hippocampus is important to our “social brain”, who we see ourselves to be in relationship to others and life’s overall picture. These active centers are involved in anomaly and error detection, which map the external experience against an internal model of reality and the social self. The Right Inferior Parietal Cortex (BA40) which may play a key role in the spatial construction of dream imagery in a “dream space,” is also involved in our visual image of self and the space around us in relationship ourselves.

3) Dreams Focus on Anomalies and Conflict and Project Appropriate Action

Nofzinger et. al. (1997; 2001) highlight the importance of the anterior cingulate cortex in dreams, which plays a role in attentional states, performance monitoring, and error detection in waking thought.[40] Although there is still some controversy over its role, some research concludes that the Anterior Cingulate monitors conflict and also detects and monitors errors, evaluates the degree of the error, and then suggests an appropriate form of action to be implemented. The Anterior Cingulate in conjunction with other rational processing centers, such as the medial frontal cortex and orbital-frontal cortex, provide a degree of rational processing. This produces coherent dramatizations that often portray the dreamer's conceptions and concerns in waking life.[63] Due to the activity error and conflict monitoring function, the resultant dream stories can focus on conflict and anomaly resolution in our lives, making dreams somewhat forward looking and predictive. Thus dreams often end with a projected direction, path or solution, even if it is not always a positive one or the direction fully formed prior to waking. This is supported by Jan Born and his colleagues at the University of Lubeck, who used a mathematical number test with a hidden trick in it, and found evidence that dream sleep more than doubled the probability of participants detecting the trick.[cited in 66]

According to Ratey,[38] the limbic system and parts of the brain stem also play a major role in arousing attention, particularly novelty detection and reward. The reticular formation alerts our cognitive mind when a stimulus is novel or persistent. The hippocampus compares the present with the past, and thus relates events as either novel or ordinary. It inhibits reaction to ordinary events, and orients us to the novel, that which doesn't fit our memory store. As above, Ratey states that this process is integral to the functioning of our emotional and social brain (who we see ourselves to be in relationship to others and life's overall picture). The dream story may therefore be stimulated by daily events that are an anomaly or don't "fit" the internal perception of self and our social world.

Furthermore, certain brain centers which are active during dreaming (including the amygdala, right inferior parietal lobe and much of the right hemisphere), are responsible for recognizing emotional body and facial expressions and are involved in processing our social interactions.[38] Dr David Kahn[62] indicates that within a dream, the dreamer is often aware of other people's thoughts and feelings. In a study of 35 subjects (who submitted 320 dream reports containing more than 1200 dream characters), he found that in a majority of their dream reports (77%), they were aware in the dream that their dream characters had feelings about them. One explanation Kahn offers is that our awareness of the feelings and thoughts of others in our dreams prepares us for social encounters when awake.

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