



THE SCIENCE BEHIND DREAMING

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Abstract

The historical perspective and interpretation of dream varies greatly from place to place based on various religious ideologies and beliefs. REM sleep became the first basis of scientific understanding of dreams. From the ancient times, people have always tried to interpret dreams and come out with various theories which greatly varied based upon socio-cultural background. A review on dream is presented here to unfold the mystery of dream.

Keywords: Dream, Sleep, REM, NREM.

Introduction

Dreams are a part of human sleep from the time immemorial. Everyone irrespective of age and gender experiences dream almost every night but remember very little or none at all in the morning because dreams are very volatile, the person immediately forgets most part of a dream after waking up.

The historical perspective and interpretation of dream varies greatly from place to place based on various religious ideologies and beliefs. The oldest such reference of dream interpretation is 5000 years old that approximately dates back to 2500 BC, nearly 2500 clay tablets collected from many historical eras (Assyrian & Babylonia) were found in the royal library of king Ashurbanipal in Nineveh, modern day Iraq. Excavators also found broken clay tablets describing the sequential dreams of the legendary Sumerian warrior, Gilgamesh. Interestingly, his mother assisted in interpreting his dreams and thus technically making her the first dream therapist on record!

Similarly, dream records made of Papyrus dated back to 2000 B.C were found in Egypt. One papyri collection contained 143 good and 91 bad dreams, plus details of interpretation methods quite similar to the ones used today. Held between the paws of the great sphinx of Giza, an early prophetic dream record on a sheet of granite was found which is also known as the "dream stela". Egyptians believed that dreams were simply a different form of seeing, even training dreamers to help plan battles and provide insight on state decisions. They also practiced dream incubation in order to encourage a special dream from the gods. Pondering upon and acting as per the images of dream is quite an old tradition, even it is said that Alexander the Great found strength for battle in a dream, enabling him to capture the city of Tyre and go on to conquer most of the known world as a young man.

Recent research suggests that some animals especially mammals also dream while in sleep, this is due to the fact that mammals are also biologically architected to undergo REM sleep just like we humans do. In an eye-opening sleep study published in 2001 in the journal Neuron, scientists Michael Wilson and Kenway Louie of MIT compared the brain patterns of rats running through a maze with their brain patterns during REM sleep afterward. They found the brain patterns so similar that they could tell what part of the maze the rats were "dreaming" of. Isn't that interesting? Now, moving forward let us understand what this REM sleep actually mean and how it became the first basis of scientific understanding of dreams?

What is REM sleep?

REM i.e., Rapid Eye Movement sleep is the 4th stage of sleep which was first discovered by scientist Eugene Aserinsky in 1953, a pioneer in sleep research. The other three stages of sleep are called as NREM or Non-REM sleep. The combination of the first three stages and the 4th REM sleep forms a complete sleep cycle that occurs several times every night when we sleep. Following are the description of each stage along with key points according to National Institute of Neurological Disorders and Stroke, USA:

- **STAGE 1 NREM SLEEP:** This stage of non-REM sleep also known as light stage sleep marks the transition from wakefulness to sleep. During this short period of relatively light sleep which lasts almost for 5-10 minutes heartbeat, breathing, and eye movements slow, and muscles relax with occasional twitches. Since this is a changeover from wakefulness, the person if awoken may realise that he/she isn't asleep at all.
- **STAGE 2 NREM SLEEP:** This stage of non-REM sleep lasts from 30 to 60 minutes and is characterised by light sleep before the person enters deep sleep. Heart rate and breathing slow down, and muscles relax even more, body temperature drops and eye movements stop. Though the brain wave activity slows but brief signals of electrical activity occur.



- **STAGE 3 NREM SLEEP:** This stage of non-REM sleep is the period of deep sleep that lasts about 20 to 40 minutes. Heart rate and breathing slow to their lowest levels, muscles are completely relaxed. Though the person may have some body movements but it is very hard to wake up someone at this stage.
- **STAGE 4 REM SLEEP:** REM sleep first occurs about 90 minutes after falling asleep. The movement of eyes become rapid sideways. Brain wave activity becomes quite similar to that seen in wakefulness. Respiration becomes faster and irregular; heart rate and blood pressure increase to near waking levels. Most of the dreaming occurs during REM sleep, although some can also occur in non-REM sleep. The arm and leg muscles become temporarily paralyzed, which resists the body to voluntarily come out of the dream state.

How REM sleep became the scientific basis of understanding Dreams?

William Dement often referred to as the American father of the sleep medicine is the pioneer who first approached dreaming to be related to Rapid Eye Movement (REM). In his paper co-authored by Nathaniel Kleitman titled “The Relation of Eye Movements During Sleep to Dream Activity: An Objective Method for the Study of Dreaming” published in 1957 in the Journal of experimental psychology, they explained about their experiment including 7 individuals (5 men and 2 women), whom they studied rigorously during their sleep time. Our brain experiences 4 types of brain waves viz. Alpha, beta, delta and theta or in simple terms oscillating electrical voltages. These electrical brain signals can be measured by Electroencephalography (EEG) which was used by Dement in his studies and concluded the fact that the brain waves were more intense during the REM phase, while those of NREM phase were deeper and less intense. So, the frequency of occurrence of dreams is particularly high during the REM phase also in NREM phase, occurrence is less and are more volatile and forgettable. This marked the very beginning of dreams being related to REM sleep.

In a first of its kind recent research work titled “Recalling and Forgetting Dreams: Theta and Alpha Oscillations during Sleep Predict Subsequent Dream Recall” published in 2011 in the journal of neuroscience, Cristina Marzano and her associates from the University of Rome aimed at understanding the relationship between dreaming and memory. They studied the sleep patterns of 65 university students in which the students were allowed to sleep in a controlled environment and their brain waves EEG were recorded and studied. They concluded that theta waves from the frontal cortex of the brain during REM sleep and alpha waves from the right temporal region during stage 2 NREM sleep are responsible for the dream recall while awakened.

Different theories on the interpretation of dreams and their reformations in the modern era

From the ancient times, people have always tried to interpret dreams and come out with various theories which greatly varied based upon socio-cultural background. In Hinduism, the Mandukya Upanishad of the Atharvaveda describes four states of consciousness viz. Waking state, dreaming state, deep sleep and pure consciousness. The Vedanta philosophers of India touched a different aspect of dream as compared to the western interpretations who described frustrated desires and past karma to be the reasons behind what we see in dream. They also emphasised on the possibility of getting blessing of almighty and spiritual experiences in dream.

The first ever western who gave a modern approach towards dream interpretations was Sigmund Freud (6th May 1856 – 23rd September 1939), an Austrian Neurologist and the founder of psychoanalysis. According to Freud, dreams are expressions of the unconscious mind as a way of resolving restrained or unwanted emotions, experiences, and aggressive impulses which he called it as “royal road to unconsciousness”. Though he described in his work that how trauma or aggression can influence the overall dream content but the major part of Freudian theory is too complex and revolves around dreams being expressions of unfulfilled sexual desires. He even described a list of symbolic sexual representations that a dream may contain and based on that dreams can be interpreted. Freud’s theory of psychoanalysis was a break through at that time but modern scientists vastly disapprove his theory and disqualifies it after experimentation on different people.

Carl Gustav Jung (26th July 1875 – 6th June 1961) was a German psychiatrist and psychoanalyst based in Zurich. He was an avid follower of Freud and they worked in collaboration for a long time to extend Freud’s theory of psychoanalysis. But later on, Jung started disapproving many of Freud’s theories and gave his own views on the analysis of dreams and thus founded the theory of Analytical psychology in which he described dreams to be revelations of the self. He argued the fact that dreams are not always meant to represent one’s unfulfilled sexual desires, rather it may be the expression of a person’s conscious memory when he/she is awake. He also believed that a dreamer must solely consider paying attention to their dreams or recurring dreams as it may present the dreamer with revelations about own-self and help resolve emotional problems and fears. He called it the process of Individuation.

Alfred Adler (7th February 1870 – 28th May 1937) was an Austrian medical doctor and psychotherapist. He considered human beings as an individual whole and thus founded the school of individual psychology. Adler believed that dreams are representations of problems in daily life, he regarded the conscious and unconscious as correlated and hence dreams must be interpreted, learn from them and incorporate them into the betterment of our everyday life. Adler never accepted any of Freud’s theories of psychoanalysis and had



his own approach towards interpretation of dreams. In his theory of individual psychology, Adler stated that the interpretation of each dream must be based on the individual concerned i.e every dream and visualizations in it would mean different for different individuals.

Friedrich (Frederick) Salomon Perls (8th July 1893 – 14th March 1970), also known as Fritz Perls, was a German psychiatrist, psychoanalyst, and psychotherapist. He along with his wife Laura Perls developed Gestalt therapy in the 1940s-1950s, a form of psychotherapy based on the concept of Gestalt Psychology developed by psychologists Max Wertheimer, Wolfgang Köhler, and Kurt Koffka in the early 20th century. According to Gestaltism or Gestalt psychology, they believed that organisms are not merely individual components but also possessed unique patterns or configurations. Perls devised his dream theory as a part of Gestaltism and coined the term gestalt therapy, in which he described dreams as projections of self which have been suppressed, rejected, or ignored. Perls approached a non-interpretation form of psychoanalysis in which the person is asked to play the dream or parts of it, describe it by imagining themselves being a part of it. He believed, this approach showed up the dreamer's personality w.r.t to the characteristics of the dreamt objects he played and described.

The most advanced approach towards the understanding of dreams is the Activation-synthesis theory given by two Harvard psychiatrists J. Allan Hobson and Robert W. McCarly in 1977. Their theory challenged the previously stated Freudian concepts and suggested that dreams occur simultaneously during the REM sleep due to periodic activation of the forebrain region. Hobson and other researchers suggested that during the REM sleep, circuits in the brain stem are activated which in turn activates certain areas of the brain that includes the amygdala, hippocampus, and areas associated with the limbic system involved in emotions, memories, and sensations. The brain then attempts to synthesize and interpret these signals resulting in visualization of meaningful images i.e dreams. Though the activation-synthesis theory gives a new direction towards the understanding of dreams from a physiological point of view, it directly does not deny the fact about dreams having real-life meanings. Hobson said that dreaming is the most creative conscious state which is a source of new ideas and novel information.

Types of dreams and dream-like states

Apart from the standard dreams that we have already discussed above, people also experience certain other types of dreams or dream-like states which are discussed as follows:

- **Nightmares:** These are realistic and disturbing dreams that cause the person to wake up immediately. Nightmares occur mostly during the REM phase of sleep and almost every person has encountered nightmares once in their lifetime. The visuals may include running from a danger, or falling off a high cliff etc. Continual and recurring nightmares may affect the sleep and cause sleep deprivation and health risks. Certain medications that affect the central nervous system such as anti-depressants, anti-anxiety drugs may also induce nightmares and in such cases a physician must be consulted.
- **Night-terrors/Sleep terrors:** These are dream-like states which occur usually in children and is characterised by episodes of panic, crying, thrashing, fear etc. They occur during the 1st non-REM sleep stage and unlike nightmares, children during night terror cannot be awoken. Though these are harmless but recurring night terrors may result in disturbed sleep, insomnia and fear to go to bed. In extreme cases medical treatment is essential.
- **Sleep Paralysis:** It is a feeling of being wake but unable to perform any voluntary movements characterised by feeling of choking, or pressured upon by someone. The occurrence and cause of sleep paralysis has not yet been concretely established but some researchers suggested that it occurs during shifting of sleep stages or due to dysfunctional REM sleep. Other causes may include improper sleep cycles, medication, stress etc.
- **Day dreaming:** It is defined as an altered consciousness stage in which the person gets detached from external tasks and alertness. Day dreaming up to a certain extent is good but excessive may cause maladaptive day dreaming which makes the person completely unaware of external on goings. Extreme day dreaming is characterised by vivid visuals of imaginary characters, persons and events, whispering, talking and making facial expressions.
- **Lucid dreaming:** It is a state in which the person is conscious that he/she is dreaming and has control over his/her dreams. During lucid dreaming, the dreamer is able to control the characters, narrative and the environment of the dream visuals. It comes with practice and maintaining a dream journal/diary aids towards perfection of lucid dreaming.
- **False-awakenings:** These are referred to as hybrid state dreams (between awakening and sleep) in which the person is convinced of being awoken while in reality they are still dreaming. In false awakenings, people often dream of performing everyday chores after getting up from sleep like bathing, cooking, cleaning, eating etc.

Conclusion

Dreams have always been a thing of mystery and utmost importance among people from all times. Over the past decades psychiatrists and neuroscientists have been puzzled with finding out the science and physiological relation to dreams but very few have been found since then. Various research institutes all over the world has been dedicated towards sleep and dream research to understand the phenomena scientifically. A major portion of the causes of dreaming and dream-like states is yet to be discovered and the conquest of finding answers is still ongoing.



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