

The dream, the remains of the night¹

Miranda Occhionero²

The term ‘dream’ defines the specific mental activity of the physiological condition of sleep. This experience has a multisensory quality, with the dreamer’s visual hallucination and participation. The dream occurs in very particular psychophysiological conditions (sleep) and consists of contents linked to mnemonic activation. The analysis of accounts of dreams collected in the laboratory under electropoligraphic control has made it possible to assess the differences related to cortical activation during the different phases of sleep. Based on the experimental data, we discuss some fundamental aspects of the dream experience.

The first aspect relates to the genesis of the dreamlike hallucinatory process. This cognitive process allows, under normal conditions, to distinguish the internal (representative) from the external (phenomenal) origin of a visual experience: in other words, it distinguishes a mental representation from a phenomenal perception. A second aspect concerns ‘the matter of dreams’, namely the activation of memories that constitute the contents of the dream.

Key words : Dreaming, Consciousness, Hallucinatory process, Memory, Representation of self

1. Introduction

That night all the dreams queued up and waited to be dreamed.

But there was no way for Helena to dream all of them.

One unknown dream started to beg :

‘dream me, you won’t regret it ! Dream me ! you’ll love it!’

Eduardo Galeano, *El libro de los abrazos* (1989)

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² Department of Psychology, Alma Mater Studiorum University of Bologna

Dreams have always been considered to be a form of thought with some meaning, depending on beliefs and the advancement of knowledge. In all cultures and civilizations, the importance of dreaming is such that it can even be seen as a source of information that can conditions life choices (Morewedge C.K., and Norton M.I. 2009).

This article provides a summary – certainly not exhaustive – of the analysis of dreams, starting from the second half of the XX century, which has led to our current scientific knowledge regarding the characteristics of the special mental activity during sleep that we call dreaming.

The first important and ineradicable problem in the study of dreams is why it makes sense to consider dreaming a scientific research topic: science requires, by definition, an ‘objective’ description of reality. In the case of the dream, the contradiction is evident since it is a mental process, or rather, an internal experience, which by its very nature cannot be directly investigated. The dream occurs in very particular psychophysiological conditions (sleep) and is made up of contents that are closely linked to the activation of a specific set of memories. Furthermore, the dream is, by definition, a ‘subjective’ experience that can only be known in its entirety by the person who is dreaming upon awakening, that is, in a psychophysiological condition that is very different from that in which this experience originated. This psychophysiological transition is of the utmost importance as it is very probable that the dreamer will not be able to remember his or her own dream experience when awake. In fact, upon awakening, the dreamer is faced with an unverifiable product, a somewhat distorted version of his or her very personal dream experience.

The problem of identifying a strong experimental paradigm for the objective acquisition of data from the ‘internal world’, that is, from the world of subjective experience, is present in many areas of study within psychology (i.e., mental imagery research). For the researcher who studies dreaming it is a fundamental, but at the same time unavoidable, problem: the dreamer’s description of the dream, recorded as speech or writing, constitutes an agreeable and testable object, but its source does not. Furthermore, the dreamer is forced to translate primarily visual, and sometimes strange and disjointed experiences, into a verbal history that can be understood by another person. Therefore, in the study of this particular mental activity we are faced with the double problem that neither the dream nor the processes that generate it can be directly investigated (Cicogna P.C., Cavallero C. and Bosinelli M. 1992). For these reasons the dream researcher is forced to work on the memory of the dream, and no experimental manipulation can be carried out on this product of the mind to investigate its generation processes. (Bosinelli M. 1975).

Having made this epistemological premise, psychological research, thanks to the development of neuroscience, especially since the 1950s, has produced a body of very interesting experimental

data concerning the nature and characteristics of this important cognitive process (Foulkes D. 1962; 1985 ; 1996). Within psychological research, the term dream defines a specific mental activity of the condition named sleep. Sleeping means first of all (almost) completely losing control of the inputs from the external environment. Secondly, sleeping means not being aware of one's vigilance, that is, of the fact that we are sleeping (and 'perchance to dream' ...). Sleep is therefore the essential physiological vigilance (and consciousness) state for dream activity to be possible (Nir Y. and Tononi G. 2009).

From the cognitive point of view, the central characteristic is that this experience, which is unique in its kind, presents a multisensory quality with a predominantly visual (but not only) hallucinatory activity, the participation of the dreamer, and a rather articulated narrative plot. This experience is lived by the dreamer as an actual perception of reality, and its hallucinatory phenomenology is recognized, *ex post*, only upon awakening. In reality, the dream does not always have such defined characteristics, and its most salient peculiarity is linked to being an extremely polymorphic mental process, with levels of variability that make its definition difficult. This variability can be seen in the level of the hallucinatory quality, which is sometimes poorly defined or uncertain, of the memories that become available for the construction of the dream, in the levels of awareness that the dreamer experiences during the dream, in the presence of bizarreness, and in the representation of the self within oneiric narrative (Occhionero M. 2004).

2. Psychophysiological approach to the study of dreaming

Starting from the discovery of the electroencephalographic polymorphism of sleep via the identification of the REM phase (Aserinsky E. and Kleitman N. 1953 ; Dement W. and Kleitman N., 1957), the study of dreaming has followed two lines:

- the first involves the study of oneiric activity to establish precise relationships between physiological aspects (in particular cortical activation) of sleep and mental events;
- the second considers oneiric activity, and the mechanisms involved in eliciting thought during different conditions of consciousness, as a mental process, similar (although with specific characteristics) to other cognitive processes.

Regarding the first question, researchers were interested in analysing the structure of oneiric mental activity through correlational studies aimed at finding psychophysiological indices that could be related to this activity. The detailed analysis of accounts of dreams collected in the laboratory under electropolygraphic control – Electroencephalography (EEG), Electrooculography

(EOG), Electromyography (EMG) – has thus allowed for the evaluation of any differences related to cortical activation during the different phases of sleep, including the stages of transition from wake to sleep and from sleep to wake (Cicogna P., Natale V., Occhionero M. and Bosinelli M. 1998). The discovery of REM sleep led to a REM = dreaming analogy. The dream was considered as merely an epiphenomenon of the cortical hyperactivation of this sleep phase (Hobson J.A. 1990). However, other researches have shown that mental activity can be observed after waking up from all stages of sleep, including deep sleep (Foulkes D. 1962, 1996 ; Cavallero C., Cicogna P.C., Natale V., Occhionero M. and Zito A. 1992 ; Cicogna P.C. et al. 1998 ; Solms M. 2000 ; Occhionero M., Cicogna P.C., Natale V., Esposito M.J. and Bosinelli M. 2005). These studies had also the merit of highlighting the differences that could be found both in terms of quantitative order related to the percentage of likelihood of remembering a dream (much greater in REM compared to the other sleep stages) but also in terms of a qualitative nature related to the contents and the structure of the dream.

As far as the second question is concerned, the first aspect to consider is the most peculiar aspect of the dream: the hallucinatory process. The difference between imagination and hallucination lies in the manner in which the content is presented to consciousness. The core of the hallucinatory process consists of a ‘mistake’ in the mental operation that differentiates between what is objective and real, and what is subjective, that is, the product of an endogenous mental process (Musatti C. 1947). This mistake produces a failure in *reality testing*, the mechanism that allows us to distinguish the stimuli coming from the outside world from processes of internal representation. This cognitive process, under normal conditions, allows us to distinguish the internal (representative) origin from the external (phenomenal) origin of an experience that has an image character; in other words, it distinguishes a mental representation from a true perception (Ohayon M.M. 2000). In this sense, therefore, the dream is a hallucinatory experience since it is a representation that is not real, the internal origin of which is not recognized. Within this definition, multisensorial hallucination is a mental process that is exclusive to dreaming in which, unlike other hallucinatory phenomena (psychiatric or caused by psychotropic drugs), there is a loss of the self-awareness that is experienced during wakefulness (Cicogna P.C. and Bosinelli M., 200 ; Kozmovà M. and Wolman R.N. 2006).

Towards the end of the 1980s, interest became more closely oriented towards the cognitive processes involved in dream production. An important aspect is related to the specific memories (the matter of dreams) that become available during sleep (Cavallero C., 1987, 1993), as well as the activation and processing of autobiographical, episodic and semantic memories that are the basis of the dream experience construction (Fosse M.J., Fosse R., Hobson J.A. and Stickgold R. 2003).

The activation of memories and their transformations according to an activation mechanism of other memories make it possible to construct the dream in the form in which we remember it once awake (Cicogna P.C., Cavallero C. and Bosinelli M., 1986). Mnemonic activation is prompted at first, and during this activation an elaboration processing activates, within a feedback process, mnemonic networks that are coherent with memories that occurred earlier. On-line translation into images, language, and emotions, which make up the conscious part of dreaming, may, in turn, be able to influence the progress of the dream by controlling and selecting the information used.

Regarding the characteristics of memory sources, according to the taxonomy of memory proposed by Daniel L. Schacter and Endel Tulving (1994), long-term memory systems can be episodic, semantic, or refer to autobiographical features of the dreamer (Cicogna P.C. et al. 1986 ; Malinowski J.E. and Horton C.L. 2014 ; Renoult L., Davidson P.S.R., Palombo D.J., Moscovitch M. and Levine B. 2012). In the dream these traces of memory undergo a rewriting process, allowing the generation of a dreamlike script that maintains a more or less evident link with the memory traces of the event that actually happened (Malinowski J.E. and Horton C.L. 2014). A particularly interesting aspect is linked to autobiographical memory. Indeed the autobiography of the dreamer remains the determining element and constitutes the *fil rouge* of the whole dream construction. This type of memory is a complex articulation of contents related to events and experiences but also to general knowledge of oneself that takes on a fundamental role for the construction of identity (Conway M. A. and Pleydell-Pearce C.W. 2000). The presence of autobiographical memories in the oneiric plot could suggest the hypothesis that the representation of oneself is a powerful factor in organizing the structure and the oneiric narrative.

A particularly interesting aspect of memory activation is the specific quality of the hallucinatory mechanism, which is the representation of oneself in the dream, and the repercussions that this representation can have in relation to the levels of consciousness active during the dream hallucination (Bosinelli M., Cavallero C. and Cicogna P.C., 1982 ; Kozmovà M. et al. 2006). Various research has shown a remarkable variability of this specific hallucination: ranging from the dreamer's thoughtful presence, to a presence as a passive observer, up to a complete hallucination which corresponds to the way we perceive ourselves in waking conditions, that is, a complex integration of body structure and psychological identity (Occhionero M. et al. 2005). Another interesting aspect related to the activation of memory traces is the frequent presence of very recent memories (diurnal remains) that make up the oneiric screenplay, an aspect that was highlighted by Freud (1900). These diurnal remains are often characterized by high emotional salience; it is therefore possible to think that the dream also has some role in the processes of regulating emotional experiences (Vallat R., Chatard B., Blagrove M. and Ruby P. 2017).

However, the processes that activate memory traces do not always provide strong consistency between different contents, given the low level of activation of the control systems. When this coherence is not fully realized, the dream can present elements of bizarreness (Colace C., 2003 ; Cicogna P.C., Occhionero M., Natale V. and Esposito M.J. 2007). The phenomenon of bizarreness within the dreamlike plot may therefore be attributable to the intrusion of activated and persistent strong memory elements that are difficult to eliminate despite their irreconcilability with the rest of the narrative. This situation makes the process of building a coherent dream script difficult, thus affecting the editing and the spatio-temporal organization of the narrative (Revonsuo A. and Tarkko K. 2002).

3. Conclusion

In conclusion, we can affirm that dreaming can belong to sleep in all its phases, starting from the process of falling asleep, naturally with sometimes significant differences in frequency and characteristics of content. If the dream is a characteristic of sleep *per se* and does not refer to any of its periods (it is well known that Aristotle had already identified in dreaming the mode of functioning of human thought during sleep) then it can be assumed that the dream is the cognitive mode that is proper to the functioning of the Central Nervous System (CNS) during sleep (Domhoff G.W., 2003 ; Hobson J.A., Pace-Schott E.F. and Stickgold R. 2000 ; De Gennaro L., Marzano C., Cipolli C. and Ferrara M. 2012). This function is mainly supported by structures and brain areas that are activated in a peculiar and specific way, as the most recent research in psychophysiology and neurophysiology has shown us (Nir Y. and Tononi G. 2009 ; Perogamvros L., Baird B., Seibold M., Riedner B., Boly M. and Tononi G. 2017 ; Siclari F., Baird B., Perogamvros L., Bernardi G., La Rocque J.J., Reider B., Boly M., Postle, B.R., and Tononi G. 2017). Furthermore, these studies have consolidated the idea of a continuity relationship between mental processes during sleep and mental activities of wakefulness (Schredl M. and Hofmann F., 2003 ; Stickgold R. and Walker M.P. 2005). This continuity of the functioning of the cognitive system (albeit at different efficiency levels in the two conditions) is the most solid scientific evidence in favour of the study of the dream in important areas such as learning, memory, and consciousness processes (Edelman G.M., and Tononi G. 2000 ; Koch C., Massimini M., Boly. M., and Tononi G. 2016 ; Occhionero M. and Cicogna P.C. 2016).

By continuing in this line of research, therefore, we can hope to approach an answer to the question « Why do we dream ? » , and to comprehend how the brain-mind system works during sleep.

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