

# Hypnagogia: Unlocking the Borderland of Your Dreams

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Hypnagogia is the experience of the transitional state from wakefulness to sleep in humans: the hypnagogic state of consciousness, during the onset of sleep. Mental phenomena that occur during this "threshold consciousness" phase include lucid thought, lucid dreaming, hallucinations, and sleep paralysis.

## Definitions

Sometimes the word hypnagogia is used in a restricted sense to refer to the onset of sleep, and contrasted with hypnopompia, Frederic Myers's term for waking up. However, hypnagogia is also regularly employed in a more general sense that covers both falling asleep and waking up, and Havelock Ellis questioned the need for separate terms. Indeed, it is not always possible in practice to assign a particular episode of any given phenomenon to one or the other, given that the same kinds of experience occur in both, and that people may drift in and out of sleep. In this article hypnagogia will be used in the broader sense, unless otherwise stated or implied.

Other terms for hypnagogia, in one or both senses, that have been proposed include "presomnal" or "anthypnic sensations", "visions of half-sleep", "oneirogogic images" and "phantasmata", "the borderland of sleep", "praedormitium", "borderland state", "half-dream state", "pre-dream condition", "sleep onset dreams", "dreamlets", and "wakefulness-sleep transition" (WST).

Threshold consciousness (commonly called "half-asleep" or "half-awake", or "mind awake body asleep") describes the same mental state of someone who is moving towards sleep or wakefulness, but has not yet completed the transition. Such transitions are usually brief, but can be extended by sleep disturbance or deliberate induction, for example during meditation.

## Signs and symptoms

Transition to and from sleep may be attended by a wide variety of sensory experiences. These can occur in any modality, individually or combined, and range from the vague and barely perceptible to vivid hallucinations.

## Sights

Among the more commonly reported, and more thoroughly researched, sensory features of hypnagogia are phosphenes which can manifest as seemingly random speckles, lines or geometrical patterns, including form constants, or as figurative (representational) images. They may be monochromatic or richly colored, still or moving, flat or three-dimensional (offering an impression of perspective). Imagery representing movement through tunnels of light is also reported. Individual images are typically fleeting and given to very rapid changes. They are said to differ from dreams proper in that hypnagogic imagery is usually static and lacking in narrative

content, although others understand the state rather as a gradual transition from hypnagogia to fragmentary dreams, i.e., from simple Eigenlicht to whole imagined scenes. Descriptions of exceptionally vivid and elaborate hypnagogic visuals can be found in the work of Marie-Jean-Léon, Marquis d'Hervey de Saint Denys.

### **Tetris effect**

People who have spent a long time at some repetitive activity before sleep, in particular one that is new to them, may find that it dominates their imagery as they grow drowsy, a tendency dubbed the Tetris effect. This effect has even been observed in amnesiacs who otherwise have no memory of the original activity. When the activity involves moving objects, as in the video game Tetris, the corresponding hypnagogic images tend to be perceived as moving. The Tetris effect is not confined to visual imagery, but can manifest in other modalities. For example, Robert Stickgold recounts having experienced the touch of rocks while falling asleep after mountain climbing. This can also occur to people who have travelled on a small boat in rough seas, or have been swimming through waves, shortly before going to bed, and they feel the waves as they drift to sleep, or people who have spent the day skiing who continue to "feel snow" under their feet. People who have spent considerable time jumping on a trampoline will find that they can feel the up-and-down motion before they go to sleep. Many chess players report the phenomenon of seeing the chess board and pieces during this state. New employees working stressful and demanding jobs often report doing work-related tasks in this period before sleep.

### **Sounds**

Hypnagogic hallucinations are often auditory or have an auditory component. Like the visuals, hypnagogic sounds vary in intensity from faint impressions to loud noises, like knocking and crash and bangs (exploding head syndrome). People may imagine their own name called, crumpling bags, white noise, or a doorbell ringing. Snatches of imagined speech are common. While typically nonsensical and fragmented, these speech events can occasionally strike the individual as apt comments on--or summations of--their thoughts at the time. They often contain word play, neologisms and made-up names. Hypnagogic speech may manifest as the subject's own "inner voice", or as the voices of others: familiar people or strangers. More rarely, poetry or music is heard.

### **Sleep paralysis**

Humming, roaring, hissing, rushing, zapping, and buzzing noises are frequent in conjunction with sleep paralysis. This happens when the REM atonia sets in sooner than usual, before the person is fully asleep, or persists longer than usual, after the person has (in other respects) fully awoken.

Sleep paralysis is reportedly very frequent among narcoleptics. It occurs frequently in about 6% of the rest of the population, and occurs occasionally in 60%. In surveys from Canada, China, England, Japan and Nigeria, 20% to 60% of individuals reported having experienced sleep paralysis at least once in their lifetime. The paralysis itself is frequently accompanied by additional phenomena. Typical examples include a feeling of being crushed or suffocated, electric "tingles" or "vibrations", imagined speech and other noises, the imagined presence of a visible or invisible entity, and sometimes intense emotion: fear or euphoria and orgasmic feelings. Sleep paralysis has been proposed as an explanation for at least some alien abduction experiences, the Night Hag and shadow people hauntings.

### **Other sensations**

Gustatory, olfactory and thermal sensations in hypnagogia have all been reported, as well as tactile sensations (including those kinds classed as paresthesia or formication). Sometimes there is synesthesia; many people report seeing a flash of light or some other visual image in response to a real sound. Proprioceptive effects may be noticed, with numbness and changes in perceived body size and proportions, feelings of floating or bobbing, and out-of-body experiences. Perhaps the most common experience of this kind is the falling sensation, and associated hypnic jerk, encountered by many people, at least occasionally, while drifting off to sleep.

### **Cognitive and affective phenomena**

Thought processes on the edge of sleep tend to differ radically from those of ordinary wakefulness. For example, something that you agreed with in a state of Hypnagogia may seem completely ridiculous to you in an awake state. Hypnagogia may involve a "loosening of ego boundaries ... openness, sensitivity, internalization-subjectification of the physical and mental environment (empathy) and diffuse-absorbed attention." Hypnagogic cognition, in comparison with that of normal, alert wakefulness, is characterized by heightened suggestibility, illogic and a fluid association of ideas. Subjects are more receptive in the hypnagogic state to suggestion from an experimenter than at other times, and readily incorporate external stimuli into hypnagogic trains of thought and subsequent dreams. This receptivity has a physiological parallel; EEG readings show elevated responsiveness to sound around the onset of sleep.

Herbert Silberer described a process he called autosymbolism, whereby hypnagogic hallucinations seem to represent, without repression or censorship, whatever one is thinking at the time, turning abstract ideas into a concrete image, which may be perceived as an apt and succinct representation thereof.

The hypnagogic state can provide insight into a problem, the best-known example being August Kekulé's realization that the structure of benzene was a closed ring while half-asleep in front of a

fire and seeing molecules forming into snakes, one of which grabbed its tail in its mouth. Many other artists, writers, scientists and inventors -- including Beethoven, Richard Wagner, Walter Scott, Salvador Dalí, Thomas Edison, Nikola Tesla and Isaac Newton -- have credited hypnagogia and related states with enhancing their creativity. A 2001 study by Harvard psychologist Deirdre Barrett found that, while problems can also be solved in full-blown dreams from later stages of sleep, hypnagogia was especially likely to solve problems which benefit from hallucinatory images being critically examined while still before the eyes.

A feature that hypnagogia shares with other stages of sleep is amnesia. But this is a selective forgetfulness, affecting the hippocampal memory system, which is responsible for episodic or autobiographical memory, rather than the neocortical memory system, responsible for semantic memory. It has been suggested that hypnagogia and REM sleep help in the consolidation of semantic memory, but the evidence for this has been disputed. For example, suppression of REM sleep due to antidepressants and lesions to the brainstem has not been found to produce detrimental effects on cognition.

Hypnagogic phenomena may be interpreted as visions, prophecies, premonitions, apparitions and inspiration (artistic or divine), depending on the experiencers' beliefs and those of their culture.

## Physiology

Physiological studies have tended to concentrate on hypnagogia in the strict sense of spontaneous sleep onset experiences. Such experiences are associated especially with stage 1 of NREM sleep, but may also occur with pre-sleep alpha waves. Davis et al. found short flashes of dreamlike imagery at the onset of sleep to correlate with drop-offs in alpha EEG activity. Hori et al. regard sleep onset hypnagogia as a state distinct from both wakefulness and sleep with unique electrophysiological, behavioral and subjective characteristics, while Germaine et al. have demonstrated a resemblance between the EEG power spectra of spontaneously occurring hypnagogic images, on the one hand, and those of both REM sleep and relaxed wakefulness, on the other.

To identify more precisely the nature of the EEG state which accompanies imagery in the transition from wakefulness to sleep, Hori et al. proposed a scheme of 9 EEG stages defined by varying proportions of alpha (stages 1-3), suppressed waves of less than 20 $\mu$ V (stage 4), theta ripples (stage 5), proportions of sawtooth waves (stages 6-7), and presence of spindles (stages 8-9). Germaine and Nielsen found spontaneous hypnagogic imagery to occur mainly during Hori sleep onset stages 4 (EEG flattening) and 5 (theta ripples).

The "covert-rapid-eye-movement" hypothesis proposes that hidden elements of REM sleep emerge during the wakefulness-sleep transition stage. Support for this comes from Bódicz et al.,

who note a greater similarity between WST (wakefulness-sleep transition) EEG and REM sleep EEG than between the former and stage 2 sleep.

Respiratory pattern changes have also been noted in the hypnagogic state, in addition to a lowered rate of frontalis muscle activity.

### **Daydreaming and waking reveries**

Microsleep (short episodes of immediate sleep onset) may intrude into wakefulness at any time in the wakefulness-sleep cycle, due to sleep deprivation and other conditions, resulting in impaired cognition and even amnesia.

Gurstelle and Oliveira distinguish a state which they call daytime parahypnagogia (DPH), the spontaneous intrusion of a flash image or dreamlike thought or insight into one's waking consciousness. DPH is typically encountered when one is "tired, bored, suffering from attention fatigue, and/or engaged in a passive activity." The exact nature of the waking dream may be forgotten even though the individual remembers having had such an experience. Gustelle and Oliveira define DPH as "dissociative, trance-like, but, unlike a daydream, not self-directed"--however, daydreams and waking reveries are often characterised as "passive", "effortless", and "spontaneous", while hypnagogia itself can sometimes be influenced by a form of autosuggestion, or "passive concentration", so these sorts of episodes may in fact constitute a continuum between directed fantasy and the more spontaneous varieties of hypnagogia. Others have emphasized the connections between fantasy, daydreaming, dreams, and hypnosis.

In his book, *Zen and the Brain*, James H. Austin cites speculation that regular meditation develops a specialized skill of "freezing the hypnagogic process at later and later stages" of the onset of sleep, initially in the alpha wave stage and later in theta.

### **History**

Early references to hypnagogia are to be found in the writings of Aristotle, Iamblichus, Cardano, Simon Forman and Swedenborg. Romanticism brought a renewed interest in the subjective experience of the edges of sleep. In more recent centuries, many authors have referred to the state; Edgar Allan Poe, for example, wrote of the "fancies" he experienced "only when I am on the brink of sleep, with the consciousness that I am so."

Serious scientific inquiry began in the 19th century with Johannes Peter Müller, Jules Baillarger and Alfred Maury, and continued into the 20th century with Leroy.

Charles Dickens' *Oliver Twist* contains an elaborate description of the hypnagogic state in Chapter XXXIV.

The advent of electroencephalography (EEG) has supplemented the introspective methods of these early researchers with physiological data. The search for neural correlates for hypnagogic imagery began with Davis et al. in the 1930s, and continues with increasing sophistication. While the dominance of the behaviorist paradigm led to a decline in research, especially in the English speaking world, the later twentieth century has seen a revival, with investigations of hypnagogia and related altered states of consciousness playing an important role in the emerging multidisciplinary study of consciousness. Nevertheless, much remains to be understood about the experience and its corresponding neurology, and the topic has been somewhat neglected in comparison with sleep and dreams; hypnagogia has been described as a "well-trodden and yet unmapped territory".

The word hypnagogia entered the popular psychology literature through Dr. Andreas Mavromatis in his 1983 thesis, while hypnagogic and hypnopompic were coined by others in the 1800s and noted by Havelock Ellis. The term hypnagogic was originally coined by Alfred Maury to name the state of consciousness during the onset of sleep. Hypnopompic was coined by Frederic Myers soon afterwards to denote the onset of wakefulness. The term hypnagogia is used by Dr. Mavromatis to identify the study of the sleep-transitional consciousness states in general, and he employs hypnagogic (toward sleep) or hypnapompic (from sleep) for the purpose of identifying the specific experiences under study.

Important reviews of the scientific literature have been made by Leaning, Schacter, Richardson and Mavromatis.

## Research

Self-observation (spontaneous or systematic) was the primary tool of the early researchers. Since the late 20th century, this has been joined by questionnaire surveys and experimental studies. All three methods have their disadvantages as well as points to recommend them.

Naturally, amnesia contributes to the difficulty of studying hypnagogia, as does the typically fleeting nature of hypnagogic experiences. These problems have been tackled by experimenters in a number of ways, including voluntary or induced interruptions, sleep manipulation, the use of techniques to "hover on the edge of sleep" thereby extending the duration of the hypnagogic state, and training in the art of introspection to heighten the subject's powers of observation and attention.

Techniques for extending hypnagogia range from informal (e.g. the subject holds up one of their arms as they go to sleep, so as to be awakened when it falls), to the use of biofeedback devices to induce a "theta" state - produced naturally the most when we are dreaming - characterized by relaxation and theta EEG activity.

Another method is to induce a state said to be subjectively similar to sleep onset in a Ganzfeld setting, a form of sensory deprivation. But the assumption of identity between the two states may be unfounded. The average EEG spectrum in Ganzfeld is more similar to that of the relaxed waking state than to that of sleep onset. Wackerman et al. conclude that "the Ganzfeld imagery, although subjectively very similar to that at sleep onset, should not be labeled as 'hypnagogic'. Perhaps a broader category of 'hypnagoid experience' should be considered, covering true hypnagogic imagery as well as subjectively similar imagery produced in other states."

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