Hallucinations: Understanding Sensory Realities

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My eyes at the moment of the apparitions by August Natterer, a German artist who created many drawings of his hallucinations.

A hallucination is a perception in the absence of external stimulus that has qualities of real perception. Hallucinations are vivid, substantial, and are perceived to be located in external objective space. They are distinguishable from these related phenomena: dreaming, which does not involve wakefulness; illusion, which involves distorted or misinterpreted real perception; imagery, which does not mimic real perception and is under voluntary control; and pseudohallucination, which does not mimic real perception, but is not under voluntary control. Hallucinations also differ from "delusional perceptions", in which a correctly sensed and interpreted stimulus (i.e., a real perception) is given some additional (and typically absurd) significance.

Hallucinations can occur in any sensory modality--visual, auditory, olfactory, gustatory, tactile, proprioceptive, equilibrioceptive, nociceptive, thermoceptive and chronoceptive.

A mild form of hallucination is known as a disturbance, and can occur in most of the senses above. These may be things like seeing movement in peripheral vision, or hearing faint noises and/or voices. Auditory hallucinations are very common in schizophrenia. They may be benevolent (telling the subject good things about themselves) or malicious, cursing the subject, etc. Auditory hallucinations of the malicious type are frequently heard, for example people talking about the subject behind his/her back. Like auditory hallucinations, the source of the visual counterpart can also be behind the subject's back. Their visual counterpart is the feeling of being looked or stared at, usually with malicious intent. Frequently, auditory hallucinations and their visual counterpart are experienced by the subject together.

Hypnagogic hallucinations and hypnopompic hallucinations are considered normal phenomena. Hypnagogic hallucinations can occur as one is falling asleep and hypnopompic hallucinations occur when one is waking up. Hallucinations can be associated with drug use (particularly deliriants), sleep deprivation, psychosis, neurological disorders, and delirium tremens.

The word "hallucination" itself was introduced into the English language by the 17th century physician Sir Thomas Browne in 1646 from the derivation of the Latin word alucinari meaning to wander in the mind. For Browne, hallucination means a sort of vision that is "depraved and receive its objects erroneously".

Classification

Hallucinations may be manifested in a variety of forms. Various forms of hallucinations affect different senses, sometimes occurring simultaneously, creating multiple sensory hallucinations for those experiencing them.

Visual

DeepDream modified toast sandwich

A visual hallucination is "the perception of an external visual stimulus where none exists". Alternatively, a visual illusion is a distortion of a real external stimulus. Visual hallucinations are separated into simple and complex.

Simple visual hallucinations (SVH) are also referred to as non-formed visual hallucinations and elementary visual hallucinations. These terms refer to lights, colors, geometric shapes, and indiscrete objects. These can be further subdivided into phosphenes which are SVH without structure, and photopsias which are SVH with geometric structures.

Complex visual hallucinations (CVH) are also referred to as formed visual hallucinations. CVHs are clear, lifelike images or scenes such as people, animals, objects, etc.

For example, one may report hallucinating a giraffe. A simple visual hallucination is an amorphous figure that may have a similar shape or color to a giraffe (looks like a giraffe), while a complex visual hallucination is a discrete, lifelike image that is, unmistakably, a giraffe.

Auditory

Auditory hallucinations (also known as paracusia) are the perception of sound without outside stimulus. Auditory hallucinations are the most common type of hallucination. Auditory hallucinations can be divided into two categories: elementary and complex. Elementary hallucinations are the perception of sounds such as hissing, whistling, an extended tone, and more. In many cases, tinnitus is an elementary auditory hallucination. However, some people who experience certain types of tinnitus, especially pulsatile tinnitus, are actually hearing the blood rushing through vessels near the ear. Because the auditory stimulus is present in this situation, it does not qualify as a hallucination.

Complex hallucinations are those of voices, music, or other sounds that may or may not be clear, may be familiar or completely unfamiliar, and friendly or aggressive, among other possibilities. A hallucination of a single individual person of one or more talking voices are particularly associated with psychotic disorders such as schizophrenia, and hold special significance in diagnosing these conditions.

If a group of people experience a complex auditory hallucination, no single individual can be named psychotic or schizophrenic.

Another typical disorder where auditory hallucinations are very common is dissociative identity disorder. In schizophrenia voices are normally perceived coming from outside the person but in dissociative disorders they are perceived as originating from within the person, commenting in their head not behind their back. Differential diagnosis between schizophrenia and dissociative disorders is challenging due to many overlapping symptoms especially Schneiderian first rank symptoms such as hallucinations. However, many people not suffering from diagnosable mental illness may sometimes hear voices as well. One important example to consider when forming a differential diagnosis for a patient with paracusia is lateral temporal lobe epilepsy. Despite the tendency to associate hearing voices, or otherwise hallucinating, and psychosis with schizophrenia or other psychiatric illnesses, it is crucial to take into consideration that, even if a person does exhibit psychotic features, he/she does not necessarily suffer from a psychiatric disorder on its own. Disorders such as Wilson's disease, various endocrine diseases, numerous metabolic disturbances, multiple sclerosis, systemic lupus erythematosus, porphyria, sarcoidosis, and many others can present with psychosis.

Musical hallucinations are also relatively common in terms of complex auditory hallucinations and may be the result of a wide range of causes ranging from hearing-loss (such as in musical ear syndrome, the auditory version of Charles Bonnet syndrome), lateral temporal lobe epilepsy, arteriovenous malformation, stroke, lesion, abscess, or tumor.

The Hearing Voices Movement is a support and advocacy group for people who hallucinate voices, but do not otherwise show signs of mental illness or impairment.

High caffeine consumption has been linked to an increase in the likelihood of one's experiencing auditory hallucinations. A study conducted by the La Trobe University School of Psychological Sciences revealed that as few as five cups of coffee a day (approximately 500 mg of caffeine) could trigger the phenomenon.

Command

Command hallucinations are hallucinations in the form of commands; they can be auditory or inside of the person's mind and/or consciousness. The contents of the hallucinations can range from the innocuous to commands to cause harm to the self or others. Command hallucinations are often associated with schizophrenia. People experiencing command hallucinations may or may not comply with the hallucinated commands, depending on the circumstances. Compliance is more common for non-violent commands.

Command hallucinations are sometimes used in defense of a crime, often homicides. In essence, it is a voice that one hears and it tells the listener what to do. Sometimes the commands are quite benign directives such as "Stand up" or "Shut the door." Whether it is a command for something

simple or something that is a threat, it is still considered a "command hallucination." Some helpful questions that can assist one in figuring out if he/she may be suffering from this include: What are the voices telling you to do?, When did your voices first start telling you to do things?, "Do you recognize the person who is telling you to harm yourself (or others)?, "Do you think you can resist doing what the voices are telling you to do?

Olfactory

Phantosmia (olfactory hallucinations), smelling an odor that is not actually there, and parosmia (olfactory illusions), inhaling a real odor but perceiving it as different scent than remembered, are distortions to the sense of smell (olfactory system) that, in most cases, are not caused by anything serious and usually go away on their own in time. It can result from a range of conditions such as nasal infections, nasal polyps, dental problems, migraines, head injuries, seizures, strokes, or brain tumors. Environmental exposures are sometimes the cause as well, such as smoking, exposure to certain types of chemicals (e.g., insecticides or solvents), or radiation treatment for head or neck cancer. It can also be a symptom of certain mental disorders such as depression, bipolar disorder, intoxication or withdrawal from drugs and alcohol, or psychotic disorders (e.g., schizophrenia). The perceived odors are usually unpleasant and commonly described as smelling burned, foul spoiled, or rotten.

Tactile

Tactile hallucinations are the illusion of tactile sensory input, simulating various types of pressure to the skin or other organs. One subtype of tactile hallucination, formication, is the sensation of insects crawling underneath the skin and is frequently associated with prolonged cocaine use. However, formication may also be the result of normal hormonal changes such as menopause, or disorders such as peripheral neuropathy, high fevers, Lyme disease, skin cancer, and more.

Gustatory

This type of hallucination is the perception of taste without a stimulus. These hallucinations, which are typically strange or unpleasant, are relatively common among individuals who have certain types of focal epilepsy, especially temporal lobe epilepsy. The regions of the brain responsible for gustatory hallucination in this case are the insula and the superior bank of the sylvian fissure.

General somatic sensations

General somatic sensations of a hallucinatory nature are experienced when an individual feels that their body is being mutilated, i.e. twisted, torn, or disembowelled. Other reported cases are

invasion by animals in the person's internal organs such as snakes in the stomach or frogs in the rectum. The general feeling that one's flesh is decomposing is also classified under this type of hallucination.

Cause

Hallucinations can be caused by a number of factors.

Hypnagogic hallucination

These hallucinations occur just before falling asleep, and affect a high proportion of the population: in one survey 37% of the respondents experienced them twice a week. The hallucinations can last from seconds to minutes; all the while, the subject usually remains aware of the true nature of the images. These may be associated with narcolepsy. Hypnagogic hallucinations are sometimes associated with brainstem abnormalities, but this is rare.

Peduncular hallucinosis

Peduncular means pertaining to the peduncle, which is a neural tract running to and from the pons on the brain stem. These hallucinations usually occur in the evenings, but not during drowsiness, as in the case of hypnagogic hallucination. The subject is usually fully conscious and then can interact with the hallucinatory characters for extended periods of time. As in the case of hypnagogic hallucinations, insight into the nature of the images remains intact. The false images can occur in any part of the visual field, and are rarely polymodal.

Delirium tremens

One of the more enigmatic forms of visual hallucination is the highly variable, possibly polymodal delirium tremens. Individuals suffering from delirium tremens may be agitated and confused, especially in the later stages of this disease. Insight is gradually reduced with the progression of this disorder. Sleep is disturbed and occurs for a shorter period of time, with rapid eye movement sleep.

Parkinson's disease and Lewy body dementia

Parkinson's disease is linked with Lewy body dementia for their similar hallucinatory symptoms. The symptoms strike during the evening in any part of the visual field, and are rarely polymodal. The segue into hallucination may begin with illusions where sensory perception is greatly distorted, but no novel sensory information is present. These typically last for several minutes, during which time the subject may be either conscious and normal or drowsy/inaccessible. Insight into these hallucinations is usually preserved and REM sleep is usually reduced. Parkinson's disease is usually associated with a degraded substantia nigra pars compacta, but recent evidence suggests

that PD affects a number of sites in the brain. Some places of noted degradation include the median raphe nuclei, the noradrenergic parts of the locus coeruleus, and the cholinergic neurons in the parabrachial area and pedunculopontine nuclei of the tegmentum.

Migraine coma

This type of hallucination is usually experienced during the recovery from a comatose state. The migraine coma can last for up to two days, and a state of depression is sometimes comorbid. The hallucinations occur during states of full consciousness, and insight into the hallucinatory nature of the images is preserved. It has been noted that ataxic lesions accompany the migraine coma.

Charles Bonnet syndrome

Charles Bonnet syndrome is the name given to visual hallucinations experienced by a partially or severely sight impaired person. The hallucinations can occur at any time and can distress people of any age, as they may not initially be aware that they are hallucinating, they may fear initially for their own mental health which may delay them sharing with carers what is happening until they start to understand it themselves. The hallucinations can frighten and disconcert as to what is real and what is not and carers need to learn how to support sufferers. The hallucinations can sometimes be dispersed by eye movements, or perhaps just reasoned logic such as, "I can see fire but there is no smoke and there is no heat from it" or perhaps We have an infestation of rats but they have pink ribbons with a bell tied on their necks." Over elapsed months and years the manifestation of the hallucinations may change, becoming more or less frequent with changes in ability to see. The length of time that the sight impaired person can suffer from these hallucinations varies according to the underlying speed of eye deterioration. A differential diagnosis are ophthalmopathic hallucinations.

Focal epilepsy

Visual hallucinations due to focal seizures differ depending on the region of the brain where the seizure occurs. For example, visual hallucinations during occipital lobe seizures are typically visions of brightly colored, geometric shapes that may move across the visual field, multiply, or form concentric rings and generally persist from a few seconds to a few minutes. They are usually unilateral and localized to one part of the visual field on the contralateral side of the seizure focus, typically the temporal field. However, unilateral visions moving horizontally across the visual field begin on the contralateral side and move toward the ipsilateral side.

Temporal lobe seizures, on the other hand, can produce complex visual hallucinations of people, scenes, animals, and more as well as distortions of visual perception. Complex hallucinations may appear real or unreal, may or may not be distorted with respect to size, and may seem disturbing or affable, among other variables. One rare but notable type of hallucination is heautoscopy, a

hallucination of a mirror image of one's self. These "other selves" may be perfectly still or performing complex tasks, may be an image of a younger self or the present self, and tend to be only briefly present. Complex hallucinations are a relatively uncommon finding in temporal lobe epilepsy patients. Rarely, they may occur during occipital focal seizures or in parietal lobe seizures.

Distortions in visual perception during a temporal lobe seizure may include size distortion (micropsia or macropsia), distorted perception of movement (where moving objects may appear to be moving very slowly or to be perfectly still), a sense that surfaces such as ceilings and even entire horizons are moving farther away in a fashion similar to the dolly zoom effect, and other illusions. Even when consciousness is impaired, insight into the hallucination or illusion is typically preserved.

Drug-induced hallucination

Drug-induced hallucinations are caused by the consumption of psychoactive substances such as deliriants, psychedelics, and certain stimulants, which are known to cause visual and auditory hallucinations. Some psychedelics such as lysergic acid diethylamide and psilocybin can cause hallucinations that range from a spectrum of mild to severe. Some of these drugs can be used in psychotherapy to treat mental disorders, addiction, anxiety, and secondary to advanced stage cancers.

Sensory deprivation hallucination

Hallucinations can be caused by sense deprivation when it occurs for prolonged periods of time, and almost always occur in the modality being deprived (visual for blindfolded/darkness, auditory for muffled conditions, etc.)

Experimentally-induced hallucinations

Anomalous experiences, such as so-called benign hallucinations, may occur in a person in a state of good mental and physical health, even in the apparent absence of a transient trigger factor such as fatigue, intoxication or sensory deprivation. It is now widely recognized that hallucinatory experiences are not merely the prerogative of those suffering from mental illness, or normal people in abnormal states, but that they occur spontaneously in a significant proportion of the normal population, when in good health and not undergoing particular stress or other abnormal circumstance.

The evidence for this statement has been accumulating for more than a century. Studies of benign hallucinatory experiences go back to 1886 and the early work of the Society for Psychical Research, which suggested approximately 10% of the population had experienced at least one hallucinatory episode in the course of their life. More recent studies have validated these findings; the precise incidence found varies with the nature of the episode and the criteria of 'hallucination'

adopted, but the basic finding is now well-supported.

Non-celiac gluten sensitivity

Non-celiac gluten sensitivity can cause hallucinations in some people, which some authors have termed "gluten psychosis".

Pathophysiology

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Visual

Sometimes internal imagery can overwhelm the sensory input from external stimuli when sharing neural pathways, or if indistinct stimuli is perceived and manipulated to match one's expectations or beliefs, especially about the environment. This can result in a hallucination, and this effect is sometimes exploited to form an optical illusion.

There are three pathophysiologic mechanisms thought to account for complex visual hallucinations. These mechanisms consist of the following:

Irritation of cortical centers responsible for visual processing (e.g., seizure activity). The irritation of the primary visual cortex causes simple elementary visual hallucinations.
Lesions that cause deafferentation of the visual system may lead to cortical release phenomenon, which includes visual hallucination.
The reticular activating system, which has been linked to the genesis of visual hallucinations.

Some specific classifications include: elementary hallucinations, which may entail flicks, specks, and bars of light (called phosphenes). Closed eye hallucinations in darkness, which are common to psychedelic drugs (i.e., LSD, mescaline). Scenic or "panoramic" hallucinations, which are not superimposed but vividly replace the entire visual field with hallucinatory content similarly to dreams; such scenic hallucinations may occur in epilepsy (in which they are usually stereotyped and experimental in character), hallucinogen use, and more rarely in catatonic schizophrenia (cf. oneirophrenia), mania, and brainstem lesions, among others.

Another thing that may cause visual hallucinations is prolonged visual deprivation. In a study where 13 healthy people were blindfolded for 5 days, 10 out of the 13 subjects reported visual hallucinations. This finding lends strong support to the idea that the simple loss of normal visual input is sufficient to cause visual hallucinations.

Psychodynamic view

Various theories have been put forward to explain the occurrence of hallucinations. When psychodynamic (Freudian) theories were popular in psychology, hallucinations were seen as a projection of unconscious wishes, thoughts, and wants. As biological theories have become orthodox, hallucinations are more often thought of (by psychologists at least) as being caused by functional deficits in the brain. With reference to mental illness, the function (or dysfunction) of the neurotransmitters glutamate and dopamine are thought to be particularly important. The Freudian interpretation may have an aspect of truth, as the biological hypothesis explains the physical interactions in the brain, while the Freudian interpretation addresses the psychological complexes related to the content of the hallucination, such as hallucinating persecutory voices due to guilt. Psychological research has argued that hallucinations may result from biases in what are known as metacognitive abilities.

Information processing perspective

These are abilities that allow us to monitor or draw inferences from our own internal psychological states (such as intentions, memories, beliefs and thoughts). The ability to discriminate between internal (self-generated) and external (stimuli) sources of information is considered to be an important metacognitive skill, but one which may break down to cause hallucinatory experiences. Projection of an internal state (or a person's own reaction to another's) may arise in the form of hallucinations, especially auditory hallucinations. A recent hypothesis that is gaining acceptance concerns the role of overactive top-down processing, or strong perceptual expectations, that can generate spontaneous perceptual output (that is, hallucination).

Stages of hallucination

Emergence of surprising or warded-off memory or fantasy images
Frequent reality checks
Last vestige of insight as hallucinations become indistinguishable from reality.
Fantasy and distortion elaborated upon and confused with actual perception
Internal-external boundaries destroyed and possible pantheistic (or personally felt or believed, possibly profound, internal spiritual or religious) experience

Biological perspective

Auditory hallucinations

Auditory hallucinations are the most prevalent type of hallucinations. They include hearing voices and music. Many times an individual suffering from auditory hallucinations will hear a voice or

voices saying the individual's own thoughts out loud, commenting on all their actions, or commanding and ordering the individual around. These voices tend to be negative and critical toward the individual. People who suffer from schizophrenia and have auditory hallucinations will often speak to the voice as though they are speaking to a second person.

Visual

The most common modality referred to when people speak of hallucinations include the phenomena of seeing things that are not present or visual perception, which does not reconcile with the physical, consensus reality. There are many different causes that have been classed as psychophysiologic (a disturbance of brain structure), psychobiochemical (a disturbance of neurotransmitters), psychodynamic (an emergence of the unconscious into consciousness), and psychological (e.g., meaningful experiences consciousness); this is also the case in Alzheimer's disease. Numerous disorders can involve visual hallucinations, ranging from psychotic disorders to dementia to migraine, but experiencing visual hallucinations does not in itself mean that there is necessarily a disorder. Visual hallucinations are associated with organic disorders of the brain and with drug- and alcohol-related illness, and not typically considered the result of a psychiatric disorder.

Schizoc hallucination

Hallucinations may be caused by schizophrenia. Schizophrenia is a mental disorder in which there is an inability to tell the difference between real and unreal experiences, to think logically, to have contextually appropriate emotions, and to function in social situations.

Neuroanatomical correlates

Normal everyday procedures like getting an MRI (Magnetic Resonance Imaging) have been used to find out more about auditory and verbal hallucinations. "Functional magnetic resonance imaging (fMRI) and repetitive transcranial magnetic stimulation (rTMS) were used to explore the pathophysiology of auditory/verbal hallucinations (AVHs)" Throughout the exploring through MRI's of patients, there were "lower levels of hallucination-related activation in Broca's area strongly predicted greater rate of response to left temporoparietal rTMS."

Also through fMRIs, it is found that there can be better understandings on why hallucinations happen in the brain, by understanding emotions and cognition and how they can prompt physical reactions that can help result in a hallucination. It suggests the theory that "motivations in the body and mind can drive us to certain behaviors that we act in, such as survival instinct and intuition" and that they can work in a hand-in-hand-like fashion. It can also be viewed as a symbolic "homeostasis" that can have adverse effects by having these hallucinations and/or mental illnesses. The amygdala has also been seen to relate to this finding by contributing a "declarative

judgement of emotional salience" as well as affecting both "efferent and afferent representational levels of affective autonomic responses in the brain". Hallucinations in schizophrenia have been found to associate with differences in morphology of the paracingulate sulcus.

Pathophysiological mechanisms

There are symptoms that are mechanism-based that are associated with hallucinations. These include superficial pressure and stabbing pain. Others include a burning-like sensation or electric shock feeling. Human studies of these symptoms remain mostly unclear unlike similar studies in animals.

Treatments

There are few treatments for many types of hallucinations. However, for those hallucinations caused by mental disease, a psychologist or psychiatrist should be alerted, and treatment will be based on the observations of those doctors. Antipsychotic and atypical antipsychotic medication may also be utilized to treat the illness if the symptoms are severe and cause significant distress. For other causes of hallucinations there is no factual evidence to support any one treatment is scientifically tested and proven. However, abstaining from hallucinogenic drugs, stimulant drugs, managing stress levels, living healthily, and getting plenty of sleep can help reduce the prevalence of hallucinations. In all cases of hallucinations, medical attention should be sought out and informed of one's specific symptoms.

Epidemiology

One study from as early as 1895 reported that approximately 10% of the population experiences hallucinations. A 1996-1999 survey of over 13,000 people reported a much higher figure, with almost 39% of people reporting hallucinatory experiences, 27% of which daytime hallucinations, mostly outside the context of illness or drug use. From this survey, olfactory (smell) and gustatory (taste) hallucinations seem the most common in the general population.