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Agnosia as a Perceptual Disorder: A Neuroanatomical Approach and Classification

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Abstract: The human brain is a complex cognitive system that depends on the integration of various cortical and subcortical networks. Agnosia is a higher-order cognitive disorder characterized by the inability to recognize stimuli despite intact primary sensory function. This literature review aims to summarize the fundamental concepts, classification, neuroanatomy, and diagnostic approaches of agnosia. The literature search was conducted using textbooks and online databases, including PubMed and Google Scholar, with relevant keywords, covering publications from 2010 to 2025 in English and Indonesian. Classically, agnosia is divided into apperceptive and associative types and, based on sensory modality, into visual, auditory, and tactile agnosia, each associated with specific lesion locations and possible mechanisms of disconnection syndromes. Understanding the clinical–neuroanatomical correlates of agnosia is important for improving topographical diagnostic accuracy and supporting more appropriate management in clinical practice.

Keywords: Agnosia; Neuroanatomical; Perceptual disorder

Introduction

The human brain is a complex biological system, consisting of approximately 100 billion information-processing cells known as neurons (Maldonado & Alsayouri, 2025; Stiles & Jernigan, 2010). This system regulates motor and sensory functions, coordination and balance, hormonal activity, as well as cognitive functions that distinguish humans from other living beings. Cognitive functions enable humans to interact with and process information, and continuously develop themselves (Morley et al., 2015).

Cognitive domains are closely associated with specific brain regions; thus, damage to particular areas may result in specific deficits. However, modern neuropsychology emphasizes that these cognitive domains function optimally only through connectivity with other brain lobes, including subcortical structures (Fuster, 2000; Pitt & Pitt, 2021).

Agnosia represents an example of a cognitive dysfunction. It may indicate specific structural lesions in certain brain regions as well as a disconnection syndrome, reflecting impaired integration between neural networks (Gürvit & Samancı, 2022; G. Humphreys & Riddoch, 2016; Kaufman, 2023; Vuilleumier, 2001). The term *agnosia* originates from Greek, where "a" means without and "gnosis" means knowledge, thus literally referring to a lack of recognition. The term was first introduced by Sigmund Freud in 1891 to describe a disorder in the ability to recognize and name objects, typically within a single sensory modality, despite intact primary sensory function. Agnosia gained widespread recognition through a case described by Oliver Sacks, in which a patient mistook his wife's face for a hat (Daroff et al., 2012; Warriner, 2008).

Agnosia is defined as a disorder of object recognition that is not attributable to deficits in basic sensory processing, memory, language, or general

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intellectual function, and may be specific to certain sensory modalities (visual, auditory, tactile) and types of stimuli (e.g., objects, faces, or words) (Kumar & Wroten, 2025; Vuilleumier, 2001).

Milner and Teuber (1968) defined agnosia as "normal perception stripped of its meaning." Patients with agnosia can perceive and describe the sensory features of an object but cannot recognize or identify it (Daroff et al., 2012). For example, a patient may be unable to identify a cup visually despite recognizing its color, yet can identify it through touch based on shape and texture. This differs from anomia, a naming disorder in which patients cannot name an object despite recognizing it through other sensory modalities such as touch or smell (Kumar & Wroten, 2025).

The diagnostic criteria for agnosia include (Daroff et al., 2012): impaired object recognition not explained by elementary sensory deficits; preserved ability to name objects once recognized (thus excluding primary anomia); and absence of generalized dementia or global intellectual decline explains the deficit.

Methods

This literature review was conducted using textbooks and online databases, including PubMed and Google Scholar. The search keywords included "agnosia," "perceptual disorder," "neuroanatomy of agnosia," "classification of agnosia," and "disconnection syndrome." Filters were applied to include articles in English and Indonesian published between 2000 and 2025. Included references were human studies with full-text access, including review articles, meta-analyses, systematic reviews, cohort studies, case-control studies, case reports, and cross-sectional studies.

Result and Discussion

Classification, Neuroanatomical Concepts, and Diagnosis of Agnosia

Classically, agnosia is divided into two types: apperceptive and associative agnosia. Apperceptive agnosia is characterized by a failure to recognize sensory stimuli at early stages of perceptual processing. In contrast, associative agnosia occurs when patients can copy, draw, or match objects but are unable to recognize them (Anggraini et al., 2018; Coslett, 2011). Based on sensory modality, agnosia is categorized into three types: visual, auditory, and tactile agnosia (Anilkumar et al., 2025).

Visual Agnosia

Visual agnosia is the inability to recognize visually presented objects despite intact visual fields, acuity, color perception, brightness discrimination, language, and memory. Patients can recognize objects through other sensory modalities (Daroff et al., 2012; Humphreys & Riddoch, 2016; Vuilleumier, 2001).

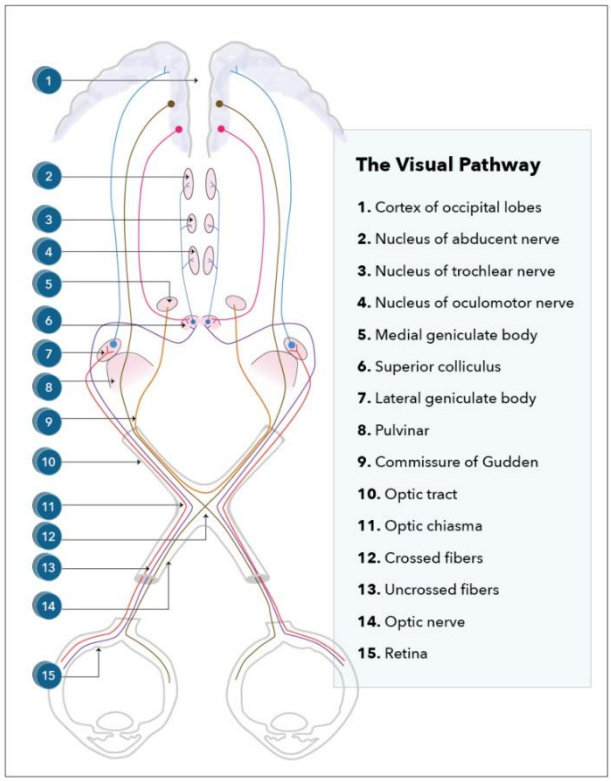

Figure 1. Visual Pathway (Gupta et al., 2026)

Visual object recognition begins with retinal input, which is transmitted to the lateral geniculate nucleus and then to the visual cortex to access stored memory representations. For example, when viewing an apple, information regarding its shape, size, and color is processed through the retina, lateral geniculate nucleus, and primary visual cortex in the occipital lobe (Gupta et al., 2026).

Subsequently, this visual processing is projected to the inferior medial temporal cortex for the recognition of visual stimuli (the "who" pathway, for example, in face agnosia; or the "what" pathway, for example, in object agnosia). In addition, projections from the primary visual cortex are also transmitted to the lateral superior temporal lobe, which plays a role in the recognition of auditory stimuli (the "who," such as a person's voice; and the "what," such as sounds of objects or spoken words). The parietal lobe is involved in spatial perception and in guiding actions toward stimuli (the "where," such as in visuospatial agnosia affecting location, orientation, or motion; and the "how," such as in ideomotor apraxia). The frontal lobe is involved in higher-order cognitive and strategic processes,

including organizing and monitoring information and actions (the "when," such as in confabulation and dyschronology; and the "why," such as reasoning and self-attribution of actions). Finally, processing also extends to limbic structures, including the hippocampus, which plays a role in the formation of episodic memory for unique entities and events. A small portion of visual information is also projected to the superior colliculus, which facilitates orientation toward moving objects within the visual field (Humphreys & Riddoch, 2013; Vuilleumier, 2001).

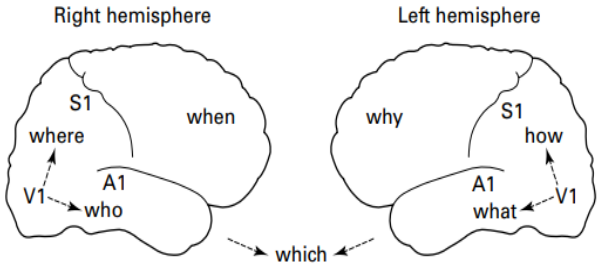

Figure 2. Schematic Illustration of Cortical Projections of Sensory Information in the Right and Left Cerebral Hemispheres (Vuilleumier, 2001)

Legend: V1 : primary visual sensory cortex; A1 : primary auditory sensory cortex; S1 : primary somatosensory cortex.

Visual agnosia is divided into two subtypes (Vuilleumier, 2001): apperceptive agnosia is defined as a failure of recognition due to abnormalities in visual perception and discrimination processes despite the absence of deficits in basic visual elements. Apperceptive agnosia is associated with lesions in the occipital and parietal cortices. Patients are unable to recognize objects, fail to adequately perceive shapes, and are unable to draw or copy figures; associative agnosia is defined as a failure of recognition due to the inability to assign meaning to what is seen. This type is associated with bilateral lesions of the inferior occipitotemporal cortex. Patients are able to draw and copy objects, but cannot identify what they have drawn. However, they can recognize objects when provided with verbal or tactile cues. Several types of visual agnosia have been described in the literature (Álvarez & Masjuan, 2016; Farah, 2004):

Simultanagnosia

Simultanagnosia is a term used to describe a disturbance of visual attention in which patients are unable to perceive multiple objects simultaneously, although they can recognize each object when presented individually. Two types of simultanagnosia have been identified (Álvarez & Masjuan, 2016).

Dorsal simultanagnosia

This occurs when patients are unable to perceive more than one object at a time. For example, when presented with a scene containing a table, a chair, and a flower vase, the patient can identify only one object (e.g., the table) when attention is directed to it, while the other objects remain unrecognized at that moment. This deficit leads to difficulties in reading, as patients can process only one word at a time, and may also result in frequent collisions with nearby objects while walking. Lesions in dorsal simultanagnosia are typically located in the bilateral occipitoparietal cortex.

Balint's syndrome, also known as Balint–Holmes syndrome, was first described by Rudolf Balint in 1909. It is characterized by a triad of symptoms: optic ataxia, ocular motor apraxia, and simultanagnosia. This rare condition is usually associated with bilateral parietal lobe lesions. In his original observations, Balint described clinical features including: (i) inability to shift gaze from a central fixation point (ocular motor apraxia), (ii) inability to identify multiple elements within a visual scene simultaneously (spatial attention deficit or simultanagnosia), and (iii) inability to reach for objects with the right hand despite preserved ability with the left hand (optic ataxia).

Ventral simultanagnosia

This refers to the inability to identify more than one object, despite the ability to perceive multiple objects at once. Patients are unable to integrate visual elements into a coherent whole. This condition is less common and is associated with lesions in the left inferior temporo-occipital region and is often linked to pure alexia. As a result, words are read letter-by-letter, and images are described in a fragmented manner (e.g., identifying "wheel," "pedal," and "face" without recognizing that the image depicts a man standing beside a bicycle). Unlike the dorsal type, there is no impairment in reaching for objects, eye movements, or navigation around obstacles.

Prosopagnosia (Face Agnosia)

Prosopagnosia refers to the inability to recognize faces. Patients fail to recognize familiar individuals, such as close friends, family members, or well-known figures, except through specific cues such as hairstyle or head shape. They often compensate by identifying individuals based on voice, gait, expression, or clothing. This disorder is specific to facial recognition and does not involve a general visual perceptual deficit (Daroff et al., 2012).

Face recognition is a complex process. Apperceptive prosopagnosia occurs when patients are unable to match facial images, indicating impairment at the early stages of visual processing. Associative

prosopagnosia occurs when patients can match faces but fail to recognize familiar individuals due to impaired association or facial memory. Patients with prosopagnosia can recognize objects, vehicles, and geometric shapes normally but cannot recognize faces (Daroff et al., 2012; Vuilleumier, 2001).

Anatomically, prosopagnosia is most commonly associated with bilateral temporo-occipital lesions, particularly involving the fusiform gyrus and occipitotemporal regions, although unilateral right-sided lesions may also produce similar symptoms. Key regions involved include: (i) the Occipital Face Area (OFA), responsible for facial form perception; (ii) the Fusiform Face Area (FFA), involved in facial identity recognition; and (iii) the anterior temporal cortex, which contributes to detailed perceptual processing of faces. Overall, facial recognition relies predominantly on right hemispheric networks. Functional MRI studies indicate that OFA plays a critical role in identifying specific individuals, whereas FFA processes broader aspects of facial perception. The disconnection hypothesis suggests that prosopagnosia may arise from disruption of connections between the occipital cortex and facial memory areas (Daroff et al., 2012).

Klüver–Bucy syndrome represents a special form of visual agnosia, first described by Klüver and Bucy in 1939 in monkeys following bilateral temporal lobectomy, and later reported in humans with bilateral temporal lobe lesions. In animal models, the syndrome is characterized by loss of normal emotional responses to visual stimuli, such as approaching predators without fear or engaging in inappropriate feeding and sexual behaviors. In humans, it presents with a constellation of symptoms including visual agnosia and prosopagnosia, memory impairment, language deficits, behavioral changes, placidity, hypersexuality or altered sexual behavior, and hyperphagia. It may result from bilateral temporal lobe damage due to surgical ablation, herpes simplex encephalitis, or neurodegenerative disorders such as Pick's disease (Daroff et al., 2012; Lanska, 2018).

Color Agnosia

Color agnosia is defined as the inability to identify colors despite preserved color discrimination and brightness perception. Diagnosis is particularly challenging because color perception is exclusively visual. Patients often have difficulty matching colors to line drawings of objects or verbally naming the colors of familiar objects. This condition is typically associated with lesions in the left occipitotemporal region.

Topographical Agnosia

Topographical agnosia is a condition in which patients are unable to recognize their environment due to impaired spatial information processing, without accompanying memory deficits, visual loss, or hemispatial neglect. According to Vuilleumier (2001), it can be classified into: (i) Perceptual type, characterized by the inability to recognize previously familiar buildings or landmarks; (ii) Mnemonic type, involving failure to recognize familiar places or layouts; and (iii) Spatial type, in which patients can recognize familiar places but cannot recall their spatial relationships or locations.

The perceptual and mnemonic types are often associated with lesions in the medial temporo-occipital region and the right parahippocampal gyrus, and are frequently associated with prosopagnosia. The mnemonic type may also involve lesions in the right posterior cingulate cortex. The spatial type is linked to damage in the right retrosplenial area and the medial posterior parietal lobe (Vuilleumier, 2001).

Finger Agnosia

Finger agnosia is the inability to recognize, name, differentiate, or point to the fingers (and sometimes toes), in the absence of sensorimotor deficits or language impairment (aphasia). It may occur in association with other symptoms such as agraphia, acalculia, and left–right disorientation. This tetrad of symptoms is known as Gerstmann syndrome. The presence of all four features, without other neurological deficits, is strongly associated with lesions in or around the left angular gyrus (Vuilleumier, 2001).

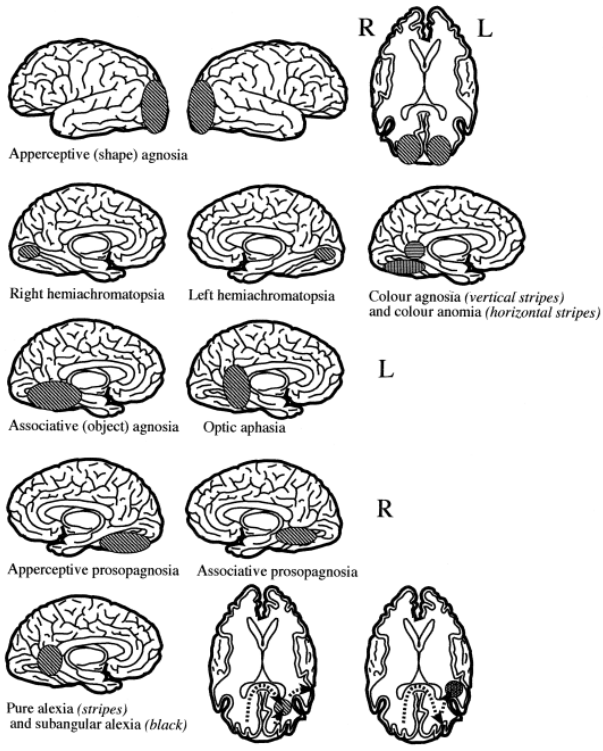

Figure 3. Anatomical Correlates of Visual Agnosia (Vuilleumier, 2001)

Akinetopsia, defined as selective motion blindness, is characterized by the inability to perceive visual motion, with patients only able to see static stimuli. As a result, visual perception appears fragmented, resembling a series of discontinuous stroboscopic images. Complete loss of motion perception is extremely rare and is typically caused by bilateral damage to brain regions specialized in motion processing, located in the parieto-temporo-occipital junction, just anterior to the lateral occipital gyrus (Vuilleumier, 2001).

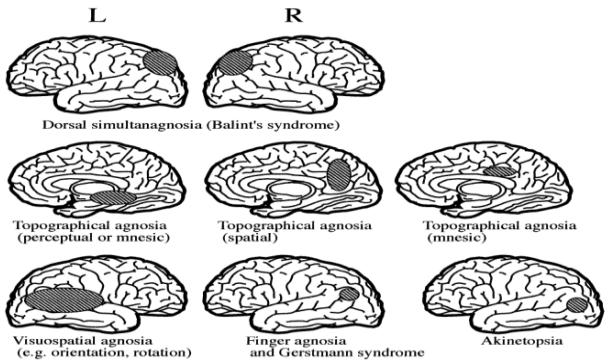

Figure 4. Anatomical Correlates of Visual Agnosia (Vuilleumier, 2001)

Table 1. Types of Visual Agnosia

Type of Agnosia	Clinical Features	Lesion Location
Dorsal simultan-agnosia	Inability to perceive more than one object at a time; attention restricted to a single object; difficulty reading (one word at a time); frequently bumps into objects	Bilateral occipito-parietal cortex
Ventral simultan-agnosia	Able to see multiple objects but unable to recognize them simultaneously; cannot perceive a whole image as a unified entity; reads letter by letter	Left inferior temporo-occipital region
Prosop-agnosia (face agnosia)	Inability to recognize familiar faces; identifies individuals through alternative cues (e.g., voice, gait); recognition of other objects remains intact	Bilateral temporo-occipital lesions (especially fusiform and occipitotemporal gyri), may also occur with right unilateral lesions
Color agnosia	Inability to identify or name colors despite intact basic color perception; difficulty naming object colors	Left occipito-temporal region
Topographical agnosia	Inability to recognize environments/ landmarks or orient in space; varies depending on subtype (perceptual, mnemonic, spatial)	Commonly right medial temporo-occipital region and parahippocampal gyrus; may also involve right posterior cingulate cortex, retrosplenial area, or medial posterior parietal cortex
Finger agnosia	Inability to recognize or name fingers; often associated with agraphia, acalculia, and left-right disorientation	Left angular gyrus
Akinetopsia	Inability to perceive motion (motion blindness); vision appears as discontinuous or stroboscopic images	Bilateral lesions in the parieto-temporo-occipital region (motion-processing areas)

Auditory Agnosia

Auditory agnosia is defined as the inability to recognize sounds despite intact hearing function (Kumar & Wroten, 2025). A key characteristic of auditory agnosia is that patients are able to perceive auditory stimuli—such as knocking on a door or a ringing telephone—but are unable to identify or assign meaning to these sounds. Patients may also demonstrate preserved speech comprehension and the ability to repeat spoken words, although repetition may occur without understanding their meaning, depending on the subtype of auditory agnosia. In most cases, patients are aware of their deficit and recognize their inability to identify sounds, which often leads to psychological distress. Auditory agnosia has been reported to result from lesions in the right posterior temporal lobe (Kumar & Wroten, 2025).

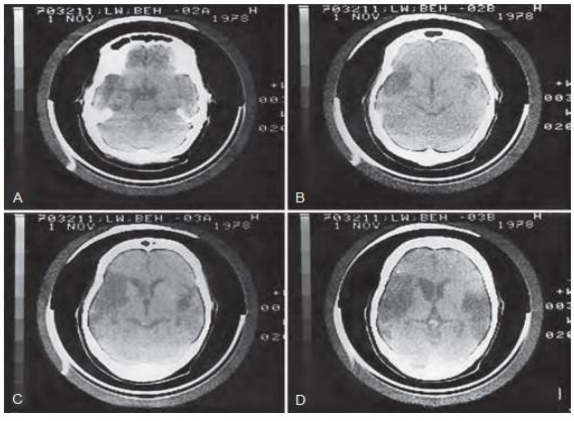

Figure 5. Head CT scan of a patient with extensive bilateral temporal lobe infarction (Daroff et al., 2012)

Similar to cortical visual syndromes, cortical auditory disorders encompass a spectrum ranging from

cortical deafness to partial deficits in recognizing specific categories of sounds. Most of these conditions require bilateral lesions of the temporal lobes, particularly involving the primary auditory cortex (Heschl's gyrus). In auditory agnosia, patients can hear sounds but cannot interpret their meaning; for example, they may fail to recognize animal sounds or environmental noises such as a ringing bell. Affected individuals often also experience difficulty understanding speech or appreciating (Vuilleumier, 2001). Based on the type of sound that cannot be recognized, auditory agnosia can be classified into four main forms:

Phonagnosia

Phonagnosia is analogous to prosopagnosia in the visual modality and is characterized by the inability to recognize familiar individuals by their voices. This disorder may be apperceptive in nature, manifesting as difficulty matching unfamiliar voices, and is typically associated with unilateral or bilateral temporal lobe damage. The inability to recognize familiar voices is often linked to lesions in the right anterior temporal lobe, and in some cases may be multimodal, involving deficits in recognizing individuals by both face and voice. A related variant is affective auditory agnosia, characterized by the inability to recognize emotional intonation in speech, usually due to right hemisphere lesions. Progressive phonagnosia has also been reported in frontotemporal dementia (Gainotti et al., 2023; Hailstone et al., 2010).

Auditory verbal agnosia (pure word deafness)

This condition is characterized by an inability to comprehend spoken words despite preserved perception of nonverbal sounds. It is often considered a progression from cortical deafness or severe auditory impairment. Classically, this syndrome is explained by a disconnection between both primary auditory cortices and Wernicke's area in the left hemisphere. Some studies suggest that strategically located unilateral lesions in the left hemisphere may also produce similar deficits by disrupting this connection. The clinical presentation of pure word deafness may resemble Wernicke's aphasia, with more severe impairment in auditory comprehension than reading comprehension, often accompanied by paraphasia, further supporting its relationship with Wernicke's aphasia (Stefanatos et al., 2005).

Nonverbal auditory agnosia

In this form, patients lose the ability to recognize meaningful nonverbal sounds (such as environmental or animal sounds), while retaining the ability to perceive pure tones and understand language. This condition is most commonly associated with bilateral temporal lobe lesions. However, cases involving unilateral left-sided lesions have also been reported, suggesting possible functional reorganization of auditory perception in the contralateral temporal lobe (Saygin et al., 2010).

Amusia

Amusia refers to the loss of musical ability due to focal brain lesions, reflecting the complexity of musical perception and processing. Lesion studies indicate that melody and pitch recognition primarily depend on the right temporal lobe, whereas the analysis of learned aspects of music—such as rhythm, tempo, and sequential organization—relies more on the left temporal lobe. Studies in patients with temporal lobe epilepsy have shown that left hemisphere lesions more significantly impair temporal sequencing in both music and speech. Furthermore, brain activity during listening to or performing music involves not only secondary auditory areas but also frontal, parietal, and cerebellar regions, indicating a widely distributed neural network underlying musical experience (Alossa & Castelli, 2009; Darvesh et al., 2024; Rosemann et al., 2017).

Tactile Agnosia

Tactile agnosia is defined as the inability to recognize objects through touch with the contralateral hand in the absence of primary sensory or somesthetic discrimination deficits. Patients retain the ability to recognize objects visually. This condition is typically caused by lesions in the contralateral inferior parietal cortex (Berti & Neppi-Modona, 2012; Kumar & Wroten, 2025).

Table 2. Types of Auditory Agnosia

Type of Agnosia	Clinical Features	Lesion Location
Phonagnosia	Inability to recognize individuals by their voice; may be apperceptive (difficulty discriminating voices); may also involve impaired recognition of familiar voices; can be accompanied by impaired recognition of emotional prosody (affective auditory agnosia)	Temporal lobe (unilateral or bilateral); particularly the right anterior temporal lobe; right hemisphere lesions for emotional aspects
Auditory verbal agnosia (pure word deafness)	Inability to comprehend spoken words; perception of nonverbal sounds remains intact; reading comprehension is relatively preserved; may be accompanied by paraphasia	Disconnection between bilateral primary auditory cortices and Wernicke's area (left hemisphere);

Type of Agnosia	Clinical Features	Lesion Location
		may also result from strategically located left unilateral lesions
Nonverbal auditory agnosia	Inability to recognize meaningful nonverbal sounds (e.g., animal or environmental sounds); perception of tones and language comprehension remain intact	Typically, bilateral temporal lobe lesions; may also occur with left unilateral lesions
Amusia	Loss of musical ability (melody, pitch, rhythm); impairment in music perception and analysis	Right temporal lobe (melody/pitch); left temporal lobe (rhythm, sequencing); also involves widespread networks (frontal, parietal, cerebellar regions)

Coslett (2011), classified subtypes of tactile agnosia based on whether object form and size are predominantly affected, as opposed to forms in which other qualities such as texture, weight, and temperature are impaired. In several literatures, these subtypes are divided into three main categories:

Amorphognosia

Amorphognosia refers to the inability to recognize the shape and size of objects through touch, for example identifying geometric forms such as triangles or circles (Coslett, 2011; Kubota et al., 2017).

Ahylognosia

Ahylognosia is the inability to recognize specific material qualities of objects, such as texture and weight, through tactile perception—for instance, distinguishing wood from cotton (Coslett, 2011; Mendoza, 2011).

Tactile asymbolia

Tactile asymbolia is a condition in which an individual can perceive shape, size, and specific texture of an object but is unable to recognize or name it (Coslett, 2011; Talmasov & Ropper, 2016). Kubota et al. (2017), reported that perception of weight, texture, and material quality (hylognosia) is primarily impaired due to lesions in the primary somatosensory cortex (SI), whereas perception of size and shape (morphognosia) is disrupted by lesions in the secondary somatosensory cortex (SII) and posterior parietal cortex, operating in a parallel processing mode. However, the a case of tactile agnosia in which both ahylognosia and amorphognosia were impaired due to a lesion confined to the primary somatosensory cortex (S1) in the right parietal hemisphere (Kubota et al., 2017).

Conclusion

Agnosia is a form of cognitive dysfunction characterized by an inability to recognize objects. Patients with agnosia are able to perceive and describe the sensory features of an object but are unable to identify or assign meaning to it. In diagnosing agnosia, the impairment in object recognition must not be attributable to elementary sensory deficits, should not represent a form of anomia, and must exclude the presence of dementia or generalized intellectual decline. Agnosia is classified based on the sensory modality in which perceptual processing is disrupted, with each subtype associated with specific structural brain lesions and disturbances in interregional brain connectivity (disconnection syndromes).

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Conflicts of Interest

The authors declare no conflict of interest.

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