Visual Agnosia: When the Eyes See but the Mind Cannot

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Visual agnosia is an impairment in recognition of visually presented objects. It is not due to a deficit in vision (acuity, visual field, and scanning), language, memory, or low intellect. While cortical blindness results from lesions to primary visual cortex, visual agnosia is often due to damage to more anterior cortex such as the posterior occipital and/or temporal lobe(s) in the brain. There are two types of visual agnosia: apperceptive agnosia and associative agnosia.

Recognition of visual objects occurs at two primary levels. At an apperceptive level, the features of the visual information from the retina are put together to form a perceptual representation of an object. At an associative level, the meaning of an object is attached to the perceptual representation and the object is identified. If a person is unable to recognize objects because they cannot perceive correct forms of the objects, although their knowledge of the objects is intact (i.e. they do not have anomia), they have apperceptive agnosia. If a person correctly perceives the forms and has knowledge of the objects, but cannot identify the objects, they have associative agnosia.

Classification

Broadly, visual agnosia is divided into apperceptive and associative visual agnosia.

Apperceptive agnosia is failure of object recognition even when the basic visual functions (acuity, color, motion) and other mental processing, such as language and intelligence, are normal. The brain must correctly integrate features such as edges, light intensity, and color from sensory information to form a complete percept of an object. If a failure occurs during this process, a percept of an object is not fully formed and thus it cannot be recognized. Tasks requiring copying, matching, or drawing simple figures can distinguish the individuals with apperceptive agnosia because they cannot perform such tasks.
Associative agnosia is an inability to identify objects even with apparent perception and knowledge of them. It involves a higher level of processing than apperceptive agnosia. Individuals with associative agnosia can copy or match simple figures, indicating that they can perceive objects correctly. They also display the knowledge of objects when tested with tactile or verbal information. However, when tested visually, they cannot name or describe common objects. This means that there is an impairment in associating the perception of objects with the stored knowledge of them.

Although visual agnosia can be general, there exist many variants that impair recognition of specific types. These variants of visual agnosia include prosopagnosia (inability to recognize faces), pure word blindness (inability to recognize words, often called "agnosic alexia" or "pure alexia"), agnosias for colors (inability to differentiate colors), agnosias for the environment (inability to recognize landmarks or difficult with spatial layout of an environment, i.e. topographagnosia) and simultanagosia (inability to sort out multiple objects in a visual scene).

Categories and subtypes of visual agnosia

The two main categories of visual agnosia are:

Apperceptive visual agnosia, impaired object recognition. Individuals with apperceptive visual agnosia cannot form a whole percept of visual information.
Associative visual agnosia, impaired object identification. Individuals with associative agnosia cannot give a meaning to a formed percept. The percept is created, but it would have no meaning for individuals who have an associative agnosia.

Subtypes of Associative Visual Agnosia

Achromatopsia, an inability to distinguish different colors.
Prosopagnosia, an inability to recognize human faces. Individuals with prosopagnosia know that they are looking at faces, but cannot recognize people by the sight of their face, even people whom they know well.
Simultagnosia, an inability to recognize multiple objects in a scene, including distinct objects within a spatial layout and distinguishing between "local" objects and "global" objects, such as being able to see a tree but not the forest or vice versa.
Topographagnosia, an inability to process the spatial layout of an environment, including landmark agnosia, difficult recognizing buildings and places; difficulty building mental maps of a location or scene; and/or an inability to discern the orientation between objects in space.
Pure Alexia, an inability to read.
Orientation Agnosia: an inability to judge or determine orientation of objects.
Pantomime Agnosia: an inability to understand pantomimes (gestures). It appears that the inferior cortical visual cortex is critical in recognizing pantomimes.

Symptoms

While most cases of visual agnosia are seen in older adults who have experienced extensive brain damage, there are also cases of young children with less brain damage during developmental years acquiring the symptoms. Commonly, visual agnosia presents as an inability to recognize an object in the absence of other explanations, such as blindness or partial blindness, anomia, memory loss, etc.. Other common manifestations of visual agnosia that are generally tested for include difficulty identifying objects that look similar in shape, difficulty with identifying line drawings of objects, and recognizing objects that are shown from less common views, such as a horse from a top-down view.

Within any given patient, a variety of symptoms can occur, and the impairment of ability is not only binary but can range in severity. For example, Patient SM is a prosopagnosic with a unilateral lesion to left extrastriate cortex due to an accident in his twenties who displays behavior similar to

congenital prosopagnosia. Although he can recognize facial features and emotions - indeed he sometimes uses a standout feature to recognize a face - face recognition is almost impossible purely from visual stimuli, even for faces of friends, family, and himself. The disorder also affects his memory of faces, both in storing new memories of faces and recalling stored memories.

Nevertheless, it is important to note the reach of symptoms to other domains. SM's object recognition is similarly impaired though not entirely; when given line drawings to identify, he was able to give names of objects with properties similar to the drawing, implying that he is able to see the features of the drawing. Similarly, copying a line drawing of a beach scene led to a simplified version of the drawing, though the main features were accounted for. For recognition of places, he is still impaired but familiar places are remembered and new places can be stored into memory.

Pathophysiology

Visual agnosia occurs after damage to visual association cortex or to parts of the ventral stream of vision, known as the "what pathway" of vision for its role in object recognition. This occurs even when no damage has been done to the eyes or optic tract that leads visual information into the brain; in fact, visual agnosia occurs when symptoms cannot be explained by such damage. Damage to specific areas of the ventral stream impair the ability to recognize certain categories of visual information, such as the case of prospagnosia. Patients with visual agnosia generally do not have damage to the dorsal stream of vision, known as the "where pathway" of vision because of its role determining object's position in space, allowing individuals with visual agnosia to show relatively normal visually guided behavior.

For example, patient DF had lesions to the ventral surface that gave her apperceptive agnosia. One of the tasks she was tested on required her to place a card through a thin slot that could be rotated into all orientations. As an apperceptive agnosic, it would be expected that since she cannot recognize the slot, she should not be able to correctly place the card into the slot. Indeed, when she was asked to give the direction of the slot, her responses were no better than chance. Yet, when she was asked to place the card into the slot, her success was almost to the level of the controls. This implies that in the event of a ventral stream deficit, the dorsal stream can help with processing of special information to aid movement regardless of object recognition.

More specifically, the lateral occipital complex appears to respond to many different types of objects. Prosopagnosia (inability to recognize faces) is due to damage of the fusiform face area (FFA). An area in the fusiform gyrus of the temporal lobe that has been strongly associated with a role in facial recognition. However, this area is not exclusive to faces; recognition of other objects of expertise are also processed in this area. The extrastriate body cortex (EBA) was found to be activated by photographs, silhouettes, or stick drawings of human bodies. The parahippocampal place area (PPA) of the limbic cortex has been found to be activated by the sight of scenes and

backgrounds. Cerebral achromatopsia (the inability to discriminate between different hues) is caused by damage to the V8 area of the visual association cortex. The left hemisphere seems to play a critical role in recognizing the meaning of common objects.

In Popular Culture

A famous report on this condition is the title essay of Oliver Sacks' book, The Man Who Mistook His Wife for a Hat.
The murder suspect in the Picket Fences episode "Strangers" supposedly suffered from agnosia.
The patient in the House episode "Adverse Events" suffered from agnosia.
Val Kilmer's character suffers from visual agnosia in the film At First Sight.
In "Folie ? Deux", a fifth season episode of the X Files, Mulder succumbs to the same belief as telemarketer Gary Lambert, that his boss Greg Pincus is a monster who disguises his true appearance by means of hypnosis. Scully, although believing this notion preposterous, suggests that what Mulder describes is analogous to an induced visual agnosia.