Agnosia and prosopagnosia:

Problems in achieving object recognition:

1. Need to solve the "image segmentation problem":

Need to distinguish between objects and their surroundings, and identify which parts belong to the same object. Often difficult because luminance differences may be an unreliable guide.

2. Need to identify the object, perceptually:

Need to recognise an object despite changes in its appearance due to changes in illumination, viewpoint, distance, etc.

So, need to be able to generalise across views.

***But* - may *also* have to distinguish between different exemplars within a category (e.g. different faces).**

3. Need to identify the object, semantically:

For familiar objects, need to access stored knowledge about their functions and meanings (e.g. "this is a chair", "I can sit on it", "this is a lecturer").

4. Other aspects of object recognition:

Need to know an object's location, relative to other objects and to ourselves.

Visual agnosia:

Impairment of visual perception due to brain damage, which is not attributable to sensory impairment or gross intellectual impairment ("agnosia" lit. "without knowledge").

Wilbrand (1887): the case of Fraulein G.:

Stroke, aged 63.

Remained able to speak several foreign languages, recite poetry; highly articulate.

"*When people stood at my bedside and spoke with pity of my blindness, I thought to myself: you can't really be blind because you are able to see the table-cloth over there, with the blue border, spread out on the table in the sick-room*".

Mistook a dog for the doctor.

Mistook a servant for the dinner-table.

The case of Fraulein G. (continued):

***Topographical agnosia:* unable to recognise familiar places.**

***Object agnosia:* unable to see her favourite vase, find letters she had written, or her glasses.**

"...at night I take any old object from the table and think; my God, what sort of thing is this then?, and only after protracted and repeated looking at it and palpating of it does it become clear to me what it is meant to be".

Prosopagnosia (inability to recognise familiar faces) including her own face in a mirror.

Remained capable of visual imagery.

Lissauer (1890):

Studied G.L., who following a head injury, had problems recognising objects – mistook pictures for boxes, jacket for trousers, couldn't recognise cutlery. Vision was intact, as was his memory of objects.

Lissauer distinguished two main types of "mindblindness" (agnosia):

Apperceptive agnosia:

Impaired ability to consciously perceive and discriminate stimuli (i.e. a perceptual deficit).

Associative agnosia:

Relatively preserved ability to perceive stimuli, but inability to interpret what was seen (i.e., a gnostic deficit).

Apperceptive agnosia:

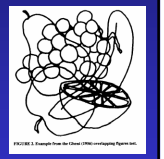
Typically impairments can be seen in:

Gollin's incomplete drawing test (Warrington & James 1967).

Ghent's overlapping / embedded figures test (DeRenzi, Scotti & Spinnler 1969).

Unusual views task (Warrington & Taylor 1973).

Foreshortened photos (Humphreys & Riddoch 1984).



Apperceptive agnosia:

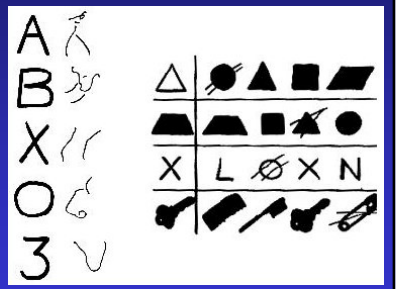
Can describe features of an object, but cannot recognise the object as a whole.

Cannot copy drawings.

Perceptual not sensory deficit (acuity etc. normal).

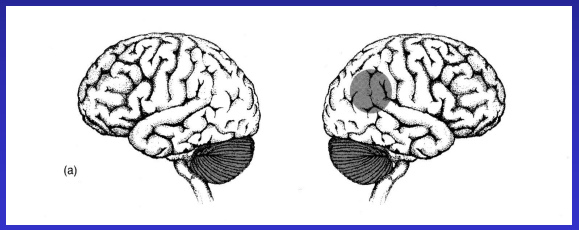
Impaired recognition if image is degraded in any of a number of ways.

Mr. S copying, and matching:



Apperceptive agnosia - pathology:

Unilateral right hemisphere damage. Right inferior parietal lobe.



Milner & Goodale (1995):

D.F. : apperceptive agnosic, due to CO poisoning.

Spatial frequency detection thresholds normal except for low frequencies.

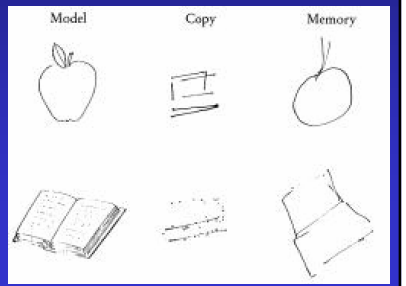
Flicker frequency threshold normal.

Colour discrimination normal.

Object recognition grossly impaired.

Cannot recognise or copy drawings of objects.

Object memory intact (i.e., *perceptual* deficit).



Associative agnosia:

Can discriminate objects but not identify them.

Can copy drawings.

Not a perceptual deficit.

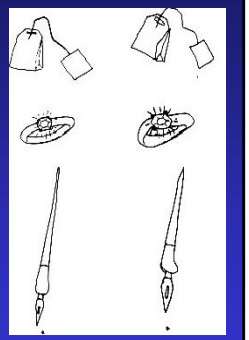
May even be able to sort objects by category.

Cannot name objects and may not be able to understand their meaning.

May not be able to draw objects from memory.

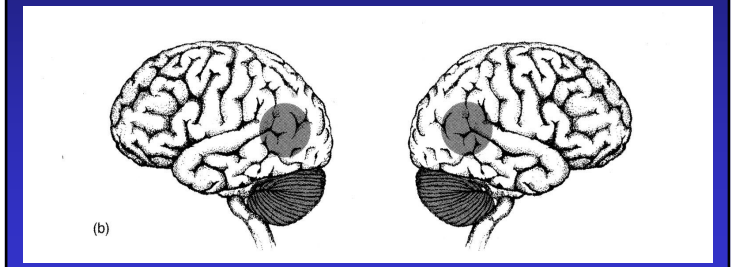
Make structural rather than functional matches between objects (e.g. closed umbrella matched to walking stick, not open umbrella – Warrington 1982).

LF copying



Underlying pathology in associative agnosia:

Usually bilateral damage. Crucial area thought to be left hemisphere. More ventral than apperceptive damage.



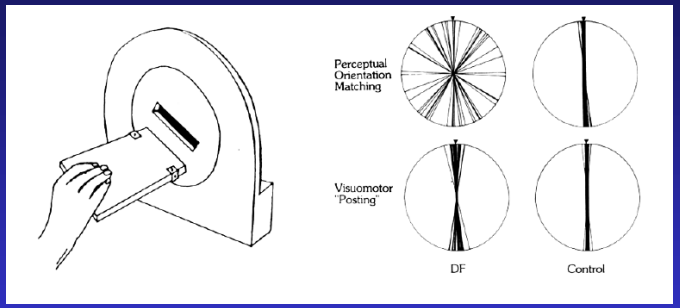
Modality specificity of agnosia:

Impairment in object recognition may be confined to a single sensory modality: visual agnosics are unimpaired in recognition by touch, hearing or smell.

Can have agnosia in other modalities (e.g. auditory agnosia).

Ability to act upon and manipulate objects may be intact in agnosics – e.g. DF.

Modality specificity of agnosia:



DF posting task: Cannot match using perceptual information alone, but can match orientation when asked to "post" the object.

(Parallel effects now found in normal individuals).

Category specific agnosias:

McCrae and Trolle (1956): severe impairment for recognition of animals; unimpaired for trees, flowers, common objects.

Hecaen & Ajuriaguerra (1956): inanimate more impaired than animate.

Warrington & Shallice (1984): JBR - animate impaired, but not inanimate.

Warrington & McCarthy (1987) YOT - object matching impaired, but animals matching unimpaired.

Prosopagnosia - specific inability to recognise faces, but OK with non-face objects.

"What" and "Where" systems:

(Ungerleider and Mishkin 1982, Goodale and Milner 1995):

Ventral stream: "what":

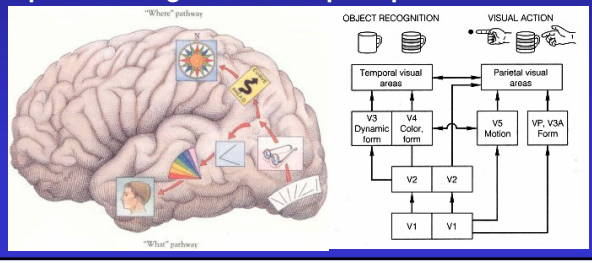
Output from V1 to V2, V4 and IT. (Inferotemporal cortex).

Primary function is object perception + recognition.

Dorsal stream: "where":

Output from V1 to V2, V3 and MT (V5). (Posterior parietal cortex).

Primary function is spatial perception.



Implications of neuropsychological data for normal perception:

Early ideas on agnosia (Lissauer 1890):

IMAGE

APPERCEPTION

ASSOCIATION

More modern conceptions (e.g. Farah 1990, Humphreys and Riddoch 1987):

IMAGE

FEATURAL ANALYSIS

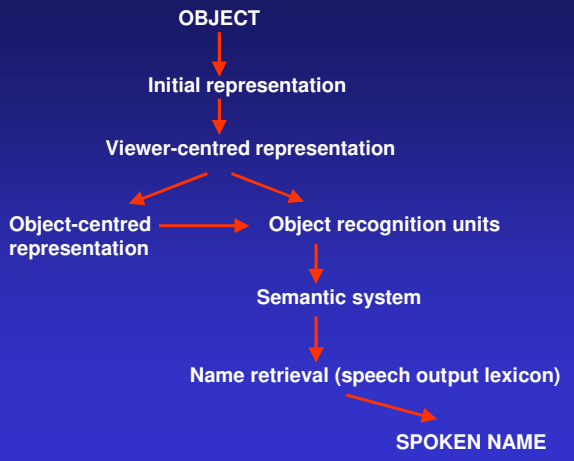
FEATURE INTEGRATION AND GROUPING

MAPPING OF PERCEPTUAL DESCRIPTIONS TO STORED STRUCTURAL DESCRIPTIONS (must cope with unusual views, etc.)

STORED STRUCTURAL DESCRIPTIONS

SEMANTIC KNOWLEDGE (object functions and associations)

Elllis and Young's (1988) model of object recognition:



Conclusions:

Neuropsychological data suggest that

(a) vision is modular - a set of processes, for different purposes.

(b) location and identification are handled by largely separate, parallel processes - from retina through to cortex.

(c) object recognition can be selectively impaired at many stages, from initial structural description (apperceptive agnosia) to linking with semantic information (associative agnosia).

(d) the same is true for face recognition; there are many different causes of "prosopagnosia".