PERCEPTION: VISION II

John Gabrieli 9.00



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Vision 2: Object Recognition

Objects & Agnosia

• Faces

• Words

Vision 2: Object Recognition

 Objects & Agnosia **Apperceptive Agnosia** from parts to percept **Associative Agnosia** from percept to meaning **Category-Specific Knowledge** relation to perception & action

AGNOSIA

Modality-specific inability to recognize a stimulus that is not explained by sensory, attentional, linguistic, or other defects

AGNOSIA

Apperceptive agnosia

- failure to construct conscious percept from sense data
- right hemisphere
- Associative agnosia
 - conscious percept (match, copy) stripped of meaning
 - left hemisphere

Lissauer, 1890





Figure 2

The copying ability of apperceptive agnosic patients. On the left is a simple geometric shape and patient E. S.'s copy. On the right are two columns of letters, numbers, and shapes, with the patient Mr. S's copies.

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Figure 3.

The shape matching ability of apperceptive agnosic patients. On the left is a set of rectangles matched for overall area, which were presented pairwise to Mr. S. to be judged same or different in shape. He was unable to discriminate all but the most distinctive, and made errors even with these. On the right are a set of rows containing a target shape (left) and a set of four choices to be matched with the target shape. Mr. S.'s answers are marked.



Figure 4 Patient X, studied by Landis et al. (1982), consistently read this stimulus as 7415.

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Drawings of an elephant by patients with agnosia, from "The Working Brain: An Introduction to Neuropsychology." Aleksandr R. Luria, have been removed due to copyright restrictions. Please see figure 29, on page 119, on Google Books.

AGNOSIA

Apperceptive agnosia

- failure to construct conscious percept from sense data
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Lissauer, 1890

Drawings done by angosia patients, from Alan B. Rubens, MD; D. Frank Benson, MD. "Associative Visual Agnosia." *Arch Neurol* 24 no. 4 (1971): 305-516, have been removed due to copyright restrictions.



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Stand mixer

Photo courtesy of Tess Aquarium on Flickr.

Rocks nonliving

Category-Specificity in Loss of Knowledge

Patients who can define and wordpicture match manufactured objects, but not foods and animals

Patients who can define and wordpicture match foods and animals, but not objects

Category-Specificity in Loss of Knowledge

Patients who can define and wordpicture match manufactured objects, but not foods and animals

Ok on body parts, bad on musical instruments

Patients who can define and wordpicture match foods and animals, but not objects

Better on large outdoor objects than small manipulable objects

Visual Similarities Among Musical Instruments





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Category-Specificity in Loss of Knowledge

How do we know and experience objects in the world?

- Visual experience (fine visual distinctions)
- Functional/motor experience

Name Line Drawings or Words



Animals > Tools

Visual cortex

Tools > Animals

Visual motion Hand action

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FACES



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FACES

- Identity
- Expression (feelings)

PROSPAGNOSIA

Selective deficit in recognizing faces posterior cortical lesion also developmental prognosia

fMRI Data Analysis : Region of Interest (ROI)

Anatomical ROI

Functional ROI





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Fusiform & Face Expertise: Fusiform Face Area (FFA)



Courtesy of Kanwisher Lab. Used with permission.



Selective FFA Response to Faces



Courtesy of Kanwisher Lab. Used with permission.

Vision 2: Object Recognition

- Faces
 - infant preference for faces topheavy bias
 - development of species-specific face processing
 - configural processing of faces
 - genetic preparation for face processing

Figure 1 from Cassia, Viola Macchi, Chiara Turati, and Francesca Simion. "Can A Nonspecific Bias Towards Top-Heavy Patterns Explain Newborns' Face Preference?" *Psychological Science* 15 (2004): 379-83. Removed due to copyright restrictions.



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FACES

Faces - configural - whole rather than the parts (eyes, nose, mouth)

This is Obama



This is Obama's house



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Photo courtesy of Pete Souza, The Obama-Biden Transition Project. CC-BY.

Test phase

Is this Obama's nose?





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Part condition

Is this Obama's window?



Part condition

Whole condition



Whole condition

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Adapted from Farah, M.J., Specialization Within Visual object Recognition: Clues from Prosopagnosia and Alexia, in Farah, M.J., and Ratcliff, G. (Eds.), The Neuropsychology of High-Level Vision: Collected Tutorial Essays. Hillsdale, NJ: Lawrence Erlbaum Associates, 1994, pp. 133–146.

 no early exposure to faces 6-24 months • before seeing a real face, preferred human & monkey faces in photographs equally, discriminated human & monkey faces gained expertise for 1 month in exposed species of faces (human or monkey) only Preferred only the exposed species vs. objects Preferrence lasted for at least a year despite exposure to humans & monkeys Genetic preparation & Sensitive period



Courtesy of National Academy of Sciences, U.S.A. Used with permission. Source: Sugita, Yoichi. "Face Perception in Monkeys Reared With No Exposure to Faces." *PNAS* 105, no. 1 (2008): 394-8. Copyright (c) 2008 National Academy of Sciences, U.S.A.

Fig. 1. An infant monkey and her living circumstance Sugita, Yoichi (2008) Proc. Natl. Acad. Sci. USA 105, 394-398



Cuneiform – 3200 BC



Photo courtesy of litlnemo on Flickr.

Gutenberg Bible – Printing Press – 1450s

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Photo by Pat Hawks on Flickr. CC-BY.

Adult Reading

- we read fast can read one word that we know, from among 50,000 – 100,000 words that we know in *50 thousandths of a second!*
- typical adult reading speed is 200-250 words per minute
- we read about 12 letters at a time, then move eyes

Moving Window Experiment

- track eye movements (McConkie & Raynor, 1975)
- with each movement, replace all others letters with x's
- people did not notice the x's

Xx xxx people of txx xxxxx xxxxx, xx xxxxx xx Xx xxx xxxxx xx xhe United xxxxx, xx xxxx xx Xx xxx xxxxx xx xx Xxxed States, ix xxxxx xx Xx xxx xxxxx xx xx XxxxX Xxxxx, in order to t Figure 1.1 from "Reading in the Brain: The Science and Evolution of a Human Invention," Stanislas Dehaene, has been removed due to copyright restriction. See: Google Books.

<u>Word Blindness/Alexia</u> Mr C – 1887 – could not read Could see Could hear words, speak words Could see numbers Write down words to dictation Figure 2.7 from "Reading in the Brain: The Science and Evolution of a Human Invention," Stanislas Dehaene, has been removed due to copyright restriction.

Figure 2.7 from "Reading in the Brain: The Science and Evolution of a Human Invention," Stanislas Dehaene, has been removed due to copyright restriction.

Vision 2: Object Recognition

• Faces

face processing as a slowly learned and highly specific skill inversion effects
fusiform specialization for faces overlap in brain between

seeing and imagining a face

- same-race memory superiority for faces

FACES

Faces - slowly learned expertise face inversion development - age 16 dog-show judges - 8 years to develop face-inversion for dog faces

Overlap of Perception & Imagination in the Brain



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Superior Memory for Same-Race Faces

Subsequent memory



GREATER FFA ACTIVATION FOR OWN THAN OTHER RACE

FFA activation (defined p < 0.0001)

FFA activation (defined *t*=2)



FACES

- **Development of Same-Race Bias**
 - not present at birth (and no species preference)
 - present by 3 months
 - Korean children 3-9 years old adopted by European Caucasian families - better memory for Caucasian faces, same as French children, opposite of Korean children

FACES

- Identity
- Expression (feelings)
 - six universal facial expressions
 - amygdala & fear

- amygdala and recognition of fearful facial expressions

Fear & The Amygdala





Image by MIT OpenCourseWare.

Fear

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Selective amygdala lesions: Rodents

• Direct implication of amygdala in emotional behaviors

Cute & Cuddly or fearsome predator?



Courtesy of American Psychological Association. Used with permission. Source: Blanchard, D., and R. J. Blanchard. "Innate and Conditioned Reactions to Threat in Rats with Amygdaloid Lesions." *Journal of Comparative and Physiological Psychology* 81, no. 2 (1972): 281-90.

Human amygdala: Impaired recognition of fear

- Intact face recognition
- Impairment selective for fear

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