PERCEPTION: VISION II

John Gabrieli 9.00

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

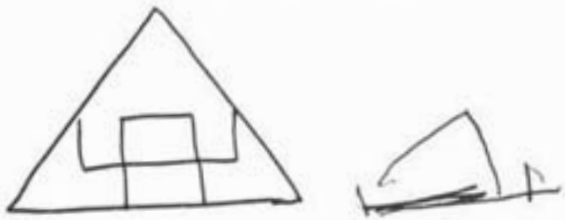
Apperceptive agnosia

- **failure to construct conscious percept from sense data**
- **right hemisphere**

Associative agnosia

- **conscious percept (match, copy) stripped of meaning**
- **left hemisphere**

Lissauer, 1890



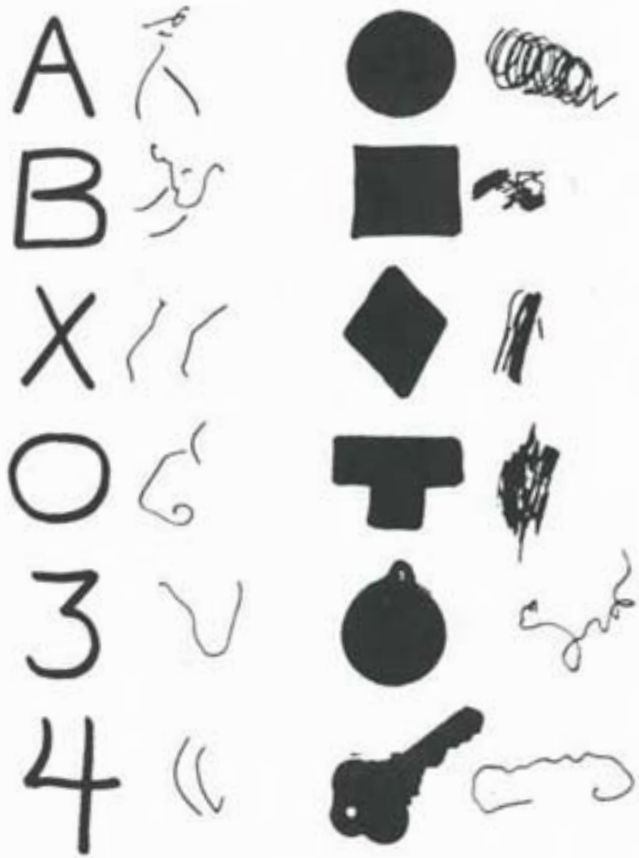


Figure 2
The copying ability of apperceptive agnosic patients. On the left is a simple geometric shape and patient E. S.'s copy. On the right are two columns of letters, numbers, and shapes, with the patient Mr. S's copies.

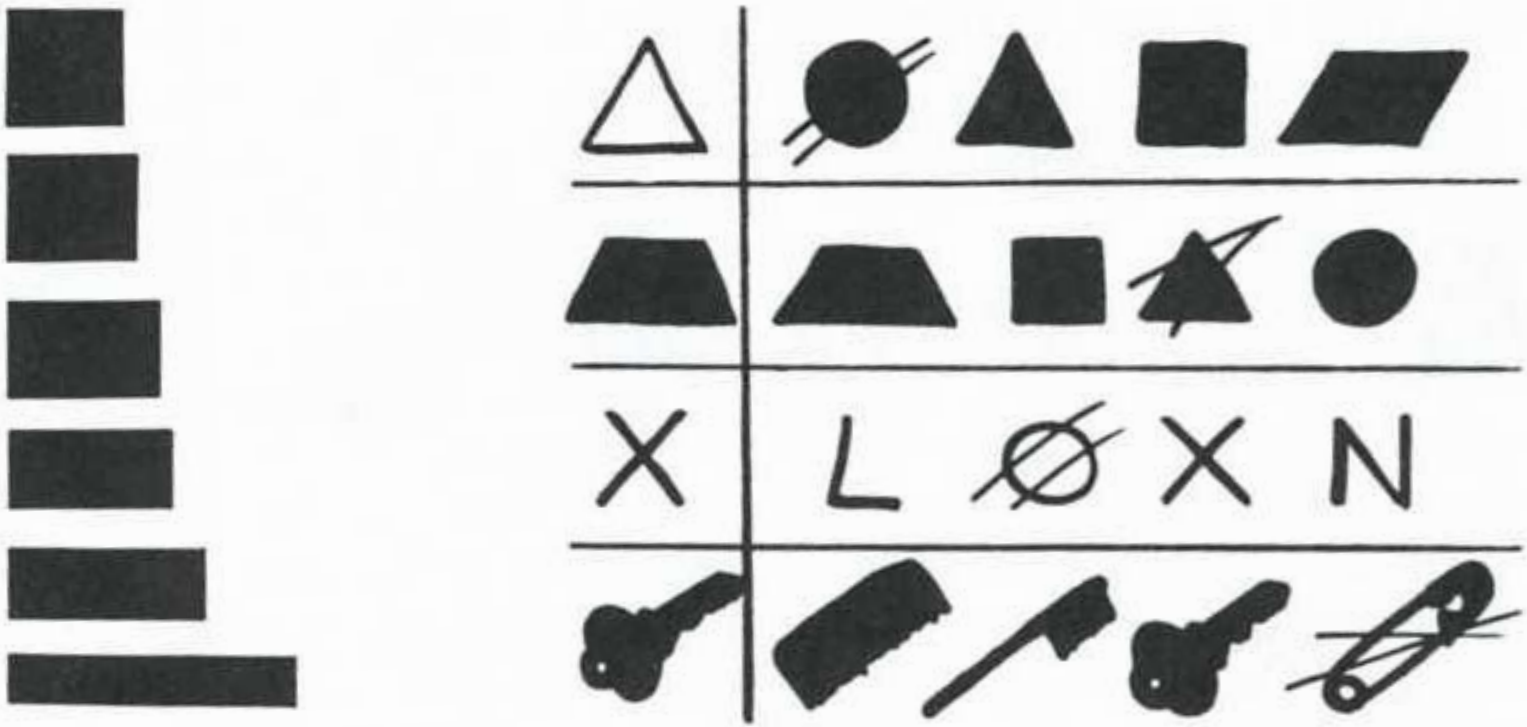


Figure 3.
The shape matching ability of apperceptive agnosic patients. On the left is a set of rectangles matched for overall area, which were presented pairwise to Mr. S. to be judged same or different in shape. He was unable to discriminate all but the most distinctive, and made errors even with these. 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.

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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Associative agnosia

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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.

Photo courtesy of ndrwfgg on Flickr. CC-BY.

Penguin
living

Photo courtesy of niallkennedy on Flickr. CC-BY-NC.

Rocks
nonliving

Stand mixer
nonliving

Kitten
living

cup
nonliving

Photo courtesy of Tess Aquarium on Flickr.

Category-Specificity in Loss of Knowledge

Patients who can define and word-picture match manufactured objects, but not foods and animals

Patients who can define and word-picture match foods and animals, but not objects

Category-Specificity in Loss of Knowledge

Patients who can define and word-picture match manufactured objects, but not foods and animals

Ok on body parts, bad on musical instruments

Patients who can define and word-picture match foods and animals, but not objects

Better on large outdoor objects than small manipulable objects

Visual Similarities Among Musical Instruments

Photo courtesy of mitko_denev on Flickr. CC-BY-NC.

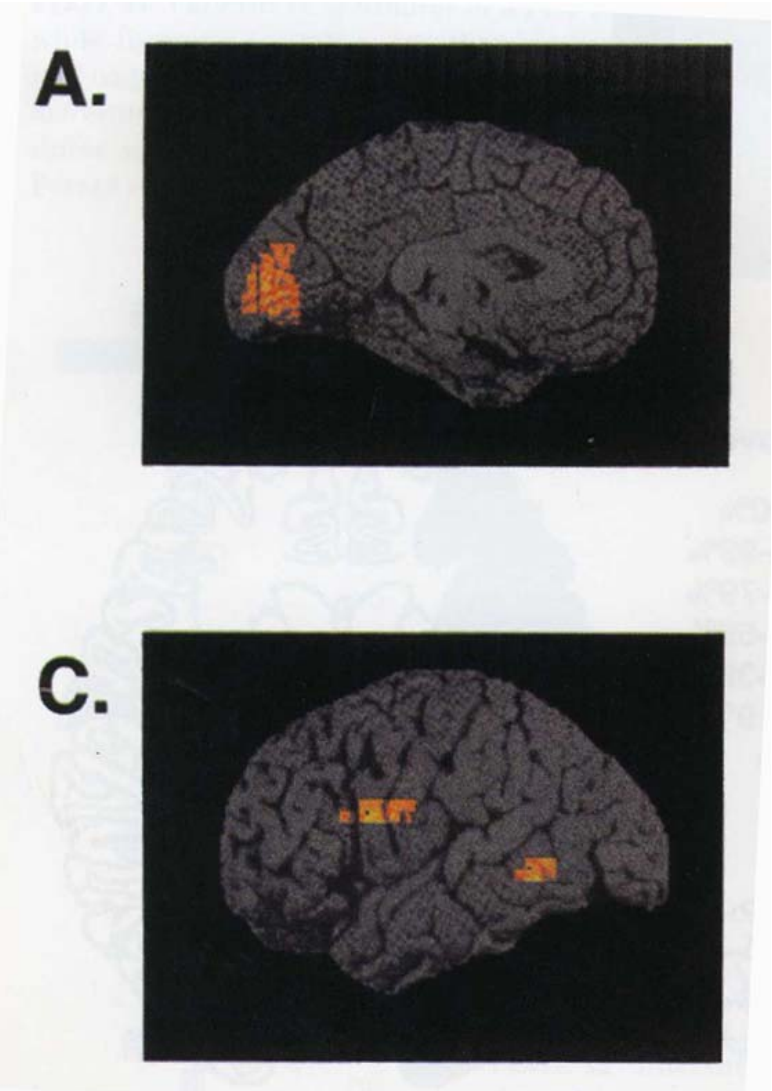
Photo courtesy of crabchick on Flickr. CC-BY.

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

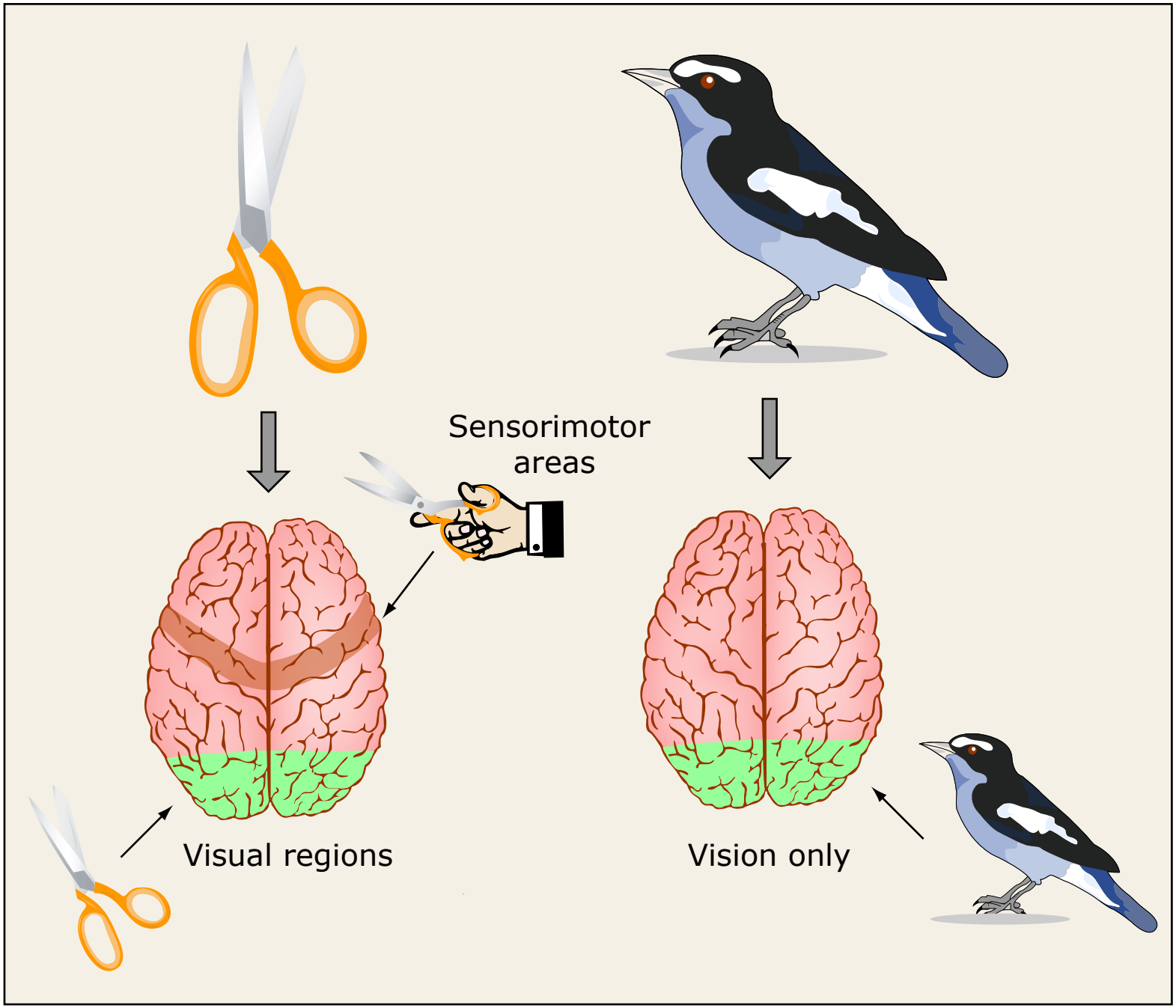


Image by MIT OpenCourseWare.

FACES

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FACES

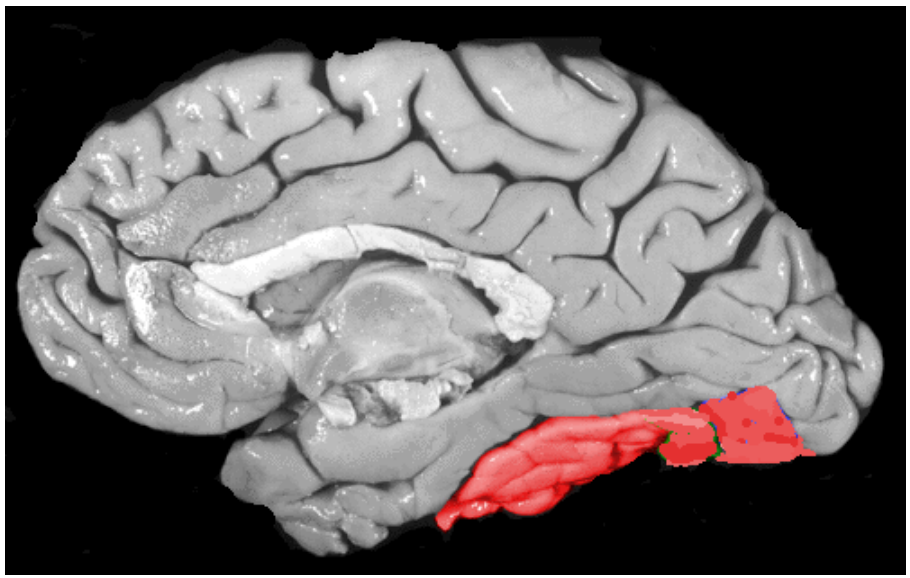
- **Identity**
- **Expression (feelings)**

PROSPAGNOSIA

Selective deficit in recognizing faces posterior cortical lesion also developmental prognosia

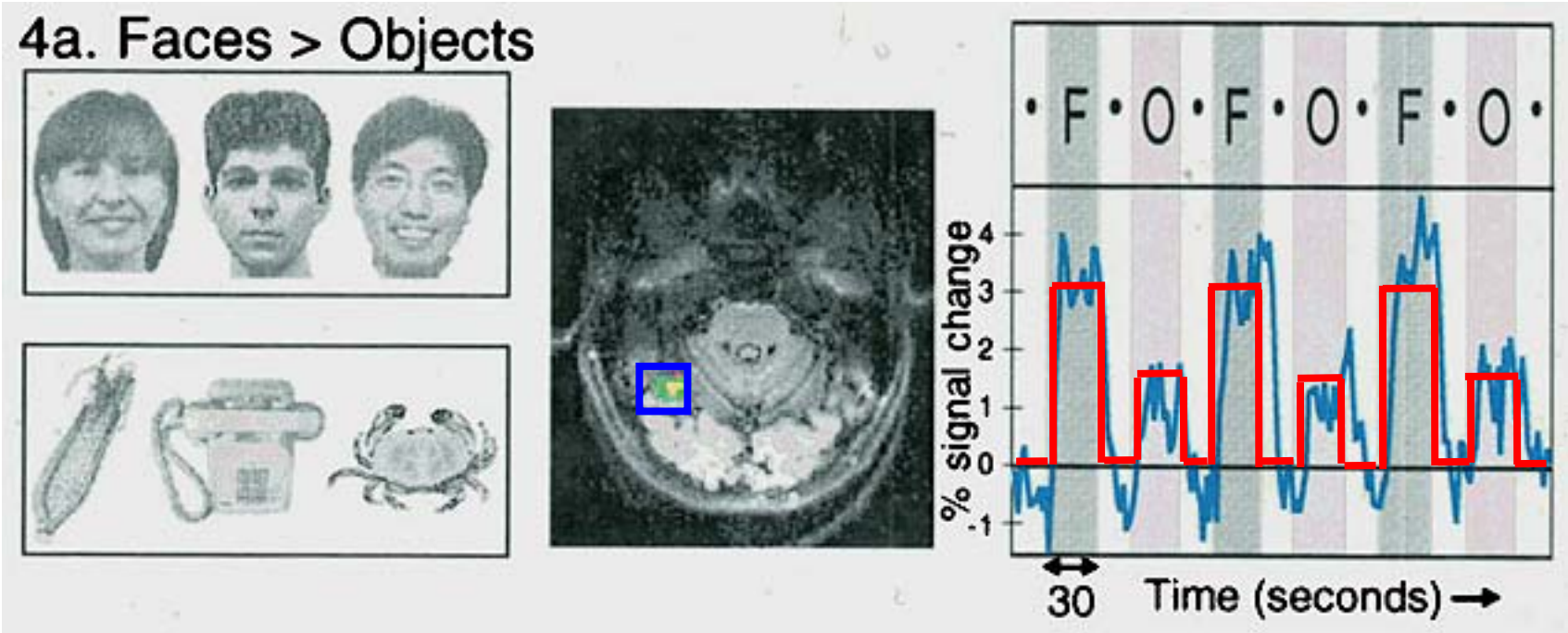
fMRI Data Analysis : Region of Interest (ROI)

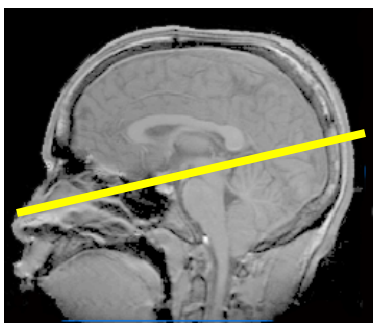
Anatomical ROI



Functional ROI

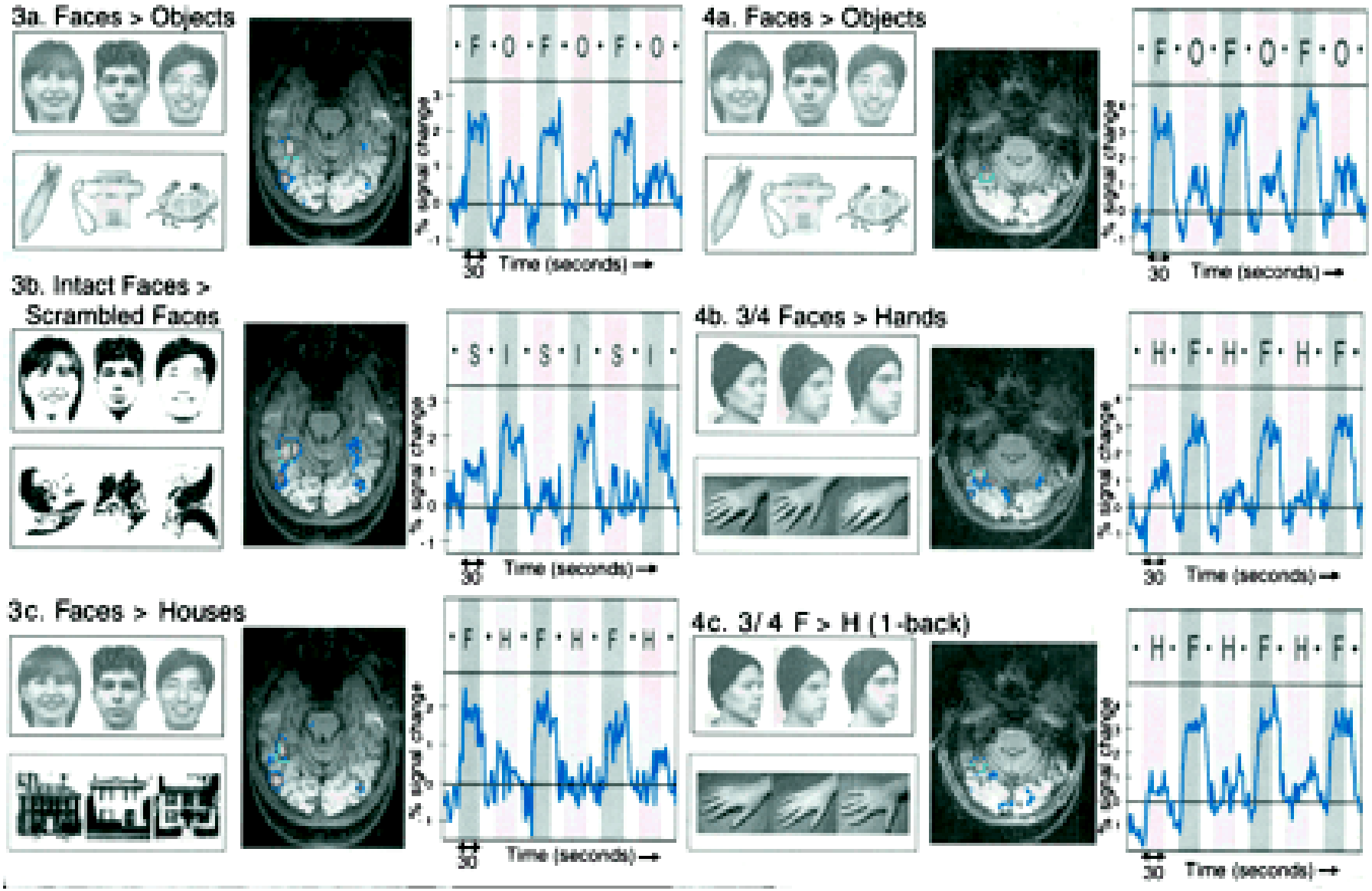
Fusiform & Face Expertise: Fusiform Face Area (FFA)





Courtesy of Kanwisher Lab. Used with permission.

Selective FFA Response to Faces



Vision 2: Object Recognition

- **Faces**

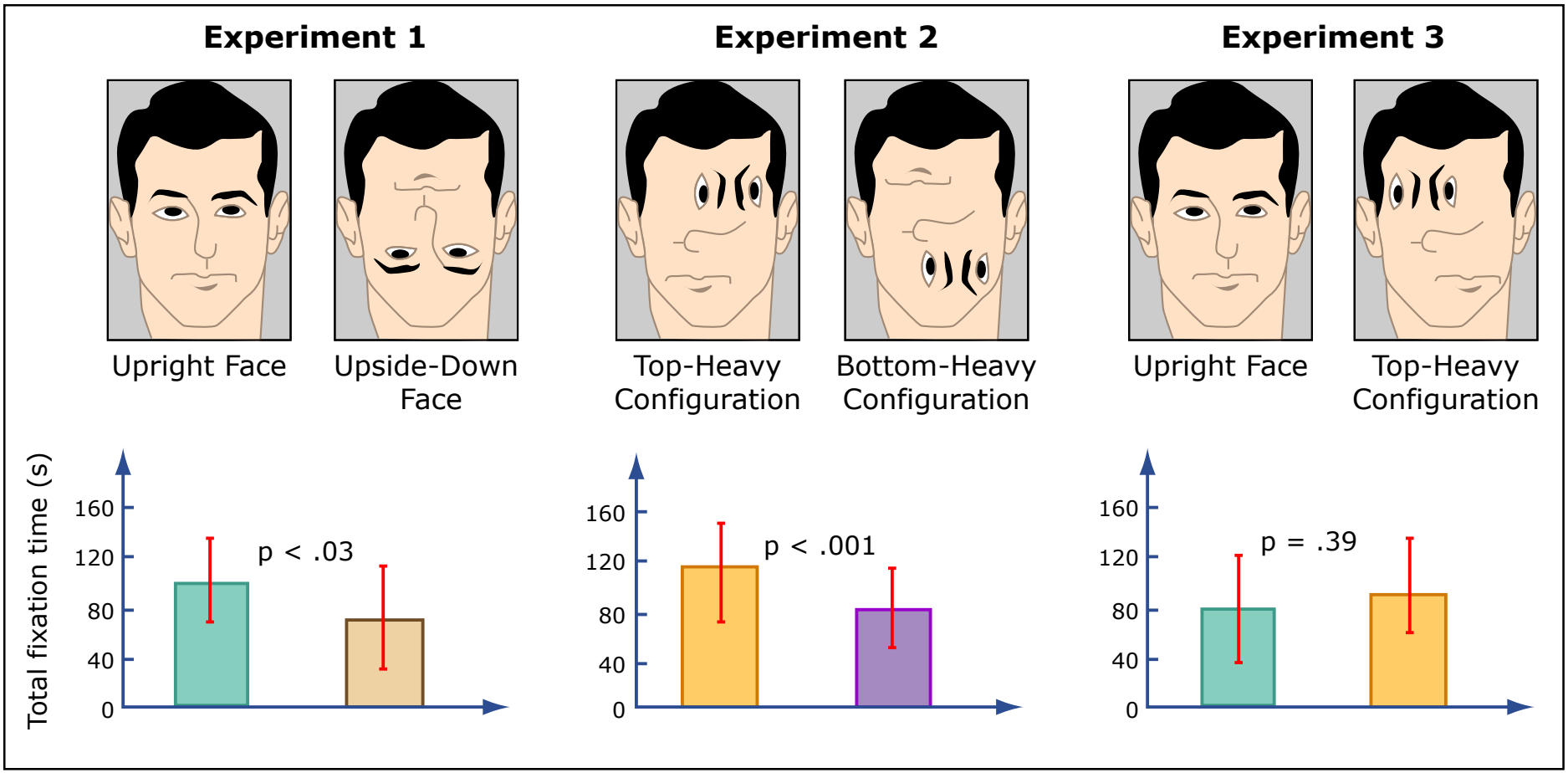
  - infant preference for faces top-heavy bias

  - 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.



FACES

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

This is Obama

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

This is Obama's house

Photo courtesy of Tom Lohdan on Flickr. CC-BY.

Test phase

Is this Obama's nose?

Part condition

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

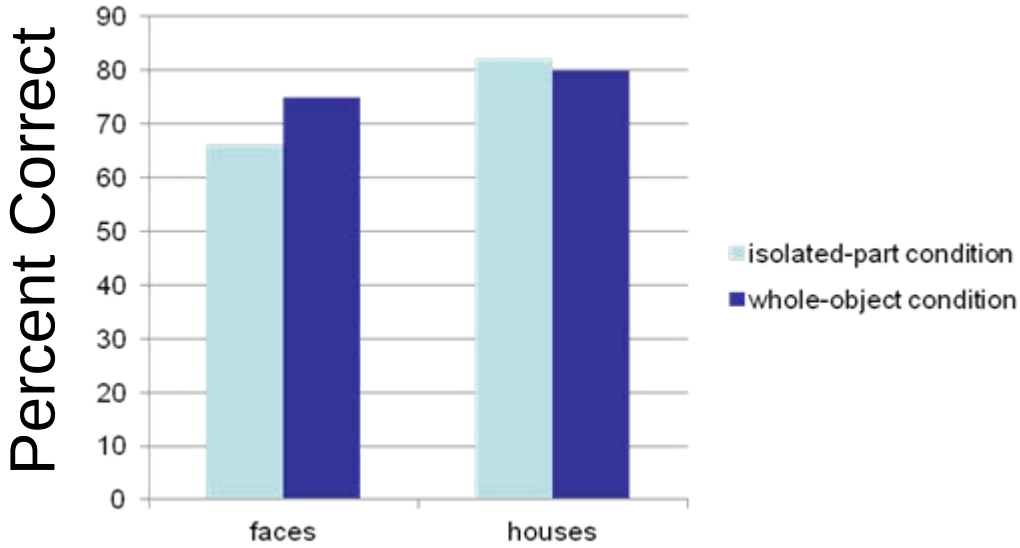
Whole condition

Is this Obama's window?

Part condition

Photo courtesy of Tom Lohdan on Flickr. CC-BY.

Whole condition



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

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

PNAS

Cuneiform – 3200 BC

Photo courtesy of litlnemo on Flickr.

Gutenberg Bible – Printing Press – 1450s

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**

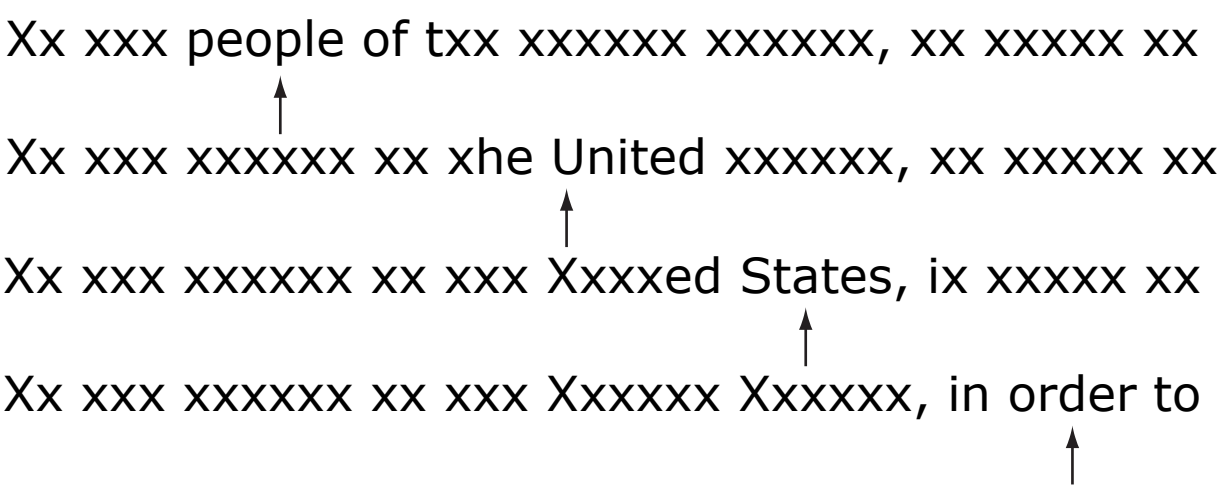


Figure 1.1 from "Reading in the Brain: The Science and Evolution of a Human Invention," Stanislas Dehaene, has been removed due to copyright restriction. See: Google Books.

Word Blindness/Alexia

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.

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Vision 2: Object Recognition

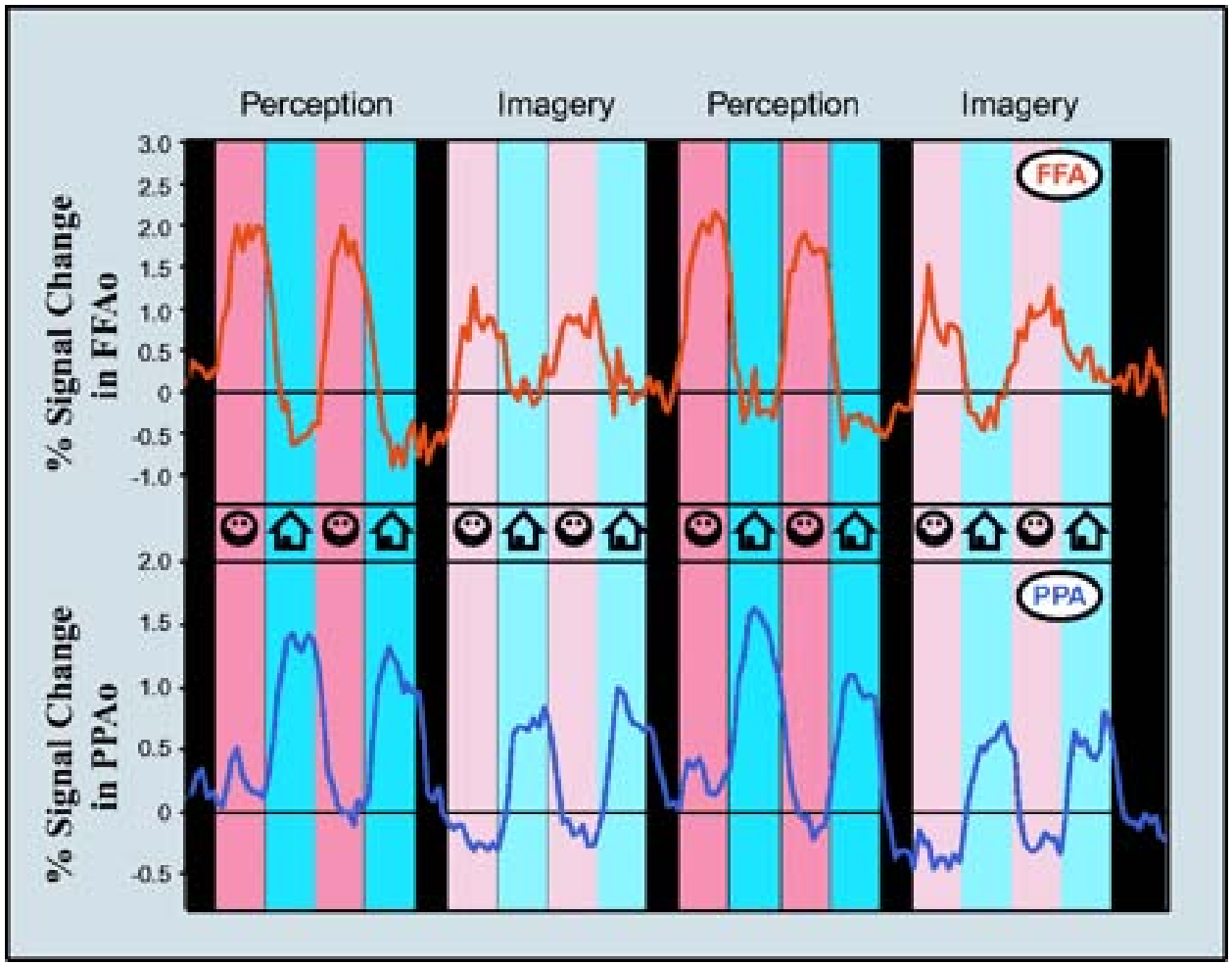
- **Faces**
  - **face processing as a slowly learned and highly specific skill**
    - **inversion effects**
  - **fusiform specialization for faces**
    - **overlap in brain between seeing and imagining a face**
  - **same-race memory superiority for faces**

FACES

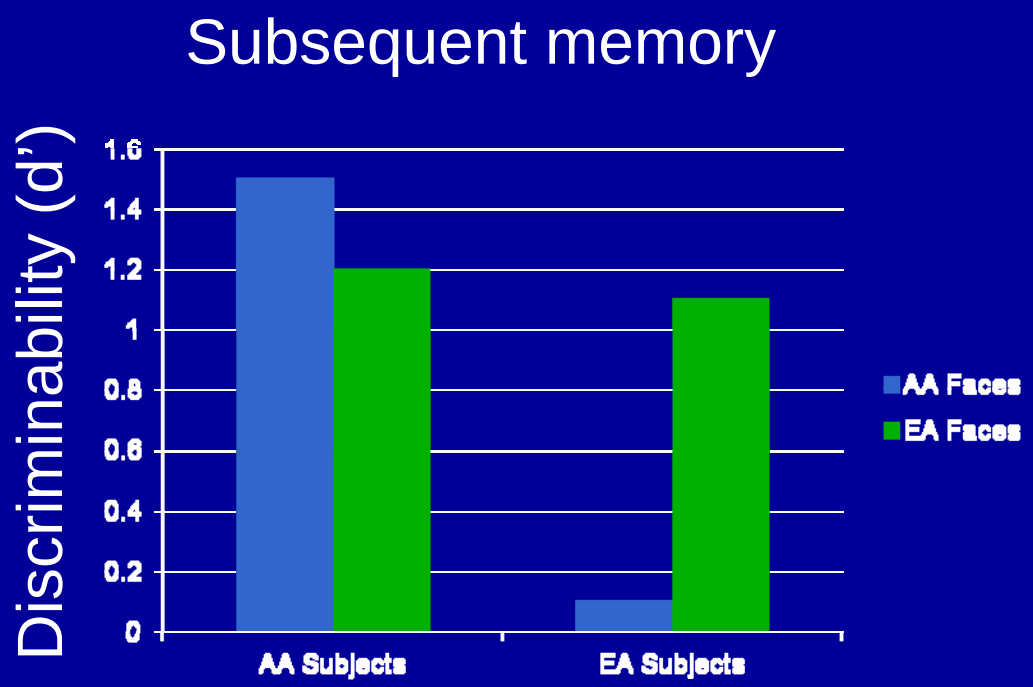
Faces - slowly learned expertise

- **face inversion**
- **development - age 16**
- **dog-show judges - 8 years to develop face-inversion for dog faces**

Overlap of Perception & Imagination in the Brain

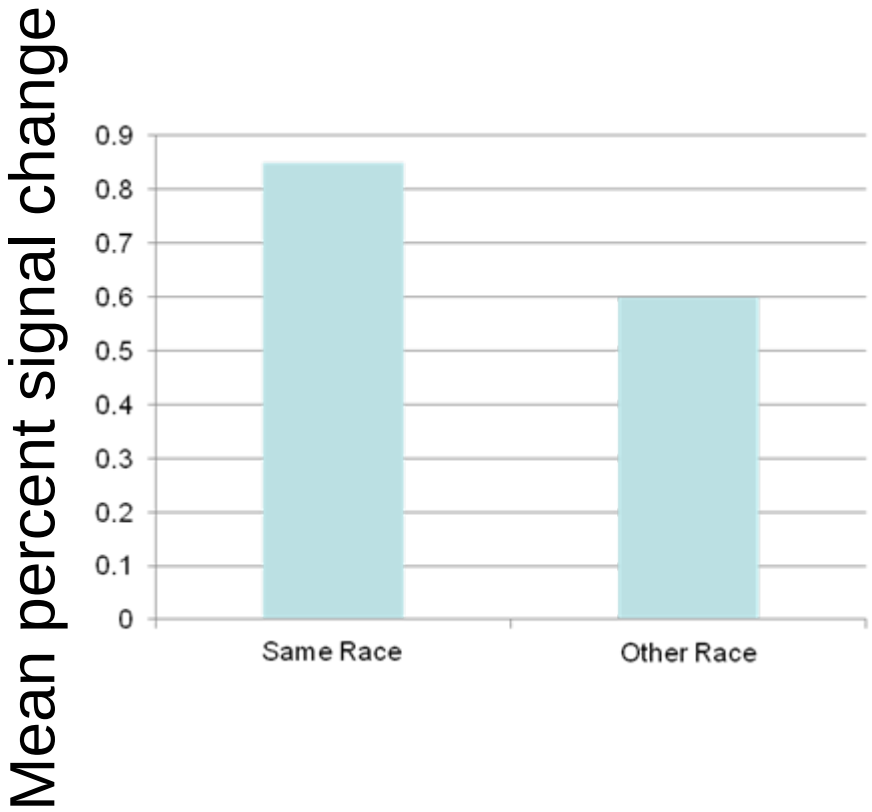


Superior Memory for Same-Race Faces

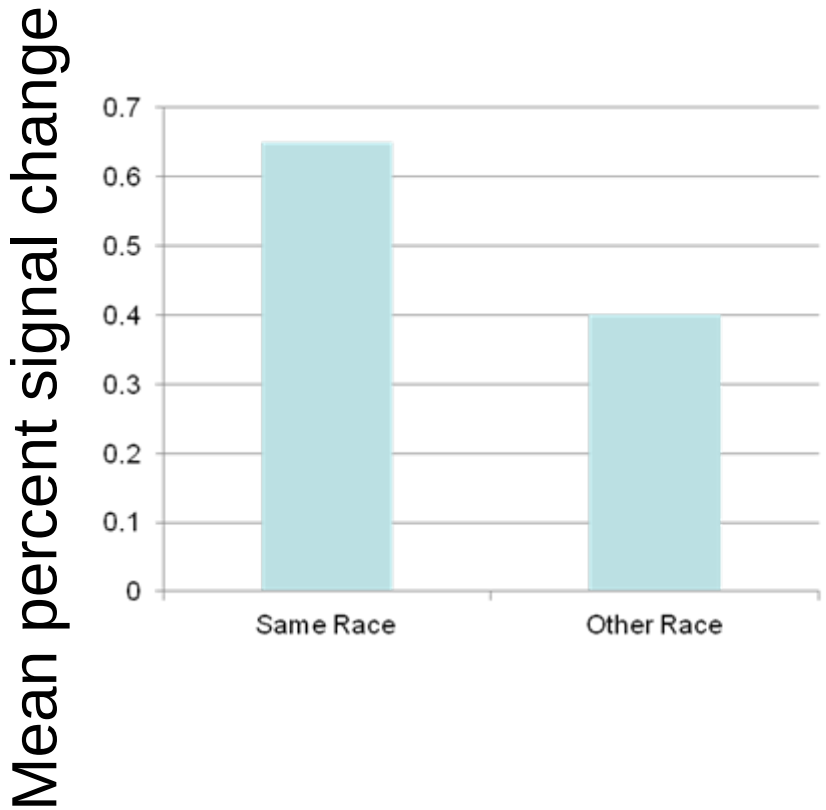


GREATER FFA ACTIVATION FOR OWN THAN OTHER RACE

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**

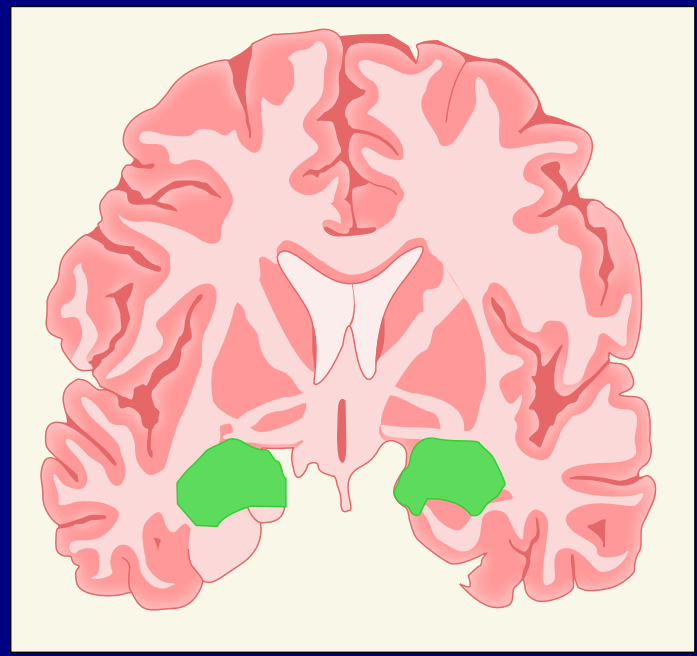
FACES

- **Identity**
- **Expression (feelings)**
  - **six universal facial expressions**
  - **amygdala & fear**
  - **amygdala and recognition of fearful facial expressions**

Fear & The Amygdala

Fear

Photo courtesy of artindeepkoma on Flickr.



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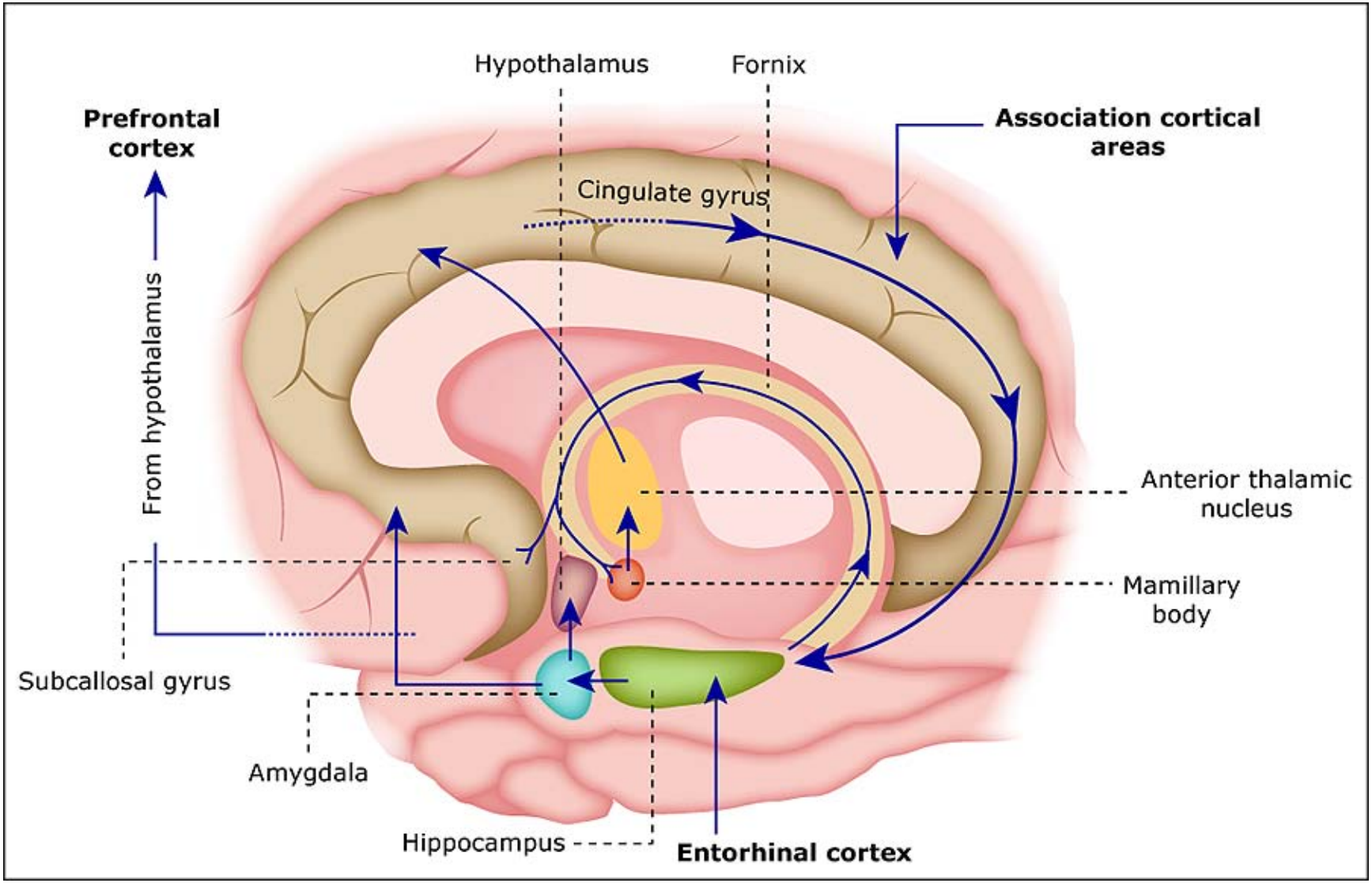

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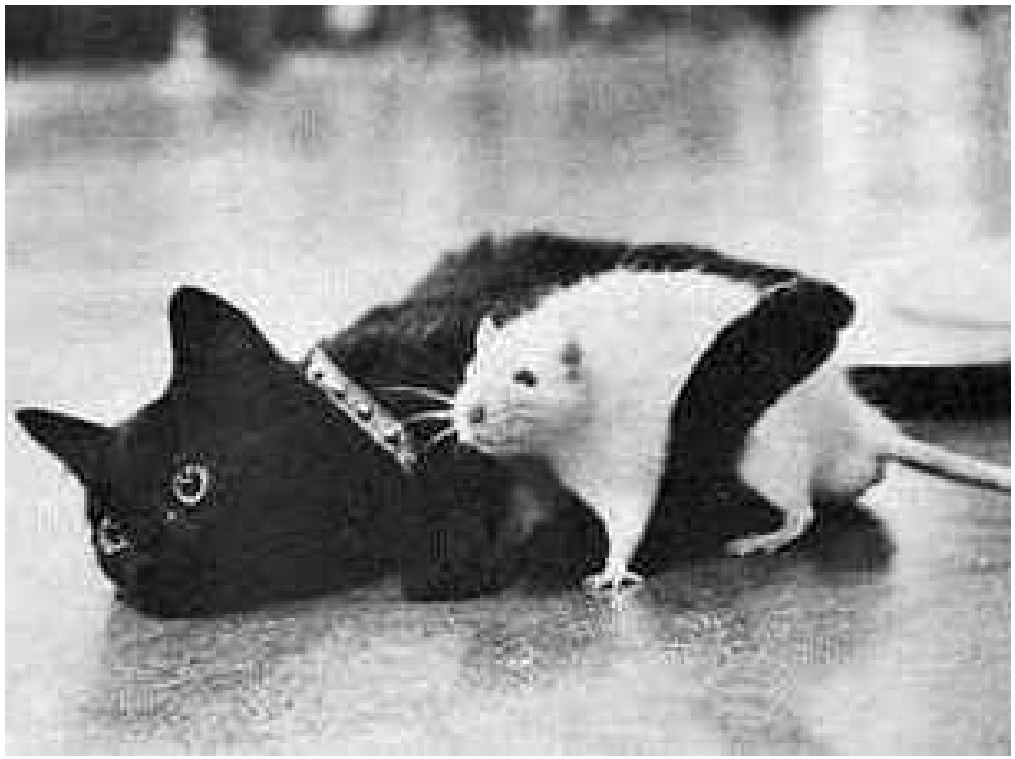
Selective amygdala lesions: Rodents

- Direct implication of amygdala in emotional behaviors

Cute & Cuddly or fearsome predator?



Human amygdala: Impaired recognition of fear

- Intact face recognition
- Impairment selective for fear

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