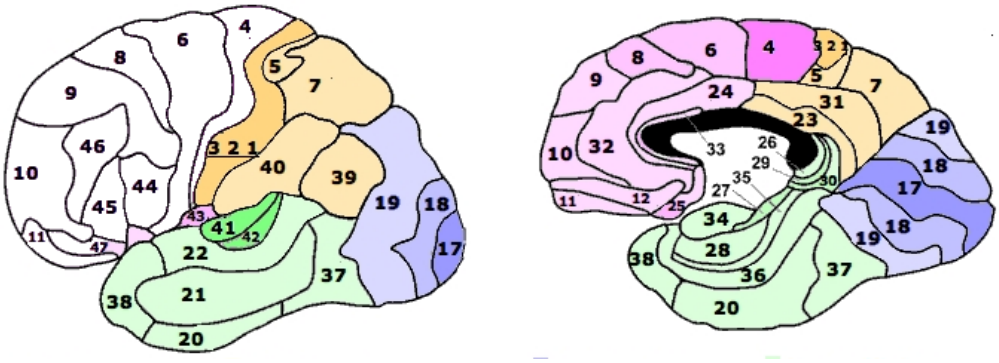
Occipital Lobe Function

(Kolb & Whishaw, 2009, pp. 350 ff, et al.)

Comprised of

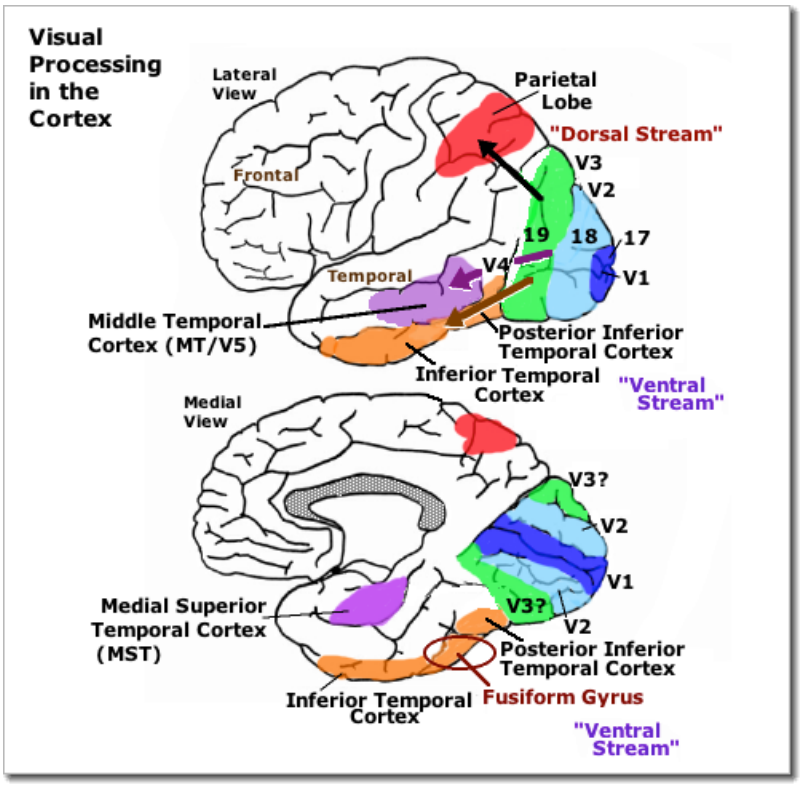
- Posterior pole of the cerebral hemispheres
- Visual Cortex: Ventral surface: lingual gyrus (V2 & VP) and the fusiform gyrus (V4)
- Brodmann areas 17, 18, 19 (see diagram below)



Human

- V1: Laminar organization (layers); multiple, e.g., IV = 4 layers
- Blobs (color) and interblobs (form & motion), thus, heterogeneous function
- V2: Stripes (thin = color; thick = form; pale = motion)
- V4 = color perception (predominantly): gives evolutionary advantage (detection of motion as well as recognition of food)

Color, Form, Motion: color vision is part of perception of position, depth, motion, and structure of objects.



Connections

Extremely complex

- V1: Striate cortex: primary vision area: receives input from lateral geniculate nucleus
- V2: Projects to other occipital regions; second level processing
- 3 pathways: to parietal, to superior temporal sulcus, and to inferior temporal sulcus

Theory of Occipital Lobe Functioning

V1 (Blobs) to V4: color (mostly; some form & color)
V1 (magnocellular) to V2 and then to V5 (motion detection)
V1 and V2 to V3: dynamic form: the shape of objects in motion

V4 damage = ***achromatopsia*** & inability to recall color from past (color cognition)

V3-V4 large lesion: form perception goes

Some V1 lesions: can't see but have a kind of blindsight, e.g., where something is located

Felleman & van Essen (1991): 32 of 70 cortical areas involved in vision for monkeys: 55% of total surface (vs. 11% for somatosensory & 3% for auditory)

A. *Vision for Action*: Parietal visual areas (Dorsal or "Where" system)

- Allows movement, e.g., grasping, ducking, gymnastics (visually-guided movements)
- Sensitive to movements of target

B. *Action for Vision*

- Extract visual information from environment, e.g., by moving eyes across targets; looking at faces

C. *Visual Recognition*: Temporal (Ventral or "What" system)

- Recognition and discrimination of objects in world
- Some separate areas to process biologically-significant visual data, esp. faces

D. *Visual Space*: both temporal & parietal

- World can be mapped vis-à-vis yourself (egocentric space) or itself (allocentric space)
- Egocentric spatial mapping allows one to move the body in regard to object
- Allocentric spatial mapping allows for constructing memory of spatial location

E. *Visual Attention*

- Need to block out or filter visual information; selective attention to elements in environment

F. *Facial Recognition* (Pitcher et al., 2011)

- An area of the occipital cortex has been described as the "occipital face area" (OFA). It is in the inferior occipital gyrus (IOG) on the lateral section of the occipital cortex. It tends to be more dominant in the right hemisphere.

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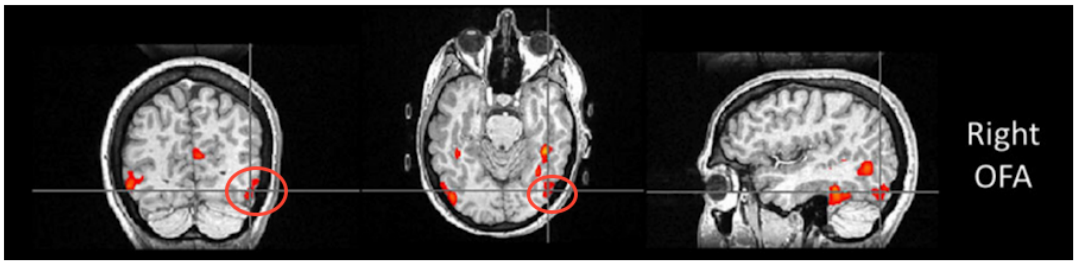
Right Occipital Face Area



Pitcher et al. (2011), fig. 1

- Neuropsychological evidence and transcranial magnetic stimulation (TMS) studies demonstrate the OFA is necessary for accurate face perception. fMRI and TMS studies investigating the functional role of the OFA suggest that it preferentially represents the parts of a face, including the eyes, nose, and mouth and that it does so at an early stage of visual perception. These studies are consistent with the hypothesis that the OFA is the first stage in a hierarchical face perception network in which the OFA represents facial components prior to subsequent processing of increasingly complex facial features in higher face-selective cortical regions" (Pitcher et al., 2011, Abstract)

- We'll look at more about this topic in the handout on the temporal lobe

References

Felleman, D. J., & Van Essen, D. C. (1991). Distributed hierarchical processing in the primate cerebral cortex. *Cerebral Cortex, 1*, 1-47.

Kolb, B. and Whishaw, I.Q. (2009) *Fundamentals of human neuropsychology* (6th ed.). New York, NY: Worth.

Pitcher, D., Walsh, V., & Duchaine, B. (2011). The role of the occipital face area in the cortical face perception network. *Experimental Brain Research, 209*, 481-493. https://dx.doi.org/ 10.1007/s00221-011-2579-1