2018-03-19 Eye & Head Movements

PSY 525.001 • Vision Science • 2018 Spring

Rick Gilmore

2018-03-19 14:30:22

Today's topics

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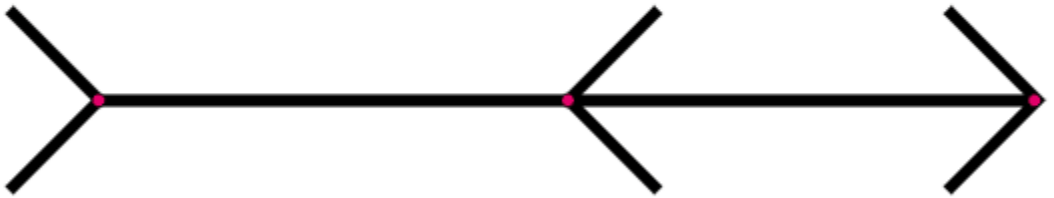
Eye and head movements

DYNAMIC MULLER-LYER ILLUSION

The red dots are equidistant, though the extremities of the line seem to alternately stretch and shrink like a rubber band.



Concept & Realisation: Gianni A. Sarcone

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Sarcone, Gianni A. "Dynamic Müller-Lyer Illusion." From Sarcone's Studio -- A Sarcone & Waeber Web Resource. http://giannisarcone.com/Muller_lyer_illusion.html. Copyright © G. Sarcone

Why move the eyes?

Why move the eyes?

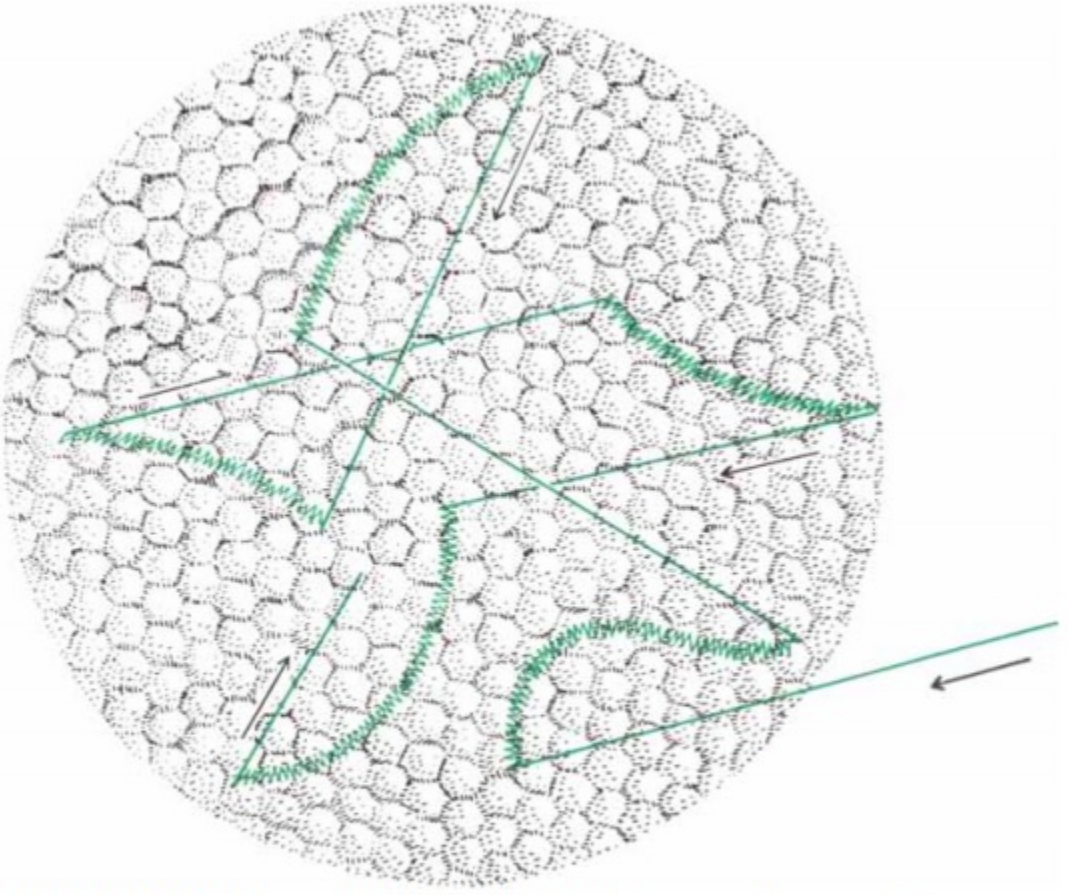
Fixation

Why move the eyes?

Fixation

Tracking

Types	Description	Comments
Nystagmus	small, rapid, oscillatory	keep things visible
Saccades	ballistic, fast	spatial frame of ref
(Smooth) Pursuit	track moving target	speed dependent
Vergence	Con/Diverge; disconjugate	cue to depth
Vestibular Ocular Response (VOR)	Stabilize eyes in head	stabilize in 3D
Optokinetic	stabilize moving field	size of motion field critical
Accommodation	Change in shape of lens	focus
Pupillary response	Change in lighting	



EYE MOVEMENTS that are halted in stabilized vision normally carry an image across the receptors of the retina as shown here. The three movements are a drift (*curved lines*) away from the center of vision, a faster flick (*straight lines*) back toward the center and a high-frequency tremor superimposed on the drift. The magnitude of all these movements is very small; the diameter of the patch of the fovea shown above is only .05 millimeter.

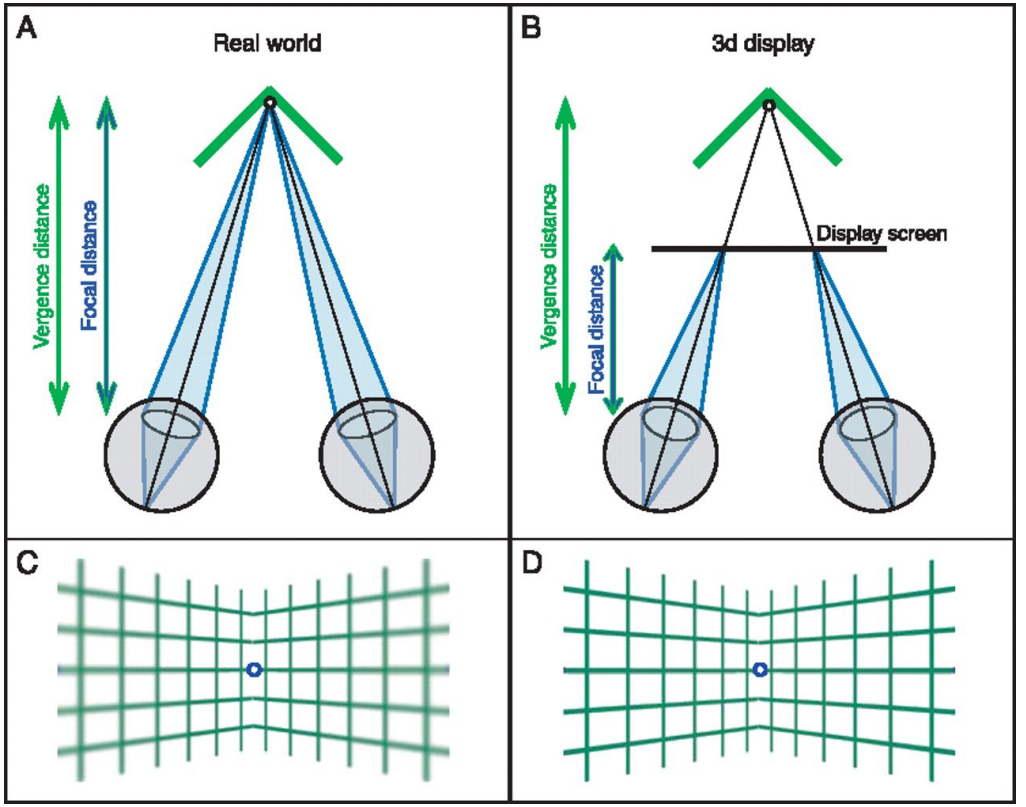
Image paths on the retina

STABILIZED IMAGES typically fade as in the illustrations on this and the following two pages. The parts of a profile drawing that stay visible are invariably specific features or groups of features, such as the front of the face or the top of the head.

MEANINGLESS CURLICUES first come and go in random sequence. But after a while small groups of curlicues organized in recognizable patterns start to behave as units. This suggests that they have themselves become meaningful perceptual elements.

Image stabilization results in perceptual fading (Pritchard, 1961)

Vergence



Vergence/accommodation conflict complicates virtual reality (VR) displays

Smooth pursuit

Vestibulo Ocular Reflex/Response (VOR) stabilizes gaze

Demo: VOR permits reading/texting while walking

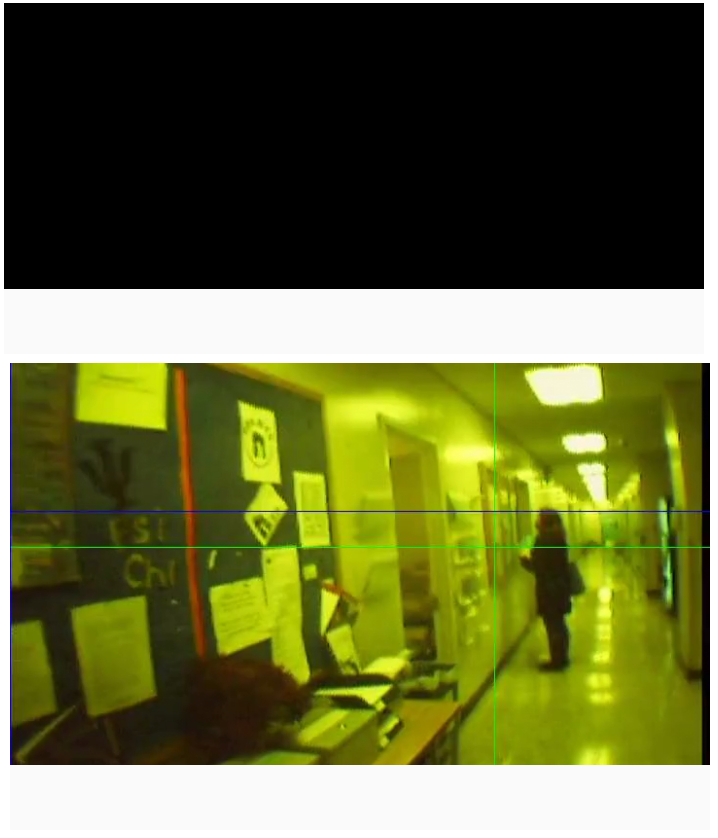
But: https://youtu.be/wl0JojWH1rQ

Optokinetic nystagmus (OKN)

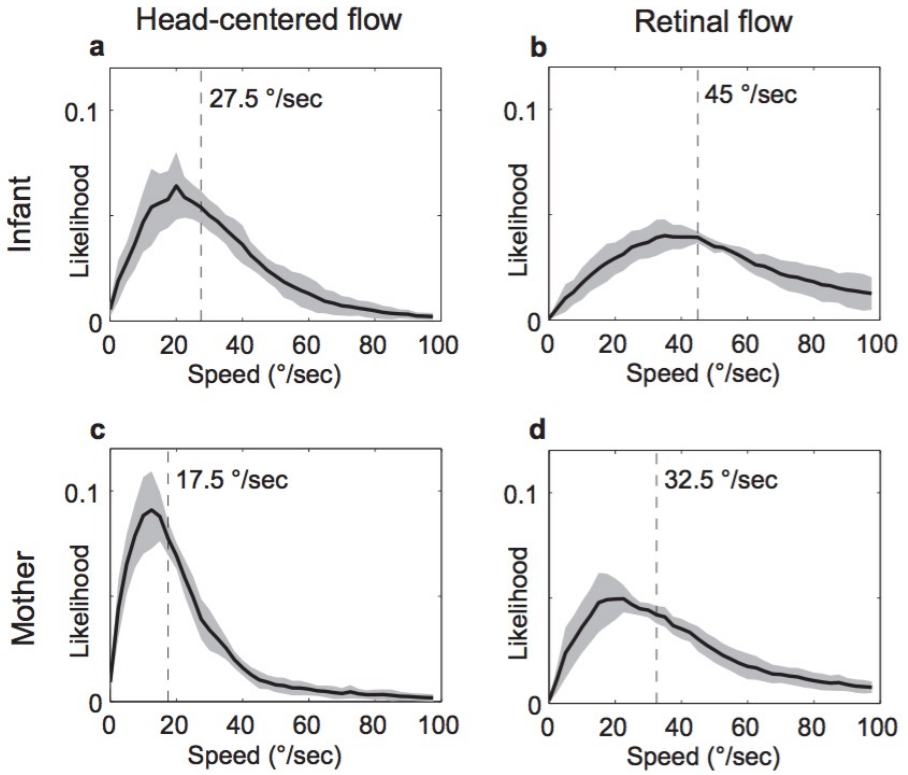
How eye trackers work

https://webgazer.cs.brown.edu/

Using a web cam!



Gilmore, R.O., Raudies, F., Franchak, J. & Adolph, K. (2015). Understanding the development of motion processing by characterizing optic flow experienced by infants and their mothers. *Databrary*. Retrieved March 16, 2018 from http://doi.org/10.17910/B7.116

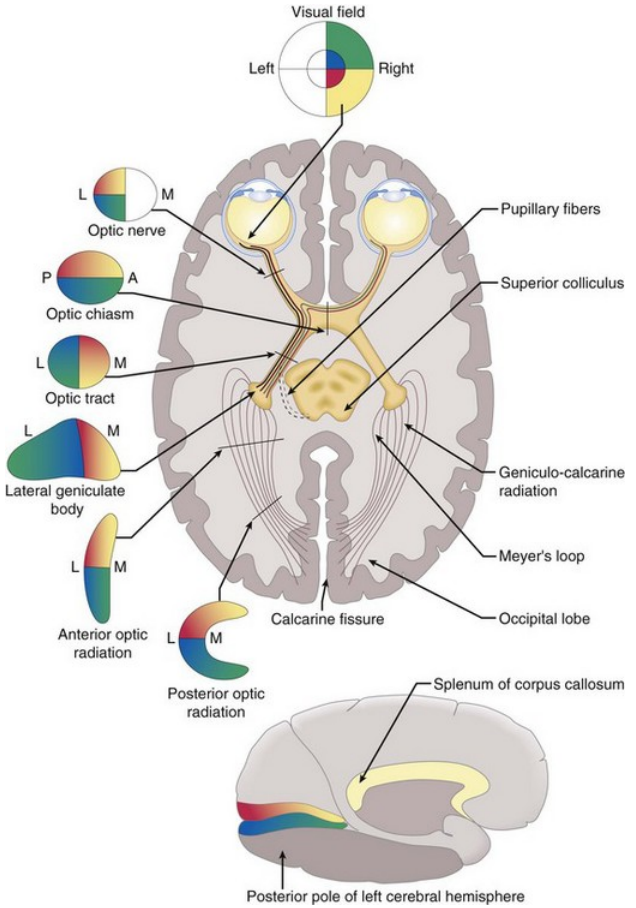


Raudies, F. & Gilmore, R.O. (2014). Visual motion priors differ for infants and mothers. *Neural Computation*, 26(11), 2652-2668. doi:10.1162/NECO_a_00645

Infants experience *faster* speeds than mothers

Simulating the effects of saccades on vision with the EyeSeeCam

Physiology and anatomy of eye movements



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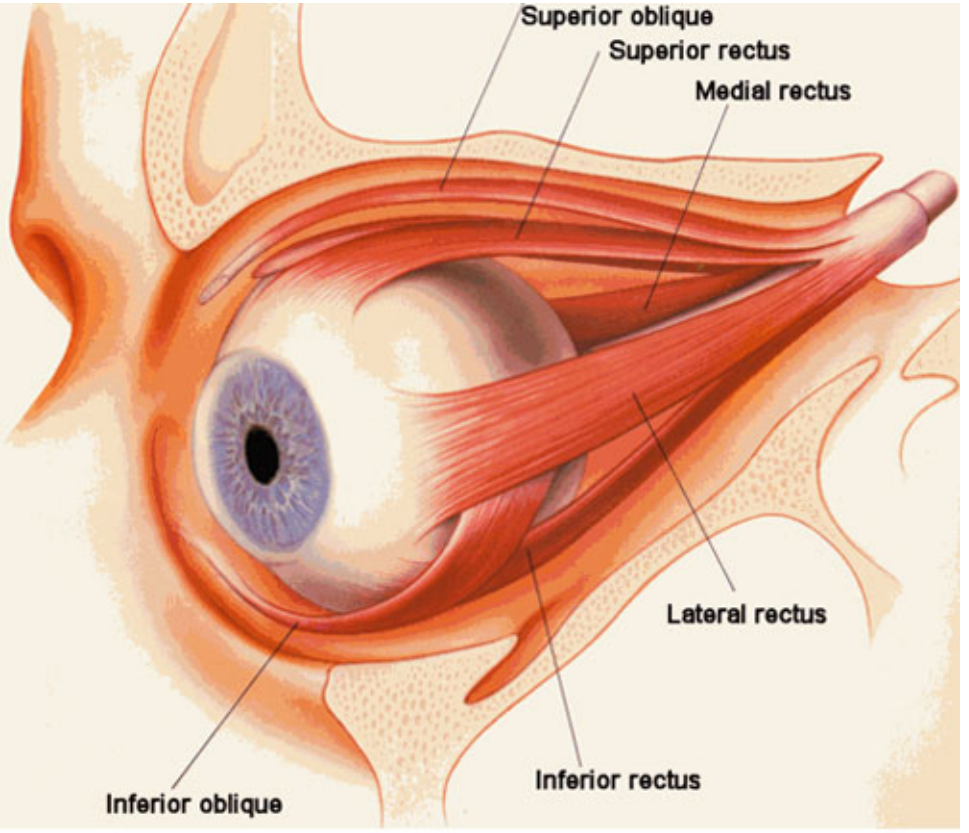
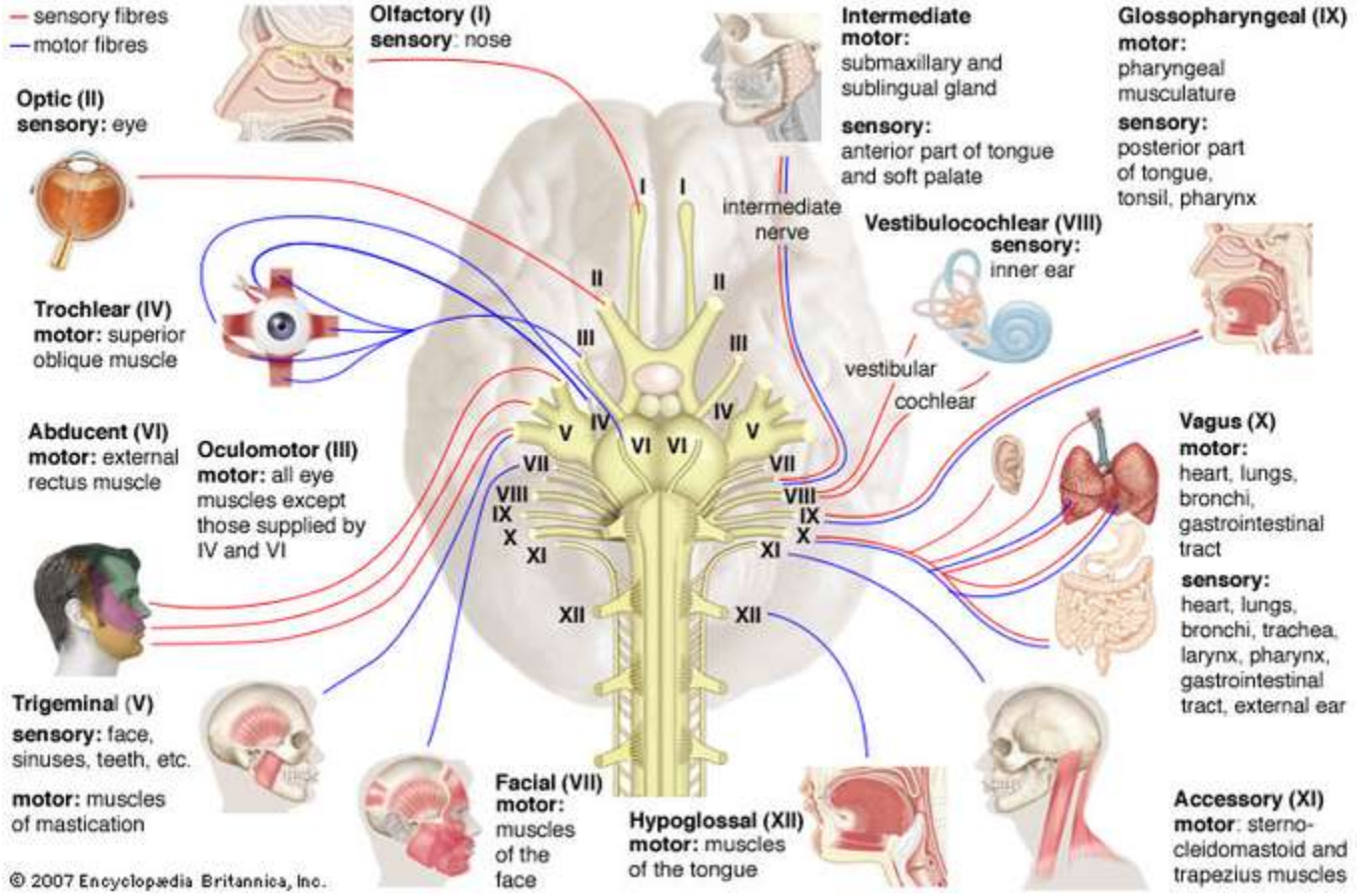
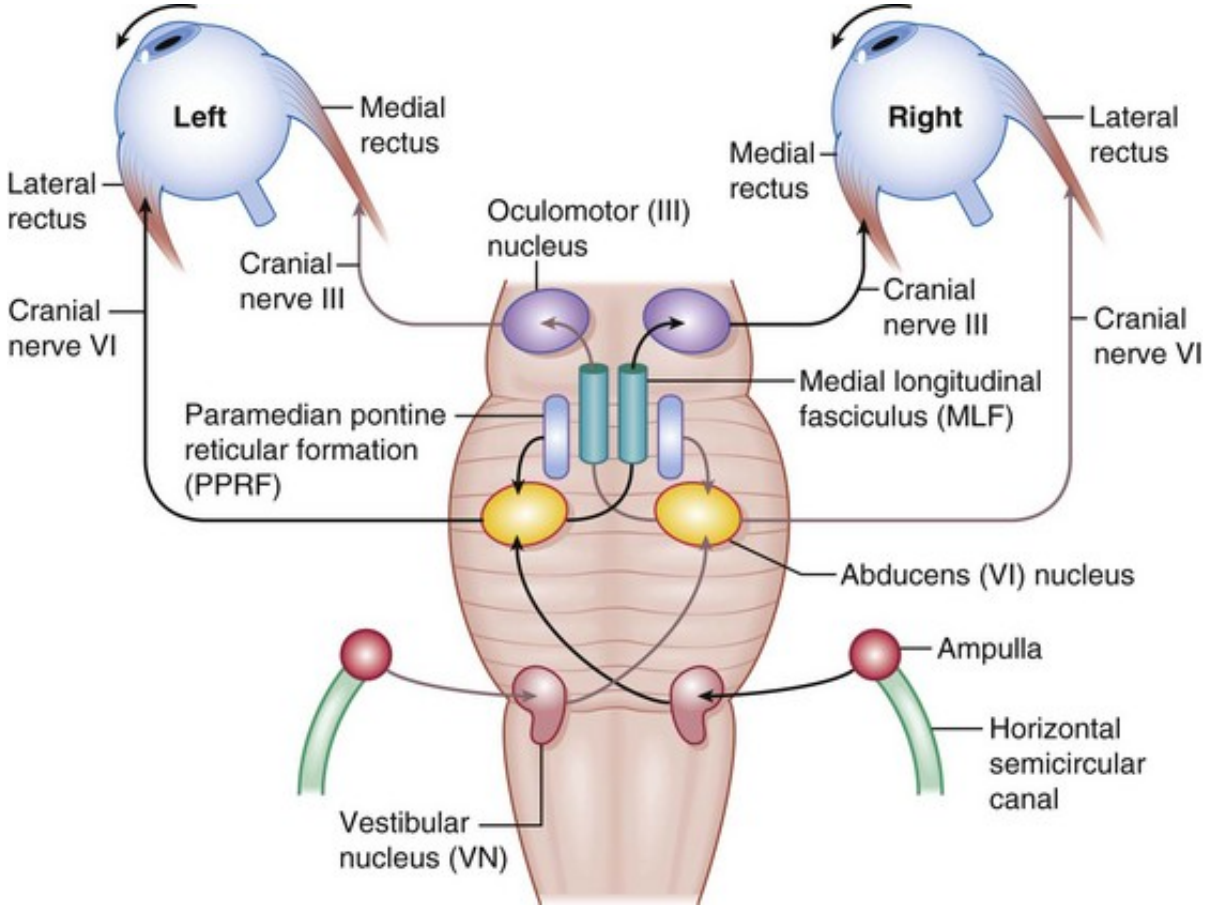


Fig. 1 Extraocular Muscle Anatomy

6 muscles/eye (superior/inferior and medial/lateral rectus + superior/inferior oblique)



3 cranial nerves: III (oculomotor); IV (trochlear); & VII (abducens)



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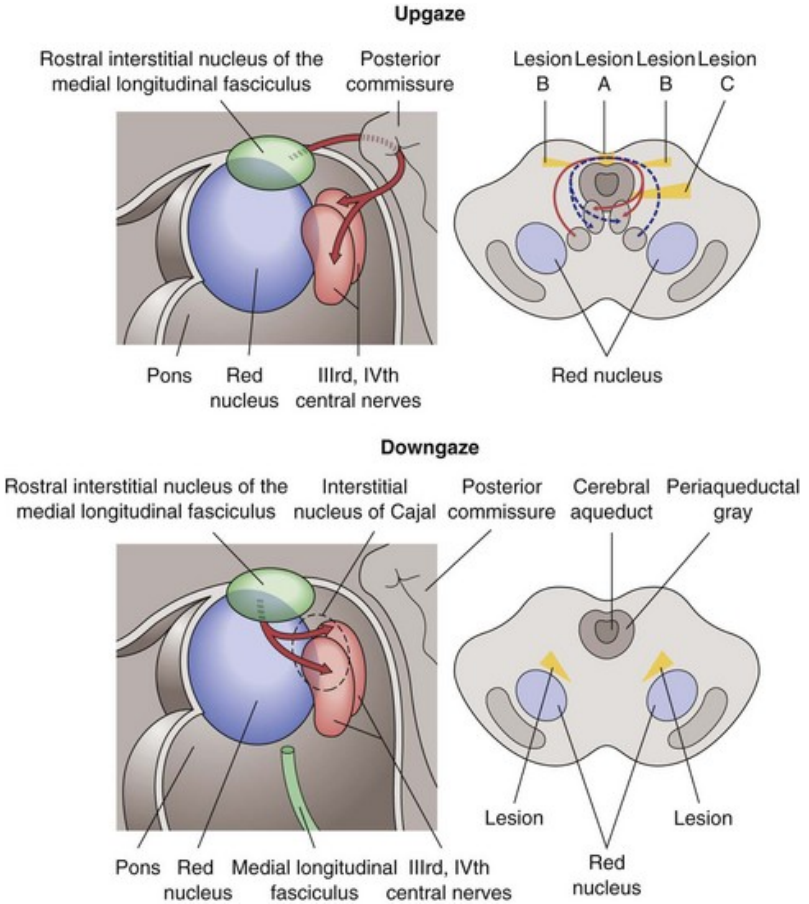

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Wilkinson, K. (2014). Preliminary investigation of visual attention to human figures in photographs: Potential considerations for the design of aided AAC

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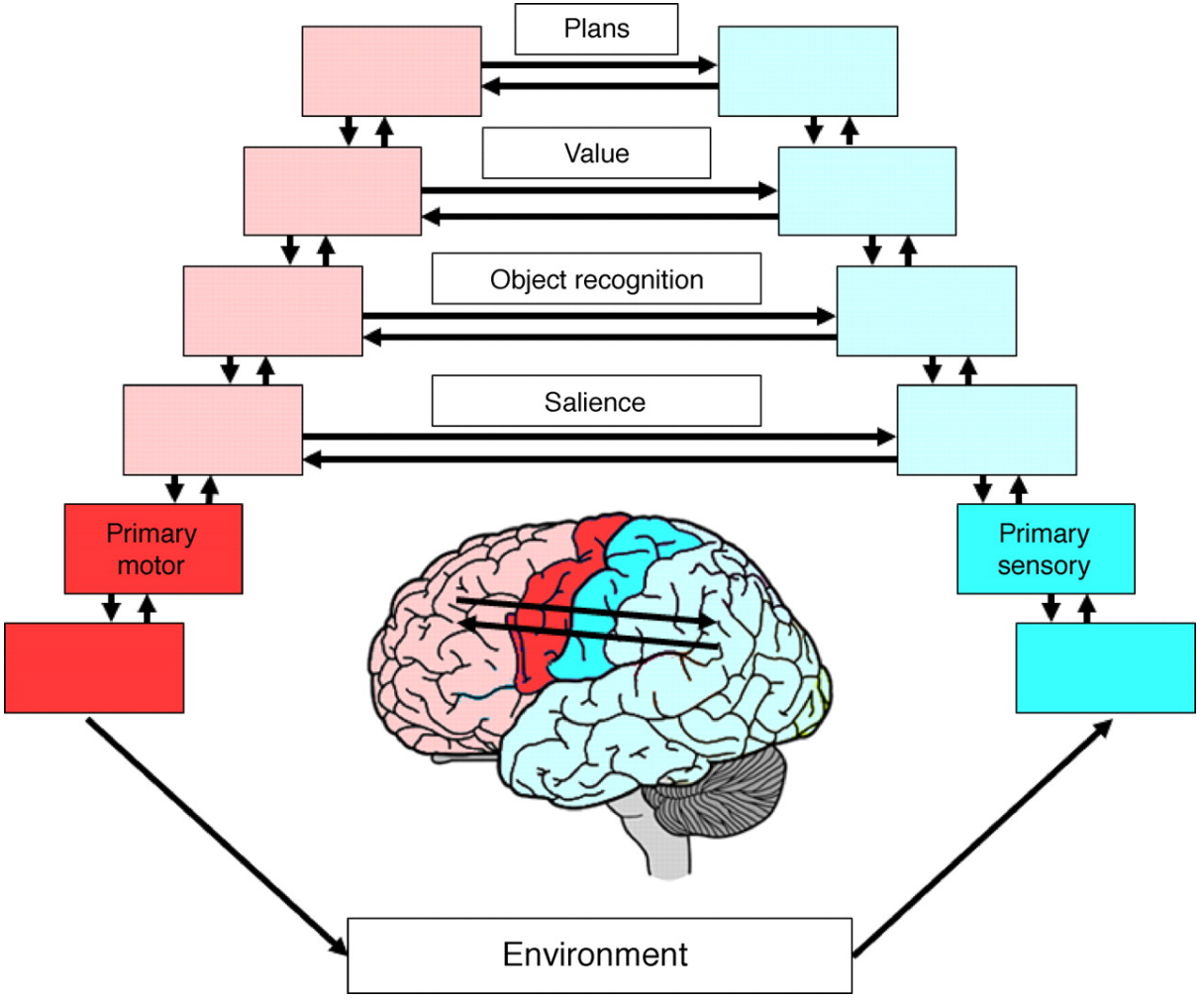
Break

Schütz, A. C., Braun, D. I., & Gegenfurtner, K. R. (2011). Eye movements and perception: a selective review. *Journal of Vision*, *11*(5). Retrieved from http://dx.doi.org/10.1167/11.5.9



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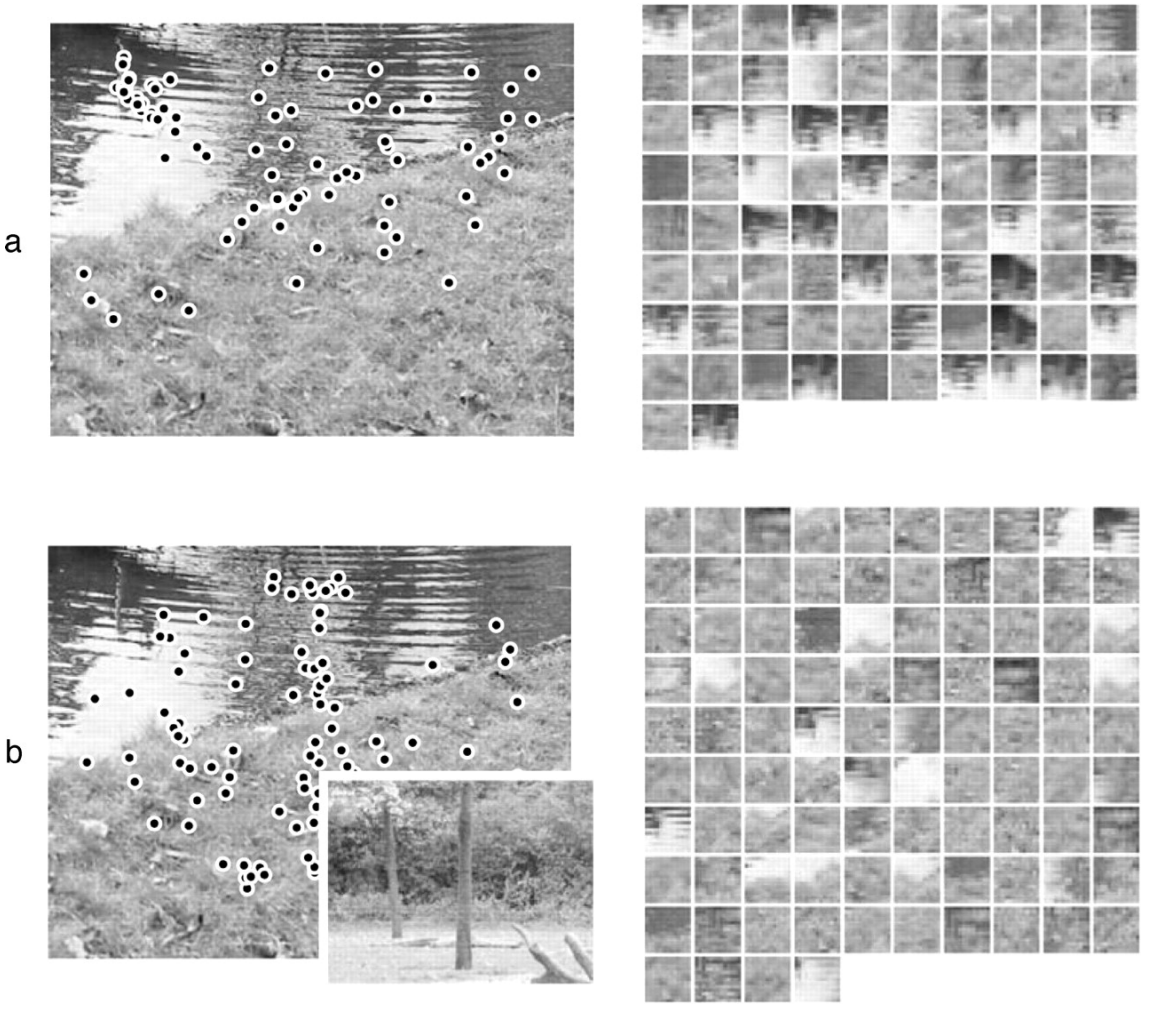

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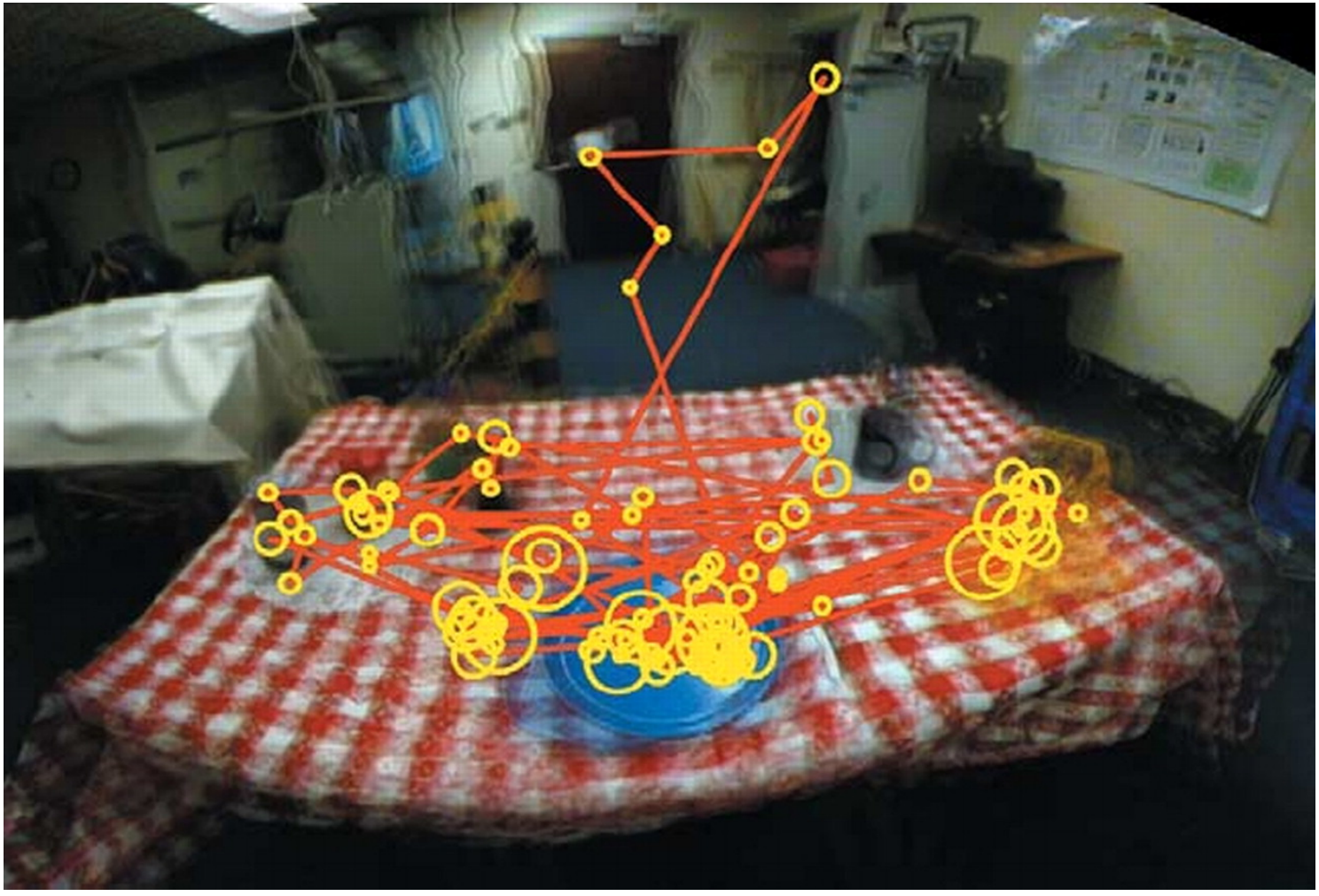

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