

2018-03-12 Motion

PSY 525.001 · Vision Science · 2018 Spring

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2018-03-12 09:17:46

# Today's topics

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Motion

# Image motion

Detecting/computing motion

Sources and types of motion

# Motion detection

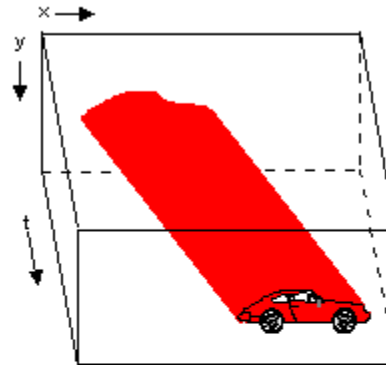
Motion -> Change in Luminance/Time

Speed = Distance/Time

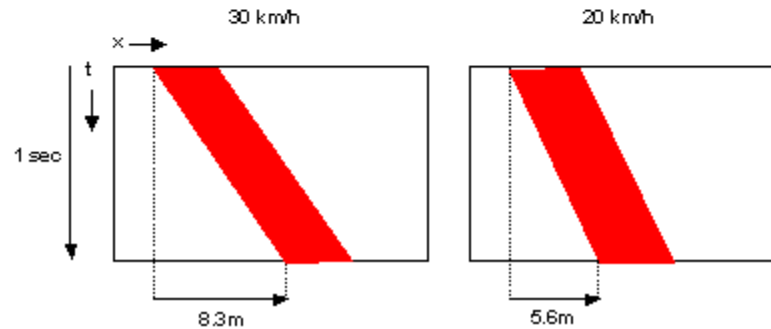
Speed =

$$\frac{d_2 - d_1}{t_2 - t_1}$$

**x-y-t plot of a moving car**

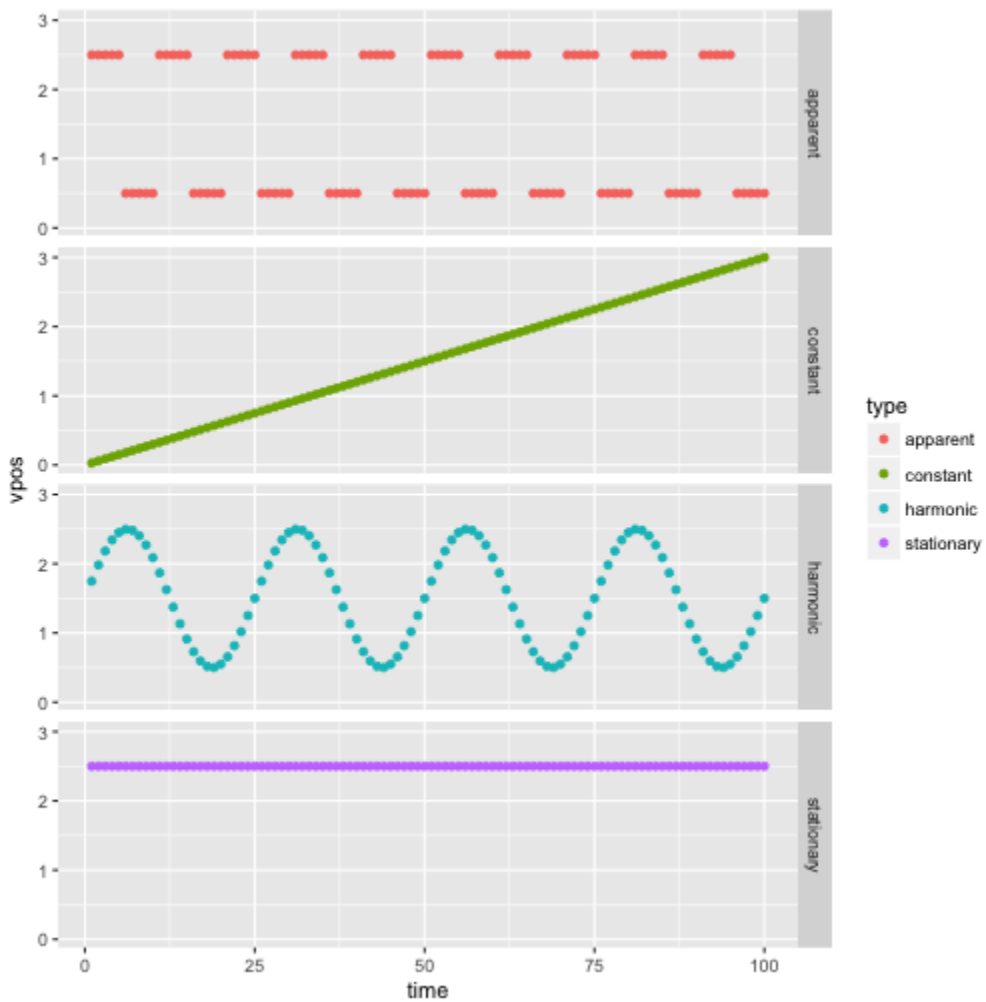


**Space-time or x-t plots of the moving car**

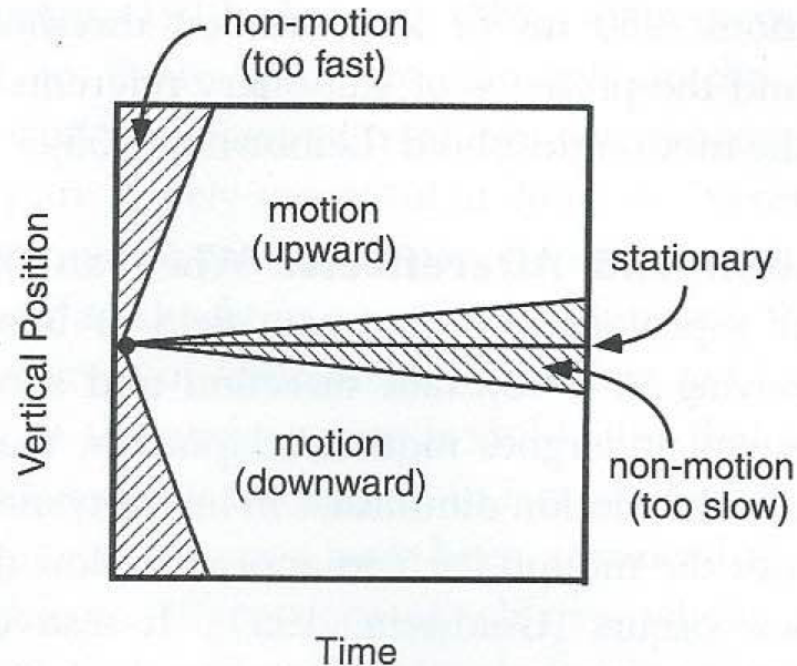


<http://www.georgemather.com/Model.html>

Speed/direction are slopes in space-time (Adelson & Bergen, 1985)

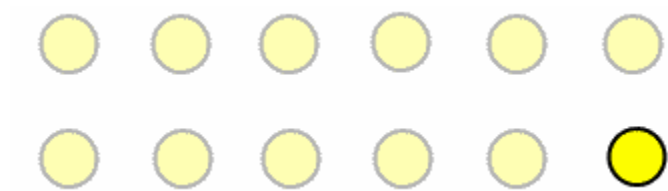






**Figure 10.1.4** The limits of motion perception. Observers experience motion as long as the object's motion is neither too slow (too shallow in space-time) nor too fast (too steep in space-time).

Detection thresholds lie within a range



By Copied from the very nice animation at [Image:Phi\\_Phenomenon.gif](#), but with the watermark with the image author's name removed in accordance with [\[1\]](#) - English Wikipedia The original file was upload by English-Wiki user Cromis, [CC BY-SA 3.0](#), [Link](#)

## Apparent motion

Phi Phenomenon



$\phi$  (phi) motion (Wertheimer, 1912)

Animation basics: The optical illusion of motion - TED-Ed



Optical Illusion: The Wagon Wheel Effect (Aliasing)



**Wagon wheel illusion illustrates correspondence  
problem in apparent motion**

Amazing Animated Optical Illusions!



**Motion from static samples smeared in space**

## How to make Animated Illusion

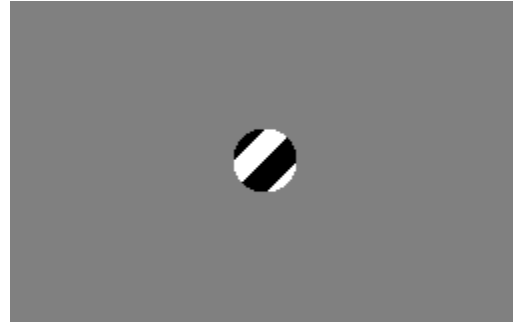


Blooms: Strobe-Animated Sculptures



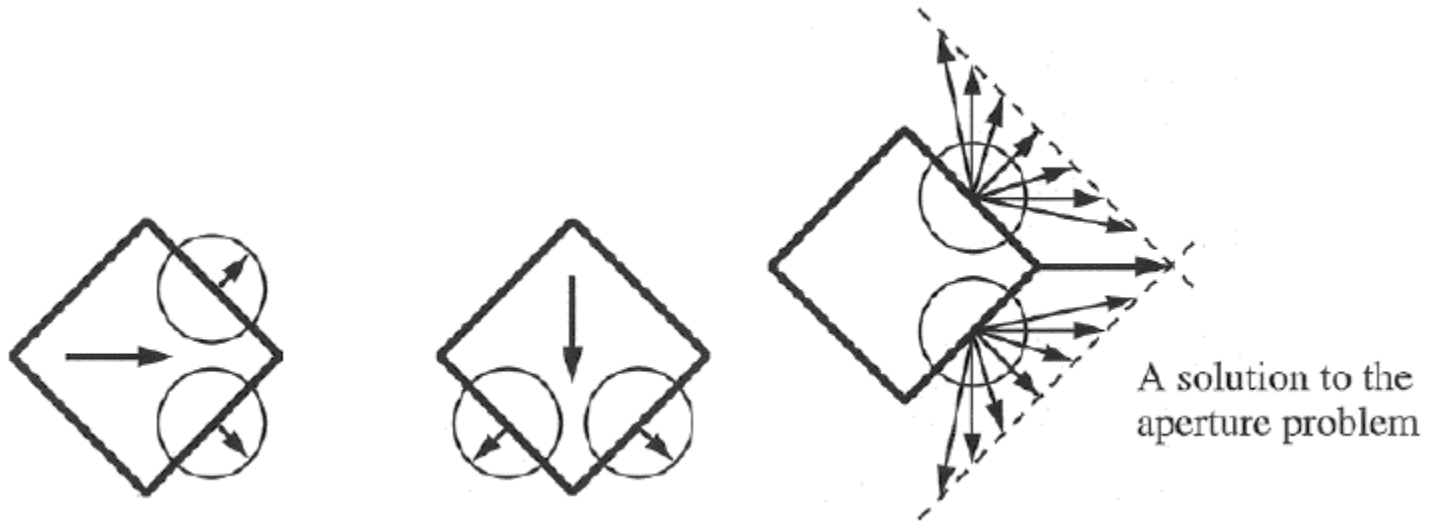
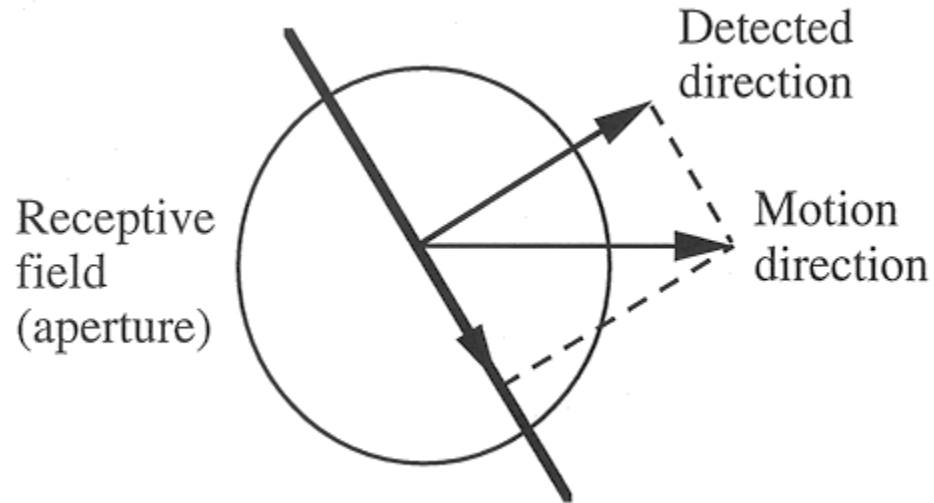
"Strobe" enabled animation





By The original uploader was [Rokers](#) at [English Wikipedia](#) - Transferred from [en.wikipedia](#) to Commons., [CC BY-SA 3.0](#), [Link](#)

## Aperture problem



<http://fourier.eng.hmc.edu/e180/lectures/motion/node11.html>

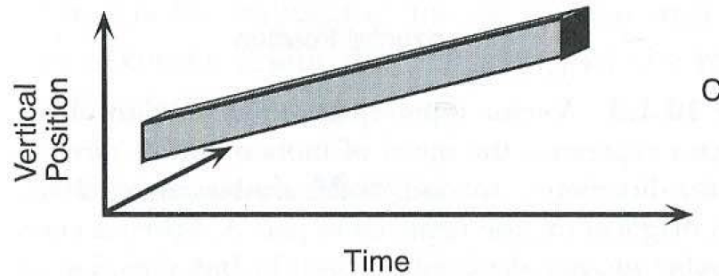
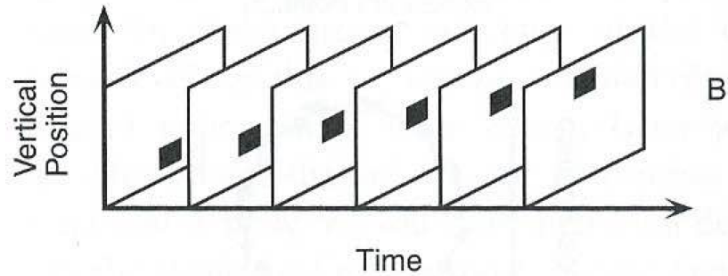
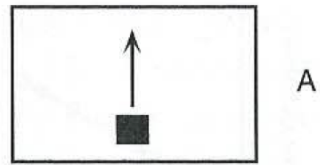
ambiguous and unambiguous plaid motion stimuli - Psychophysi...



<https://rmartins.net/demos/ambiguous-and-unambiguous-plaid-motion-stimuli-psychophysics-toolbox>

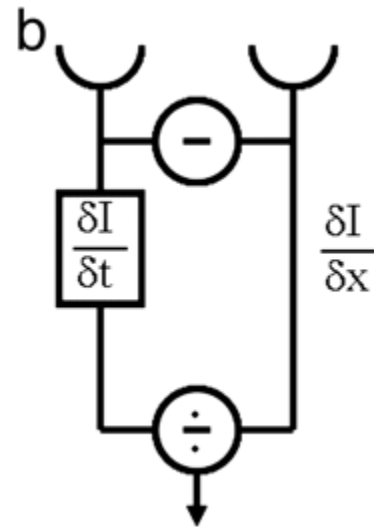
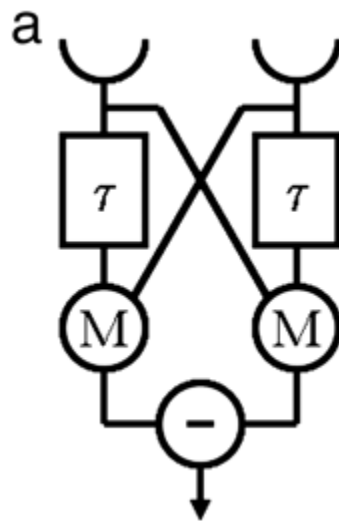
**Plaid motion illustrates motion  
integration/segregation**

# Detecting/computing motion

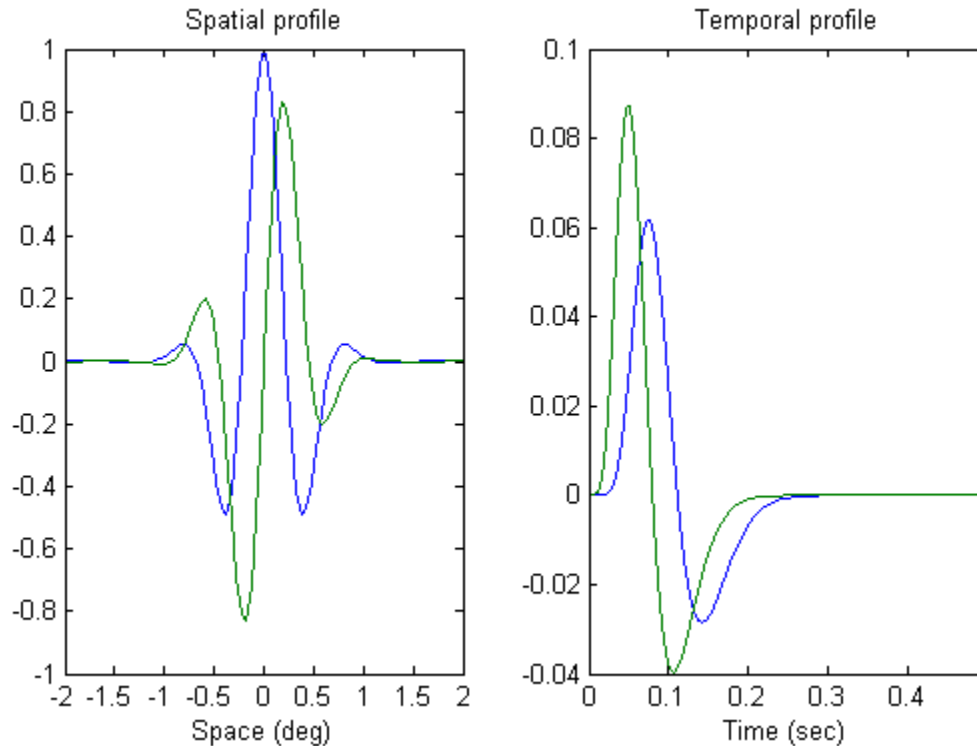


Palmer 1990, Fig 10.1.1

# Motion as a trajectory in space-time



(Werner) Reichardt detector



<http://www.georgemather.com/Model.html>

## Motion Energy Filters (Adelson & Bergen, 1985)

# Sources & Types of Motion



**Source: Object vs. Self**

**Direction, speed, type**

Shape from motion only



2D form from motion

A flipbook visit from SLIMEY the Worm



# Flipbooks

Structure from Motion Demo



Structure from motion

Kinetic Depth Effect Demo



Perceived motion can induce 3D perception via kinetic depth effect

Archival Gibson - 1958 - Motion parallax and perceived depth

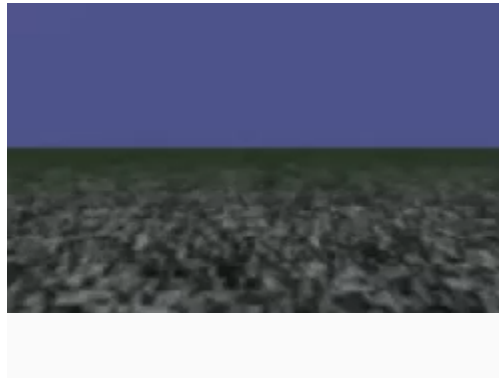


**Motion parallax specifies relative depth**

Task 1: Example of 100% Radial Optic Flow (no random dots) wit...



**Optic flow specifies observer motion**



[http://viperlib.york.ac.uk/categories/104-optic-flow/contributions/1596-pureflow-2002?from\\_preview=true](http://viperlib.york.ac.uk/categories/104-optic-flow/contributions/1596-pureflow-2002?from_preview=true)



How the brain processes 3D motion



## Binocular motion signals and 3D perception

Motion Integration Illusion

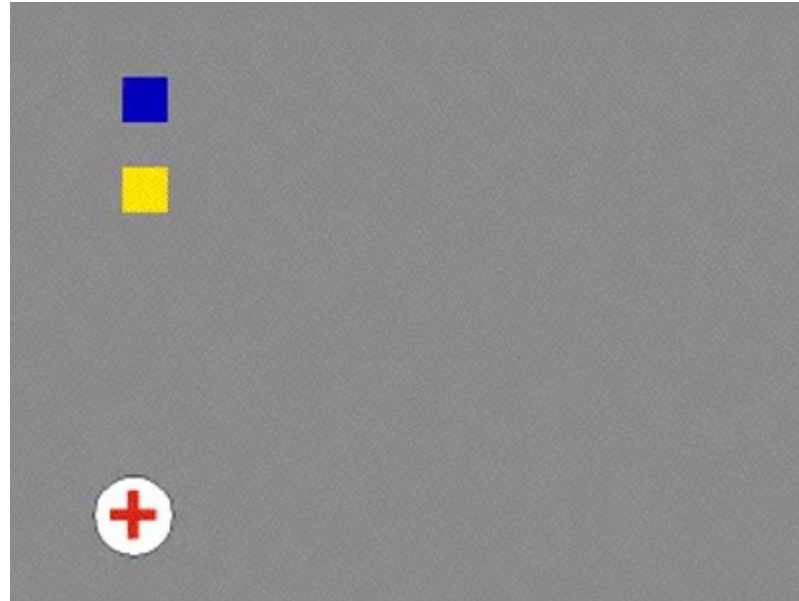


Motion integration

Second-order motion perception



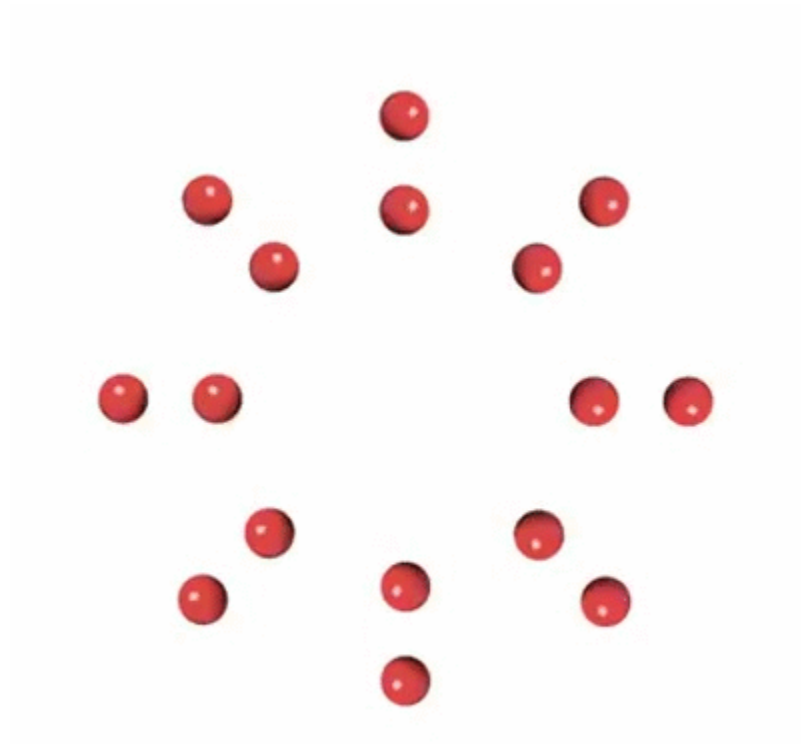
Second-order (changes in contrast, texture, etc.) but  
not overall luminance



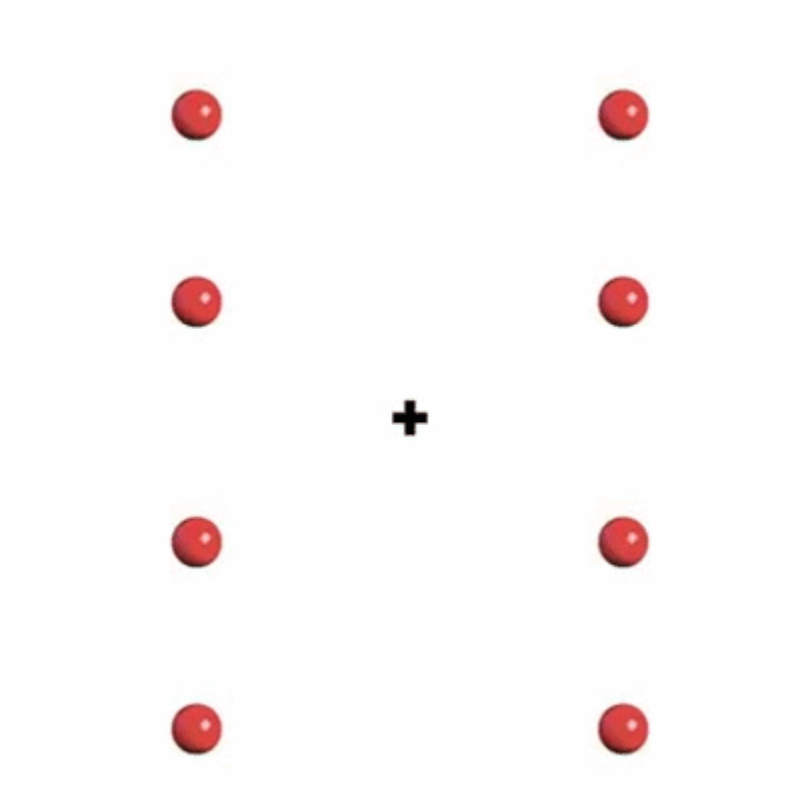
Relative contrast matters



Context effects **Anstis, 2015**



Grouping effects **Anstis, 2015**



Grouping effects **Anstis, 2015**

Top 5 Illusions of the 2016 | Best Illusion of the Year Contest



**Motion detection, integration**



Moving Illusions



## Anomalous motion illusions



[http://viperlib.york.ac.uk/categories/91-eye-movements/contributions/2060-breathing-windows?from\\_preview=true](http://viperlib.york.ac.uk/categories/91-eye-movements/contributions/2060-breathing-windows?from_preview=true)

PsychoPy, <http://www.psychopy.org/>

Matlab Psychophysics Toolbox,  
<http://psychtoolbox.org/>

Break

Johansson, G. (1973). Visual perception of biological motion and a model for its analysis. *Perception & Psychophysics*, 14(2), 201–211. Springer-Verlag.  
Retrieved December 20, 2017, from  
<https://link.springer.com/article/10.3758/BF03212378>

## Johansson: Motion Perception part 1

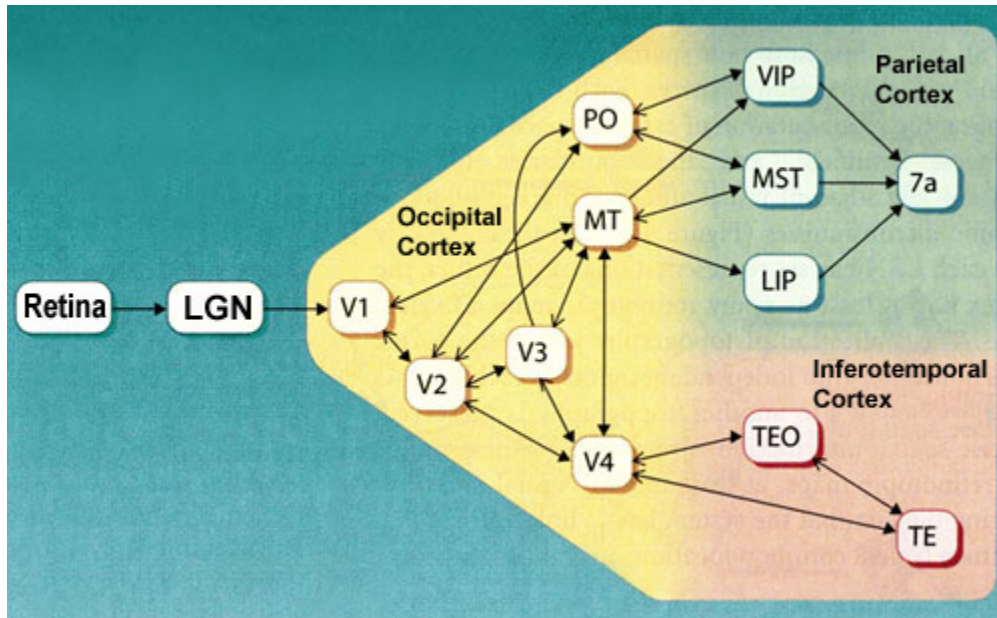


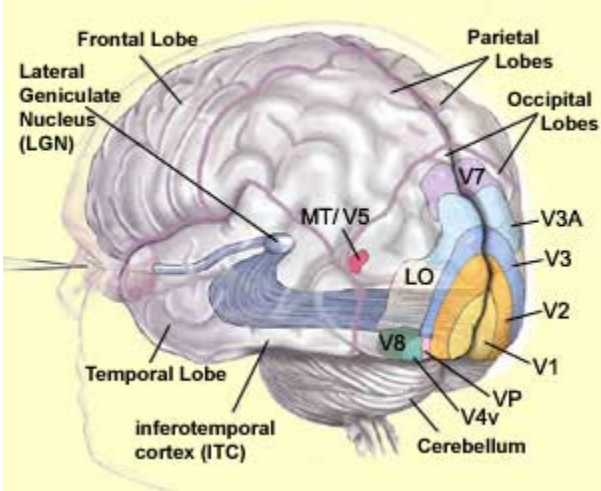
## Johansson: Motion Perception part 2



Newsome, W. T., & Paré, E. B. (1988). A selective impairment of motion perception following lesions of the middle temporal visual area (MT). *The Journal of Neuroscience*, 8(6), 2201–2211. Retrieved March 30, 2015, from <https://www.ncbi.nlm.nih.gov/pubmed/3385495>







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