User Interaction: The Human

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INF 133 Fall 2010

"...in an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it" (Simon 1971, p. 40-41).

Augmented (hyper) reality

http://vimeo.com/8569187

"Designing an object to be simple and clear takes at least twice as long as the usual way. It requires concentration at the outset on how a clear and simple system would work, followed by the steps required to make it come out that way -- steps which are often much harder and more complex than the ordinary ones. It also requires relentless pursuit of that simplicity even when obstacles appear which would seem to stand in the way of that simplicity."

T.H. Nelson, 1977

http://www.flickr.com/photos/schultzlabs/933418919

http://www.flickr.com/photos/oxborrow/51812810/

Humans are limited in their capacity to process information.

This has important implications for design.

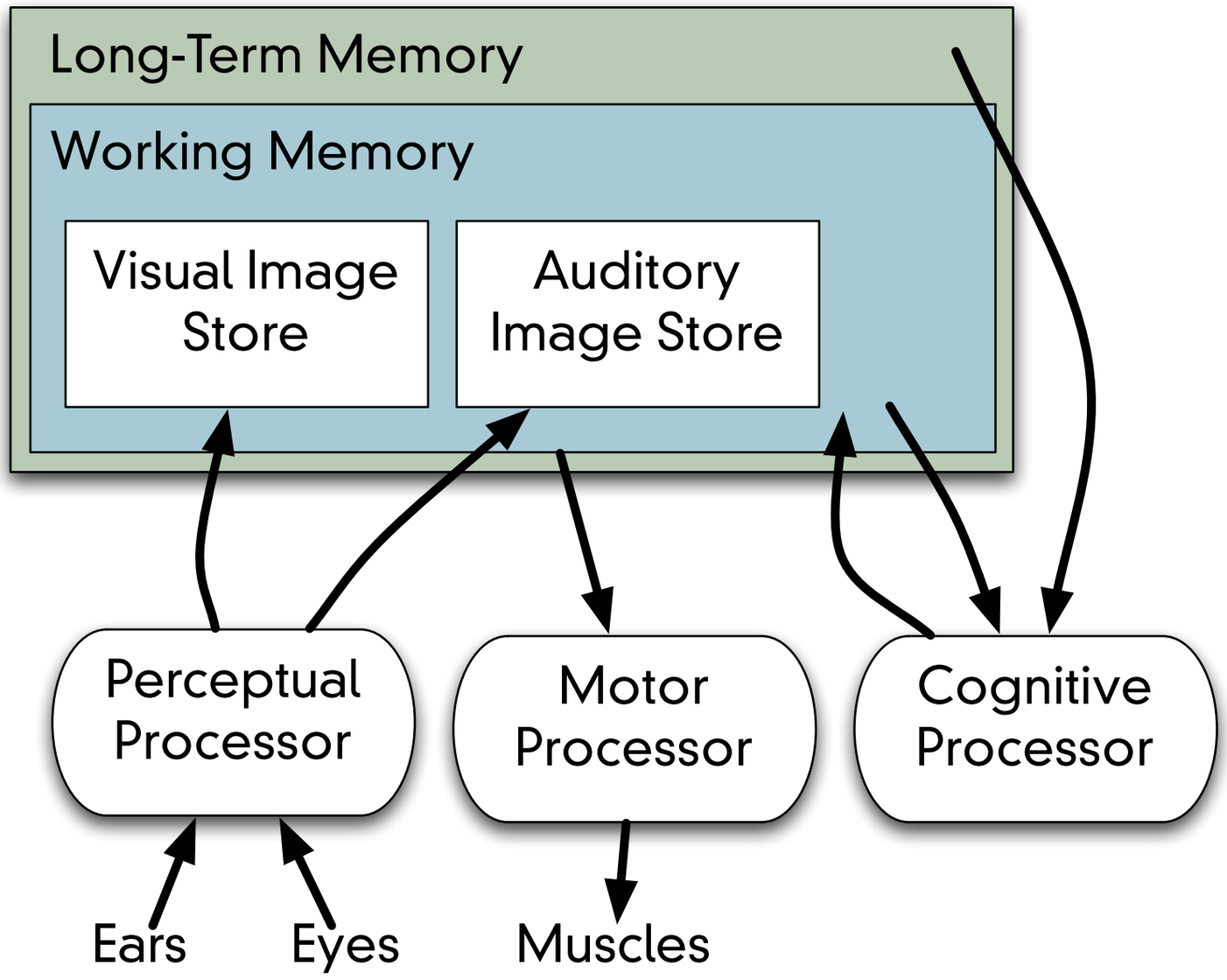
Human Computer Interaction is a misnomer.

Rarely do people want to interact with a computer.

They want to interact with people, data, media.

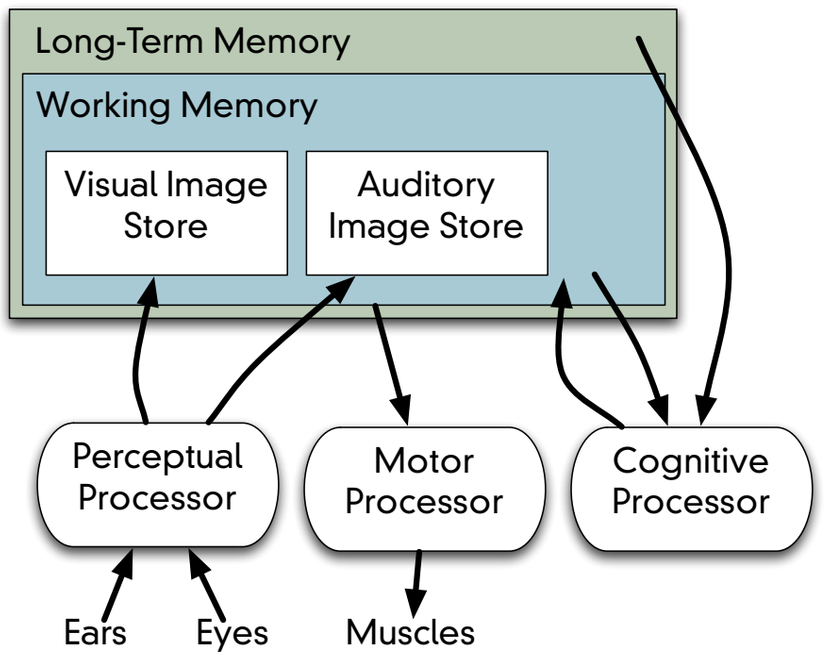
Even gaming isn't about the computer as much as it is about having fun through a computer.

The Model Human Processor



Card, Moran, Newell (1983)

The Human



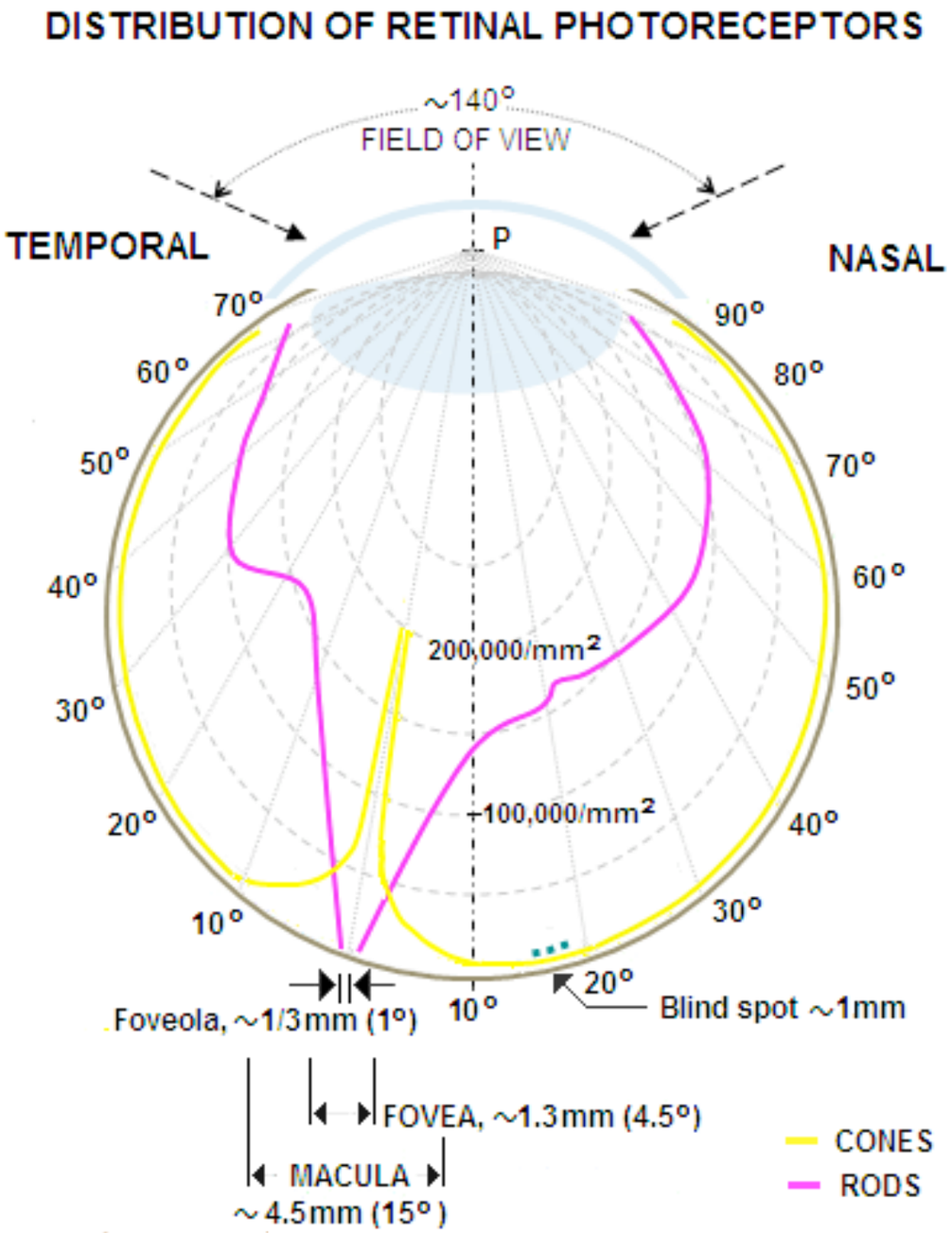
- Information Input/Output
  - visual, auditory, haptic, movement
- Information stored in memory
  - sensory, short-term, long-term
- Information processed and applied
  - reasoning, problem solving, skill, error
- Emotion influences human capabilities
- Each person is different

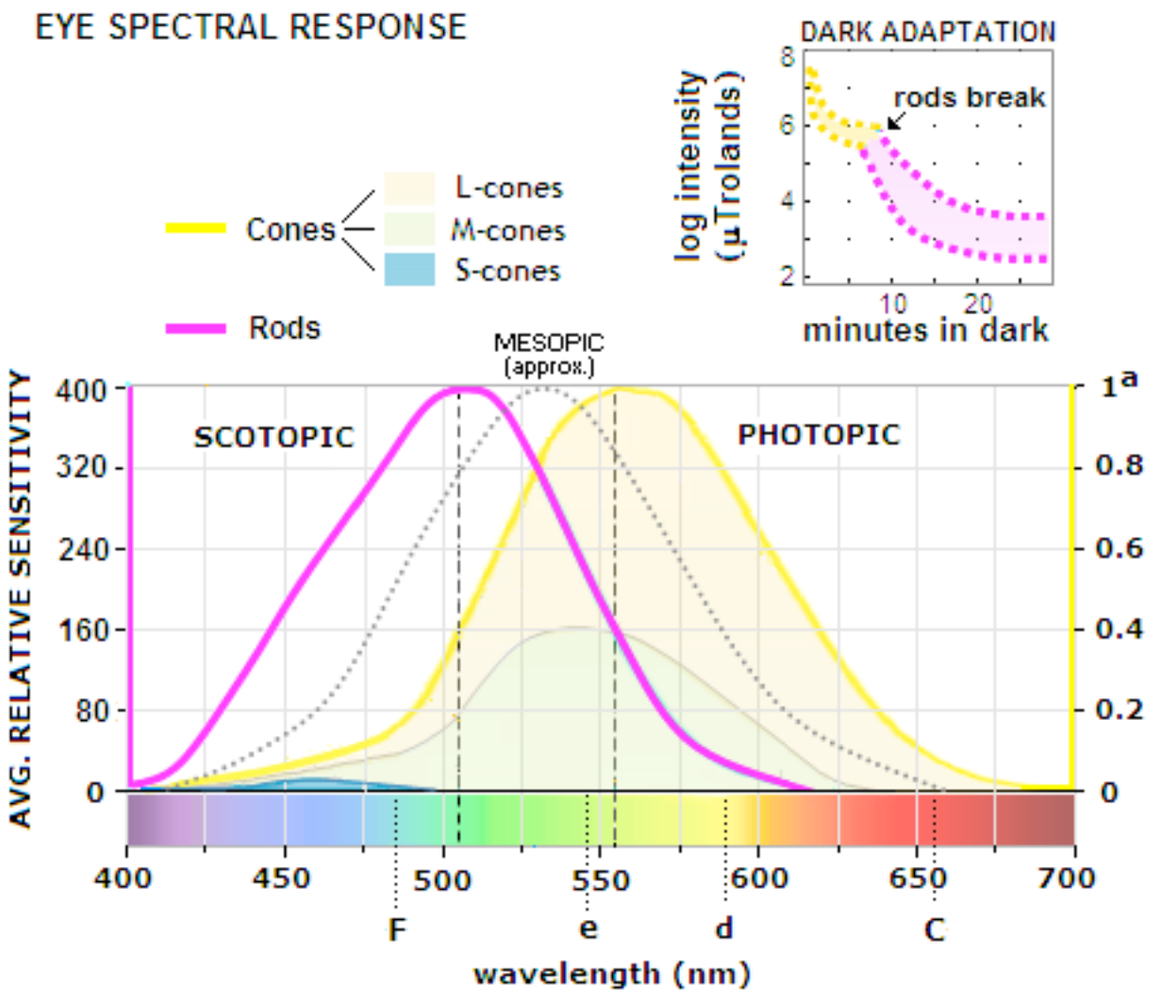
The Eye - Physical Reception

- mechanism for receiving light and transforming it into electrical energy
- light reflects from objects
- images are focused upside-down on retina
- retina contains rods for low light vision and cones for color vision
- ganglion cells (brain!) detect pattern and movement

The Eye - Interpreting the signal

- Brightness
  - subjective reaction to levels of light
  - affected by luminance of object
  - measured by just noticeable difference
  - visual acuity increases with luminance as does flicker
- Color
  - made up of hue, intensity, saturation
  - cones sensitive to color wavelengths
  - blue acuity is lowest
  - 8% males and 1% females color blind


DISTRIBUTION OF RETINAL PHOTORECEPTORS
~140°
FIELD OF VIEW
TEMPORAL
NASAL
P
70°
60°
50°
40°
30°
20°
10°
90°
80°
70°
60°
50°
40°
30°
20°
10°
200,000/mm²
100,000/mm²
Foveola, ~1/3mm (1°)
Blind spot ~1mm
FOVEA, ~1.3mm (4.5°)
MACULA
~4.5mm (15°)
CONES
RODS


EYE SPECTRAL RESPONSE
Cones
L-cones
M-cones
S-cones
Rods
DARK ADAPTATION
log intensity (μTrolands)
rods break
minutes in dark
MESOPIC (approx.)
SCOTOPIC
PHOTOPIC
AVG. RELATIVE SENSITIVITY
wavelength (nm)
F
e
d
C

The Eye - Interpreting the signal

- Size and depth
  - visual angle indicates how much of view an object occupies
    - (relates to size and distance from eye)
  - visual acuity is ability to perceive detail (limited)
  - familiar objects perceived as constant size
    - (in spite of changes in visual angle when far away)
- cues like overlapping help perception of size and depth
- thumbnail at arms length is equivalent to 640x480 pixels

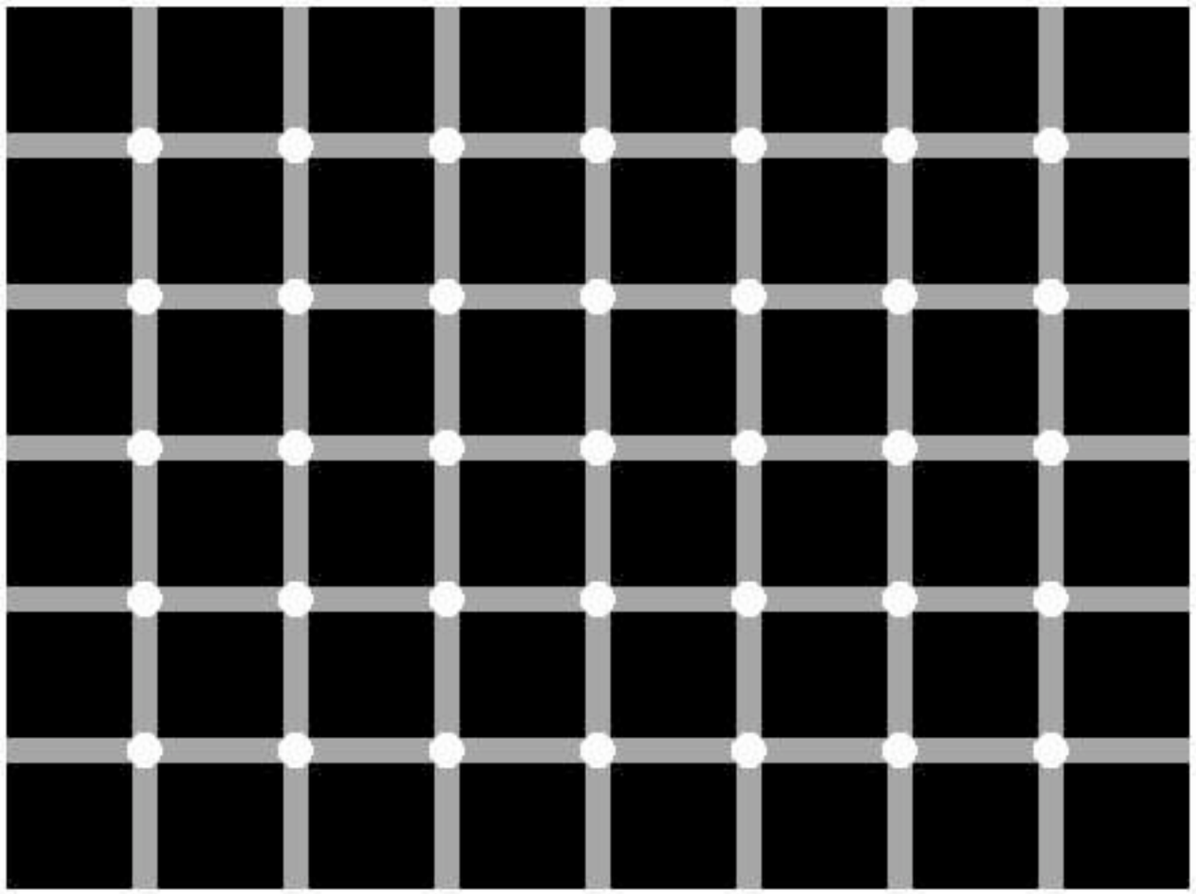
The Eye - Interpreting the signal

- The visual system compensates for:
  - movement
  - changes in luminance.
- Context is used to resolve ambiguity
- Optical illusions sometimes occur due to over compensation

Your brain heavily compensates for effects of your biology

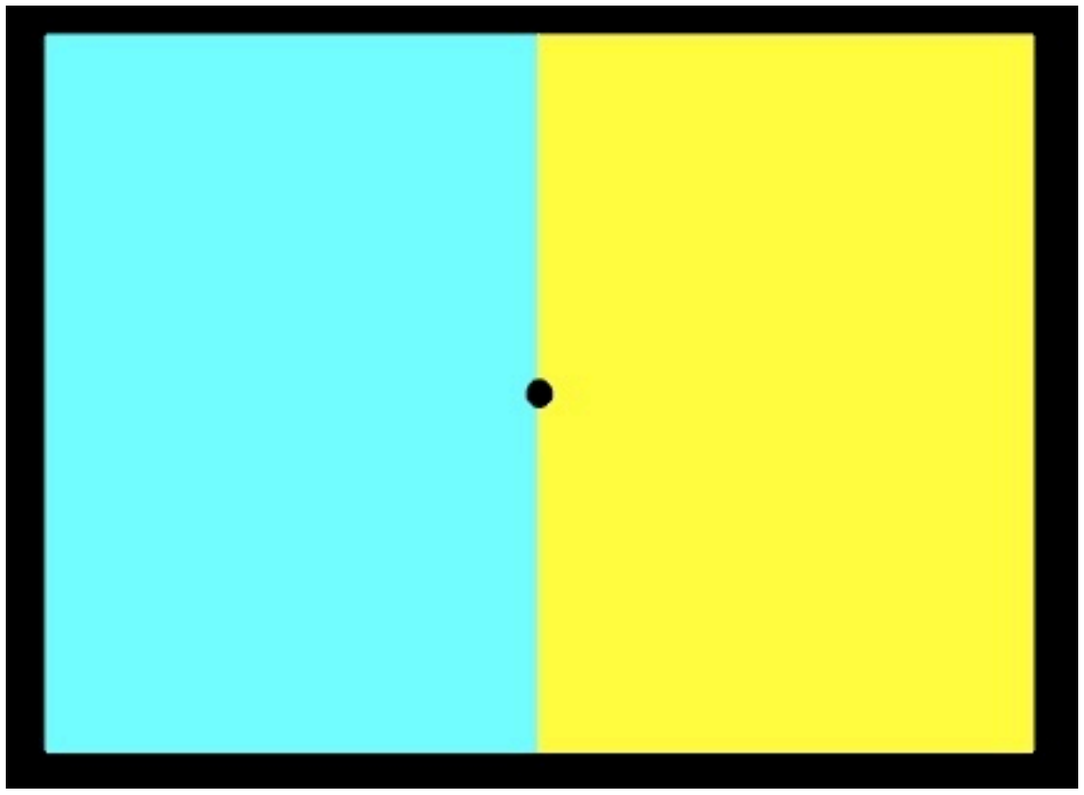
The Eye - Interpreting the signal
Optical Illusions

The Eye - Interpreting the signal
Optical Illusions



The Eye - Interpreting the signal
Optical Illusions - Chromatic Adaptation

The Eye - Interpreting the signal
Optical Illusions - Chromatic Adaptation



The Eye - Interpreting the signal
Optical Illusions - Chromatic Adaptation

Your brain heavily compensates for effects of your biology

Rubin, N., Nakayama, K. and Shapley, R. (2002), The role of insight in perceptual learning: evidence from illusory contour perception. In: Perceptual Learning, Fahle, M. and Poggio,

- There are similar effects for other input and output
  - Hearing
    - Pitch, Loudness, Timbre
    - Frequency and Processing
      - MP3s
  - Touch
    - Heat, Pain, Pressure
    - Adaptation
  - Movement
    - Reaction Time, Fidelity

Phantom Words

Rubin, N., Nakayama, K. and Shapley, R. (2002), The role of insight in perceptual learning: evidence from illusory contour perception. In: Perceptual Learning, Fahle, M. and Poggio,

"People appear to hear words and phrases that reflect what is on their minds – rather as in a Rorschach test, though it's my impression that the present effect is stronger. I can bet who is likely to be on a diet, as they report words like 'I'm hungry'. 'diet coke' or 'feel fat'. And students who are stressed tend to report words that are related to stress – if I play these sounds close to exam time, some students may well hear phrases like 'I'm tired', 'no brain', or 'no time'. Interestingly, female students often report the word 'love', while male students are more likely to report sexually explicit words and phrases."

-Diana Deutsch

http://www.psychologytoday.com/blog/illusions-and-curiosities/200906/phantom-words

Sine Wave Speech

http://www.mrc-cbu.cam.ac.uk/people/matt.davis/sine-wave-speech/

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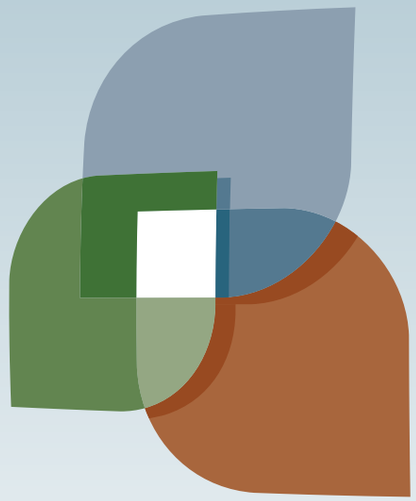

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Monday, September 27, 2010