

## Psychology 101

Action – Perception – Cognition

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### Action-perception coupling

« Classical » psychology (cognitivist approach)  
Perception  $\Leftrightarrow$  Cognition  $\Leftrightarrow$  Action

Coupling between action and perception

Action for perception

Move head to perceive depth

Manipulate object to perceive its shape

Perception for action

Adjust arm and hand motion to grasp an object

### Ecological theory of perception - J.J. Gibson

Co-evolution between the animal  
and its environment

Direct perception

« Information pick up »

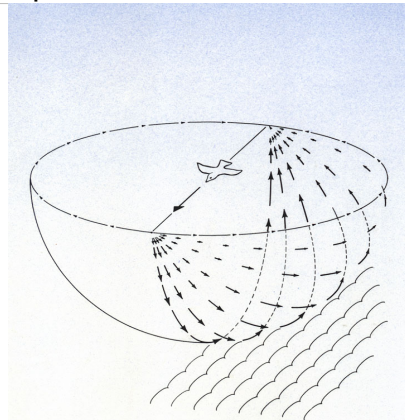
Visual perception

Perception of optical flow

Extract invariants

Example :

direction of motion =  
fixed point in the optical flow



### Visual channel: Sight

Visual field is about 180°

Focus of attention

Visual acuity: 0.04mm at 50cm

Peripheral perception

Less sensitive to colors,  
More sensitive to motion

Perception of color, motion, depth

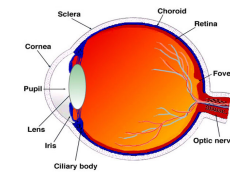
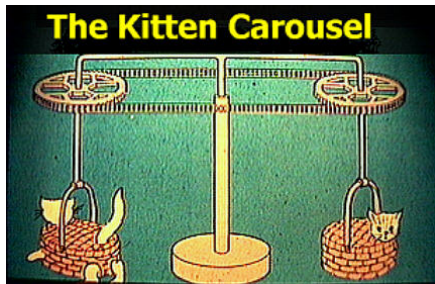


Fig. 4. Vertical sagittal section of the adult human eye.

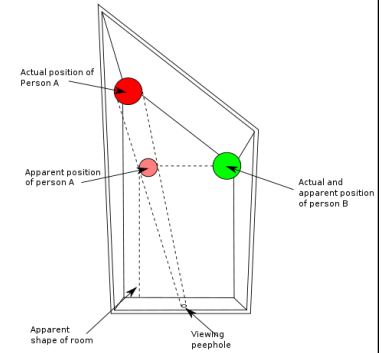
## Held & Hein (1963) Kitten Carousel

The role of experience in perceptual-motor development



Self-produced movement and concurrent visual feedback are essential for the development of visually guided behavior

## Depth illusion: Ames room



## The Monkey Business Illusion

Watch this video:

[https://www.youtube.com/watch?v=IGQmdoK\\_ZfY](https://www.youtube.com/watch?v=IGQmdoK_ZfY)



## Change blindness

We do not always notice changes in visual stimuli, even when the change is dramatic

Attention is selective: notifications can go unnoticed



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## Auditory channel: Hearing

Very large sensitivity range

Hearing without listening  
« Cocktail-party » effect

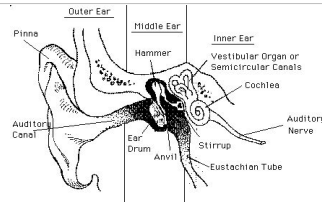
Masking effects

Distance between sources

Distance between peak frequencies

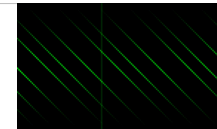
Localizing a source

Correlation with visual localisation

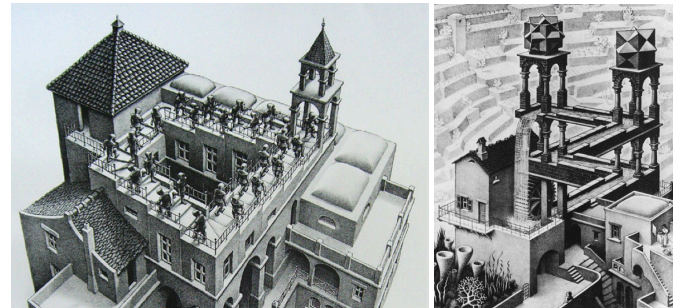


## Auditory illusion: Shepard-Risset tones

A sound that (seems to) always go down

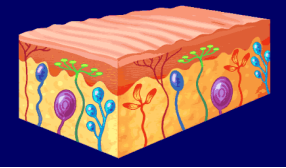




Audio equivalent to Escher's stairs or fountain



### Haptic channel: TPK




Touch: 6 types of receptors  
Heat, Cold, Pain  
Pressure, Vibration, Texture

### Haptic channel: TPK

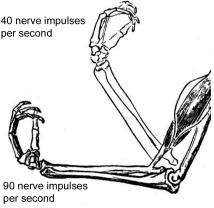

Touch

Proprioception  
Configuration of one's body in space,  
used to perceive, e.g., the shape of an object

### Haptic channel: TPK

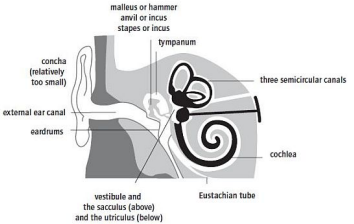

Touch  
Proprioception  
Kinesthesia  
Tension of one's muscles,  
used to assess the weight or resistance of an object

### Vestibular sense

Sense of balance: relative orientation in space  
Located in the inner ear

Multimodal perception: visual, kinesthetic, vestibular  
Discrepancies cause

### Motor system

Control body movements  
 Locomotion  
 Physical action  
 Gesturing, hand movements  
 Voice

### Motor system

Control body movements  
 Kinematic chain: articulated arrangement of the limbs  
 to combine large amplitude and precise movements

### Motor system

Control body movements  
 Kinematic chain

Bi-manual control (Yves Guiard)  
 Non dominant hand: sets the context  
 Dominant hand: acts within that context

### Motor system

Control body movements  
 Kinematic chain

Bi-manual control (Yves Guiard)  
 Application to a drawing interface: Toolglasses

Toolglasses and Magic Lenses,  
 Bier et al., SIGGRAPH 1993

## Motor system

Controlling a gesture: target pointing

Fitts' law

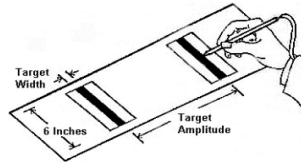
$$MT = a + b \log(1 + D/W)$$

MT, movement time

D, distance to target

W, width of target

a, b, empirically determined constants



Scale invariant:

pointing a target twice as large at a distance twice as long takes the same time

## Functions of the gestural channel (Claude Cadoz)

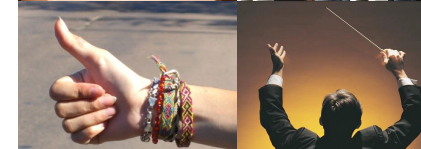
Epistemic:  
acquire information



Ergotic:  
transform through  
physical action



Semiotic:  
emit information



## Memory and learning

Short-term memory

Working memory

Low capacity ( $7 \pm 2$ )

Short-lived (10-30s)

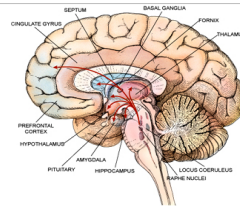
Long-term memory

Infinite capacity

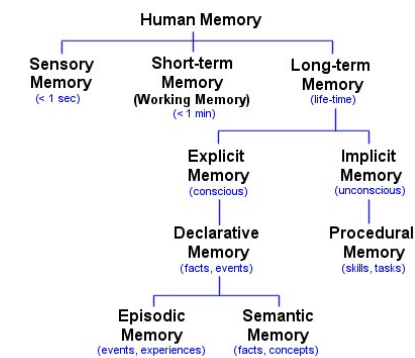
Unlimited duration

Associative access

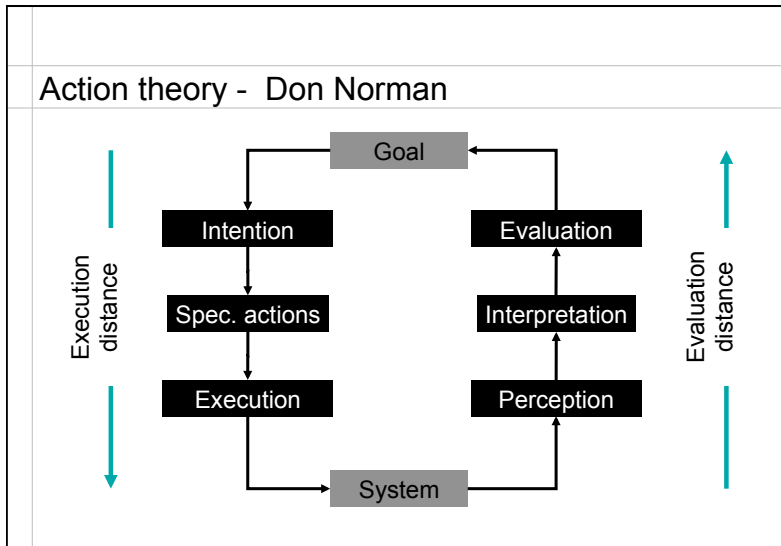
Repetition reinforces memory and learning



## Different types of memory



<http://www.human-memory.net/types.html>



### Plans and Situated Action (Suchman)

Humans do not always act according to a pre-made plan

Action is *situated*  
The plan is revised / adapted according to the local situation

Example: empty printer

- add paper
- print to another printer
- give up printing

