FILOZOFICKÁ FAKULTA
Univerzita Karlova

Department of psychology

Computers and Cognitive Sciences I
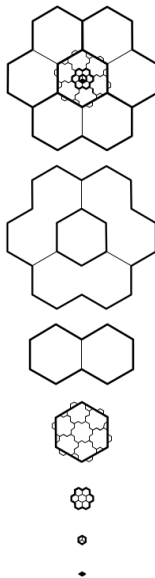Class 1 - Introduction

Jiří Lukavský

Class

Instructor

- Jiří Lukavský
- jiri.lukavsky@ff.cuni.cz
- www.lukavsky.info
- office hours Tue 9:30 - 10:30 (Celetná 20, room 334)

Schedule

- 4 meetings
  - 23.10., 20.11., 27.11., 4.12.
- Wednesdays 12:20 - 15:30, room S9

Mission

- Cognitive sciences
  - origins & methods
- Sensation and perception
- Attention
- Memory
- Mental representation
- Decision making

Depressive Phenomena at Various Layers of Nested Complexity

Social Level
Loss of important relationships
Loss of social status

Behavioral Level
Decrease in pleasurable activities
Social withdrawal

Mental Level
Cascade of negative thoughts (rumination)
Sadness; Decreased motivation

Neurological/Physiological Level
Circuits regulating mood, sleep, and appetite
Left prefrontal cortex, amygdala, hippocampus
hypothalamus (governs stress response)

Neurochemical Level
Reduced serotonin activity throughout the brain
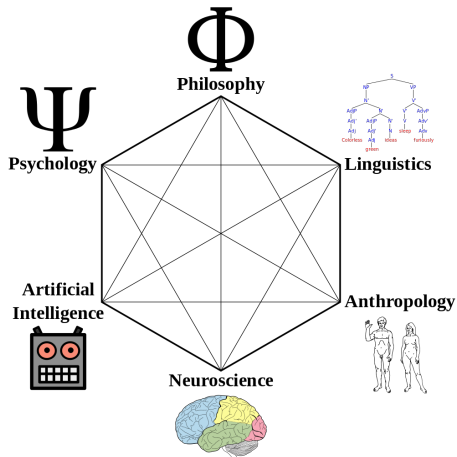*Reduced BDNF; increased CRF, cortisol*

Molecular-Genetic Level
'Short' copies of the serotonin transporter gene

Cognitive sciences - origins & methods

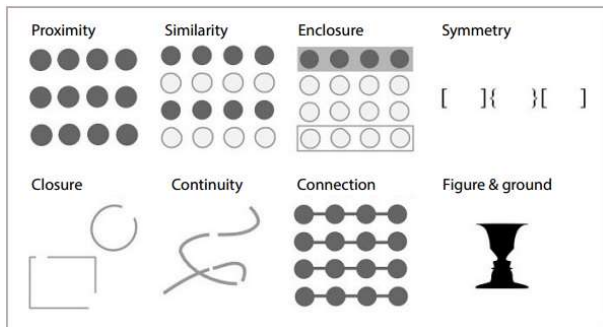# Science or Sciences

History

- old question
  - thinking, memory, intelligence
- philosophy
  - Greece - Plato, Aristoteles
  - rationalism - Descartes, Leibnitz
  - empiricism - Locke, Hume
- medicine
  - e.g., Purkyně

Experimental psychology

- 1879 Wilhelm Wundt
- Leipzig laboratory
- cognitive research (memory, perception)

- introspection
- associationism
- psychophysics

Gestalt psychology

- response to associationism
- higher functions - perception, problem solving

American tradition

- William James (1842-1910)
  - Principles of Psychology
- Behaviorism

Behaviorism

"Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods….."

- focus on what can be observed, S-R, black-box
- animal research

- J.B.Watson
  - "The Behaviorist Manifesto"
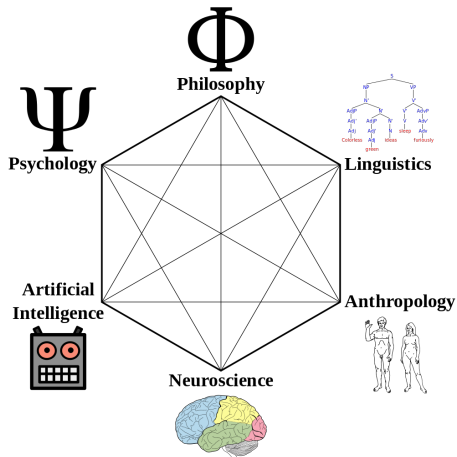 - 12 infants
- B.F.Skinner

Birth of cognitive science

- 1956 – George Miller – mental capacity 7 ± 2, chunks
- AI research
  - John McCarthy, Marvin Minsky, Allen Newell, Herbert Simon
- language research
  - Noam Chomsky - language is not limited to "verbal behavior"
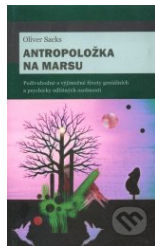
Methods

- introspection
- experiment
- theories and models
- neuroscience
  - neuroimaging
  - single-cell recording
  - lesions, case-studies
- ethnography

Sciences - different approaches, examples

Neurosciences

- neuroimaging
- case-studies (Oliver Sachs)

Philosophy

Mary is a brilliant scientist who is, for whatever reason, forced to investigate the world from a black and white room via a black and white television monitor. She specializes in the neurophysiology of vision and acquires, let us suppose, all the physical information there is to obtain about what goes on when we see ripe tomatoes, or the sky, and use terms like 'red', 'blue', and so on. She discovers, for example, just which wavelength combinations from the sky stimulate the retina, and exactly how this produces via the central nervous system the contraction of the vocal cords and expulsion of air from the lungs that results in the uttering of the sentence 'The sky is blue'. [...] What will happen when Mary is released from her black and white room or is given a color television monitor? Will she learn anything or not?

Linguistics

- Sapir-Whorf hypothesis
- Winawer, J., Witthoft, N., Frank, M. C., Wu, L., Wade, A. R., & Boroditsky, L. (2007). Russian blues reveal effects of language on color discrimination. *Proceedings of the National Academy of Sciences*, 104(19), 7780-7785.
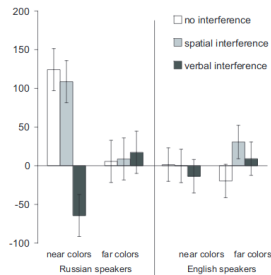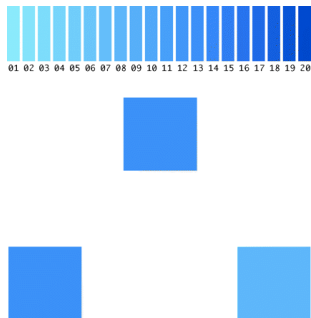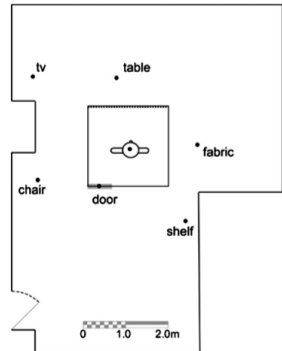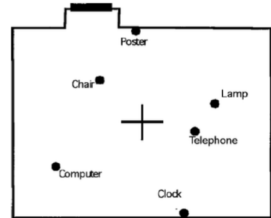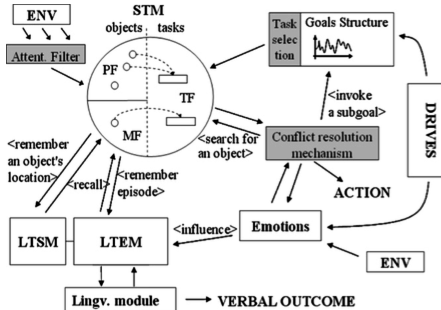
Winaver et al. (2007)

Fig. 3. Category advantage is plotted for Russian speakers (*Left*) and English speakers (*Right*) as a function of comparison distance (near color vs. far color) and interference condition (none, spatial, and verbal). Category advantage is calculated as the difference between the average reaction time for within-category trials and that for cross-category trials (msec). Error bars represent one SE of the estimate of the three-way interaction among category, interference condition, and color distance.
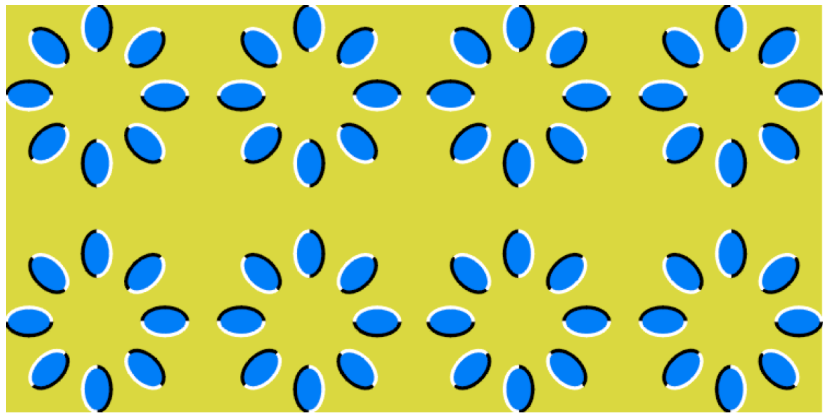
Computer science, simulations

- Brom et al. (2012)

Anthropology

- cross-culture research
- reading and illiteracy

Psychology

- "reverse engineering"
- manipulate inputs, measure output

Illusions

Generates hypotheses for anatomy/physiology

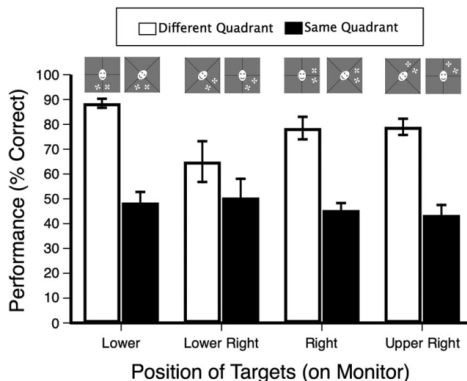- Multiple Object Tracking - https://youtu.be/IAQM4QJRYV8

Fig. 6. Quadrantic deficits and reference frames. Tracking performance for four locations on the monitor tested with two head orientations (upright, rotated clockwise 45°). In all four locations, tracking performance was better when the targets were located in separate quadrants (open bars) than when targets were located in the same quadrant (filled bars).

Sciences - different approaches