PHIL/PSYCH 256 INTRODUCTION TO COGNITIVE SCIENCE

Week 9: Brains

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How to Investigate Brains

Dissection 

Single cell recording

EEG: Electroencephalography

Psychological experiments on people with brain damage, e.g. HM, hemineglect

Brain scanning

Transcranial magnetic stimulation

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Types of Brain Scans

- CAT: Computerized axial tomography.
- PET: Positron emission tomography.
- fMRI: Functional magnetic resonance imaging
- MEG: Magnetoencephalography

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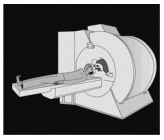
fMRI

- The magnet realigns atoms and protons.
- Machine sends a radio pulse that causes atoms to release energy.
- A computer detects energy release and produces an image.
- Functional MRI measures brain function by measuring changes in blood volume.



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Neurocomputational Models

- Theoretical neuroscience: emerging combination of neuroscience, psychology, and computer modelling.
- More realistic computer models:
  - Spiking neurons.
  - Large networks: 1000s with many connections.
  - Organized into brain areas.

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How Brains Represent

- Neural populations represent inputs by patterns of firing that encode them.
- Pinker: "Brain cells fire in patterns."
- Neural populations represent neural populations by encoding inputs from neural populations.

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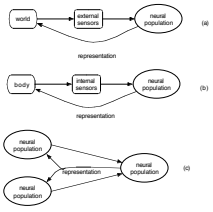
Neural Representation



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Discussion Question

- What are the benefits and limitations of using neuroscience to study the mind?

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How Brains Compute

- Similar to connectionism: neurons linked by excitatory and inhibitory links.
- Molecules matter:
  - Individual cells can perform computations internally.
  - Neuronal signaling via synapses depends on many different kinds of chemical neurotransmitters. Drugs.
  - Long distance signaling takes place by hormones.
  - Brain chemicals have temporal as well as topographic effects: coordination and synchrony.

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One-minute Essay

- What is an fMRI scan?

1. Please write your name clearly in the top right corner.
2. In a LARGE BLOCK letter, place the first letter of your last name at the top left.

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Key Points

- Neuroscience brings new methods, e.g. brain scanning to the investigation of mind.
- Experimental results can be explained using more neurally realistic computer models.

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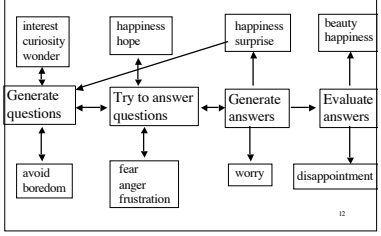
Emotions in Scientific Thinking



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Theories of Emotion

- Cognitive appraisal
  - Emotions are judgments about situations.
- Somatic perception
  - Emotions are perceptions of bodily states.
- Unified (EMOCON)
  - Emotions are brain states that simultaneously represent cognitive appraisal and somatic perception.
- Emotions also have molecular and social aspects, e.g. love.

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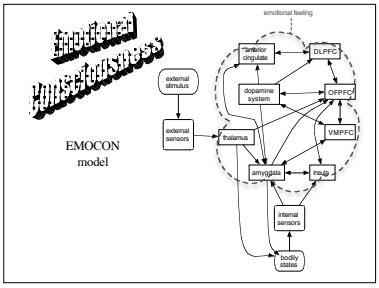

EMOCON model

Discussion Question

- How important are emotions to human thinking?
- Can neuroscience explain emotions?

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Oatley: Cognitive functions of Emotions

- Happiness: subgoals being achieved.
- Sadness: failure of plan or loss of goal.
- Fear: self-preservation goal threatened.
- Anger: Active plan frustrated.
- Disgust: Gustatory goal violated.

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Key points

- Emotions have both cognitive and somatic (physiological) aspects.
- Theoretical neuroscience is beginning to offer explanations of how brains produce emotions.

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One-minute Essay

- What is the difference between cognitive and physiological (somatic) theories of emotions?

1. Please write your name clearly in the top right corner.
2. In a LARGE BLOCK letter, place the first letter of your last name at the top left.

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