Cognitive Science
Overview
- Cognitive Science Defined
- The Brain
- Assumptions of Cognitive Science
- Cognitive Information Processing
- Cognitive Science and Instructional Design

Definition
As the science of the mind, cognitive science is concerned with human cognition, i.e., mental phenomena such as perceiving, thinking, remembering, language comprehension, learning, and emotion.
Cognitive Science emerged at the intersection of:

- Cognitive psychology
- Linguistics
- Philosophy
- Computer science
- Artificial intelligence
- Neuroscience
- Anthropology

### Introduction

#### Learning Process

Information (visual, verbal, ...)

- Sensory and Working Memory
- Long-term Memory

- Cognitive Theories
- Learning Theories
- Learner Characteristics

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**Cognitive Science**

**The Human Brain**

- Macromolecular level: Anatomy
- Microscopic Level: Neurons and Glia
- Cellular Level: Brain cells

**Brain Anatomy**

- **Frontal Lobe**: motor activity, including speech, integrates personality with emotion and transforms thought into action
- **Parietal lobe**: sensory information from opposite site of body, integration of vision and sound
- **Temporal lobe**: hearing, involved in learning, memory, emotion
- **Occipital lobe**: visual perception
- **Cerebellum**: Balance, posture, movement
Cognitive Science

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Cognitive Science

Neuron: cellular unit of the central and peripheral nervous systems
- Glia: "glue" binds neurons together
- Neurons communicate by means of neurotransmitters acting across synapses
- 50-100 billion neurons in brain
- 1 Million billion connections between neurons
- 2.5 Million neurons generated per minute during prenatal life
Cognitive Science

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Brain cells

- Based on genetic code in DNA
- Approx. three Billion DNA bases
- Difference to chimpanzees: 1%
- Specialization of brain cell: Information transfer
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Cognitive Science Assumptions

Scientific assumption

- Mind as natural phenomenon
- Governed by physical processes
- Observable

Cognition as a form of computation, Mind is information processing system

- Formal information processes—can be studied as patterns and the manipulation of patterns (independent of particular instance)
- Mental representations—Separation of symbols from their meaning
- Separating formal processes from their physical basis
- Cognitive Science is basic science

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Discussion

• What are the limits of the Computer Metaphor for human information processing?

• How can information be separated from its meaning and then processed? Can you provide examples for this method?

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Cognitive Information Processing
Discussion

- Cognitive information processing:
  - Can information processing be separated
    - from the biological or neurological,
    - from the sociological or cultural?
Cognitive Science & ID

Connection between Cognitive Science and ID

- Instructional Design and Cognitive Science are systems theories
- Cognitive Science dominant theoretical influence on instructional design practice
- Analysis
- Design
- Development
- Delivery/Implementation
- Evaluation