

F2

Cognitive Systems

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PSI 3560 – COGNITIVE SYSTEMS

class F2

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FOUNDATIONAL CONCEPTS OF COGNITIVE SCIENCE

Perception, cognition, learning, consciousness, attention, emotions,
language, decision making, action planning, etc....

Session F2

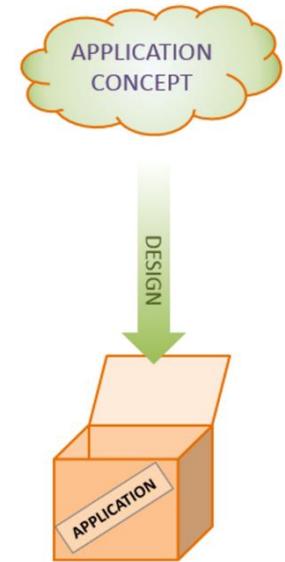
Summary

– Second session (9:20 – 11:00)

- What is cognition
 - Mind & behavior
- Modelling mind
- Modelling behavior
- The bounds of cognition
 - Philosophical schools of thinking

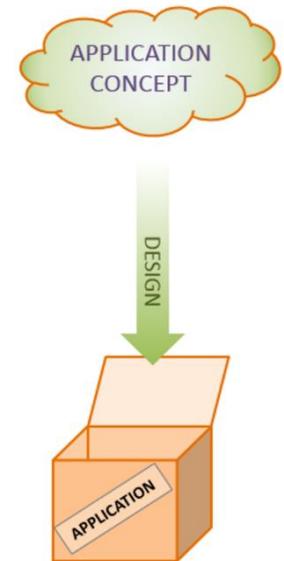
What is cognition

- Working definitions
 - Cognitive process
 - Cognitive system
 - Cognition
 - Cognitive agent
 - Cognitive tool



What is cognition

- Working definitions
 - Cognitive process
 - A process that **builds knowledge** from given information (**data**)
 - Cognitive system
 - A system of cognitive processes
 - Cognition
 - A cognitive system that **uses knowledge** to **improve the autonomy** of an **agent**
 - Cognitive agent
 - An agent that has cognition
 - Cognitive tool
 - A cognitive system that can be used by an agent
- Concept of cognition → natural cognition



What is cognition

- Concept of cognition
 - Commonsense concept
 - Most people take cognition as **thinking**
 - Both intellectually and everyday thinking
 - Some include other items:
 - Perceiving the world, experiencing pain, feeling emotions, having moods, reasoning, making decisions to act, being conscious...
 - So, what is thinking ?

What is cognition

- Concept of cognition (commonsense)
 - Thinking → succession of mental states
 - **Mental state** → an expression of a consideration about something
 - » **Consideration** → a belief, desire, intention, expectation, attitude...
 - **Propositional attitude**
 - » believe that p
 - » desire that p
 - » intend that p
 - » expect that p
 - **Thinking** is the mental process that expresses a propositional attitude
 - **Mental process** → something that happens in the mind
 - » in the brain...

What is cognition

- Concept of cognition (commonsense)
 - Propositional attitude
 - Is a relation to a proposition
 - Is a declarative sentence → has meaning, has content
 - The meaning is derived from a composition of elementary meanings
 - » Compositionality → Syntactic prescriptions
 - Production rules → Generative grammar
 - Alphabet + Vocabulary + Grammar → Language
 - Language → *the language of thought*
- Model of mind → language of thought

What is cognition

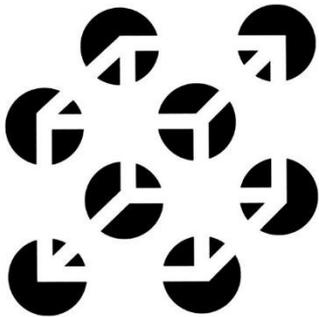
- Concept of cognition (commonsense)
 - Reviewing our previous points:
 - Most people take cognition as **thinking**
 - Language of thought (L.O.T.)
 - Some include other items:
 - Perceiving the world, experiencing pain, feeling emotions, having moods, reasoning, making decisions to act, being conscious...
 - Can these items be included in the L.O.T. ?
 - Requirements: alphabet, vocabulary, grammar...
 - Provided by a **representational** capability

What is cognition

- Concept of cognition (commonsense)

- Representations

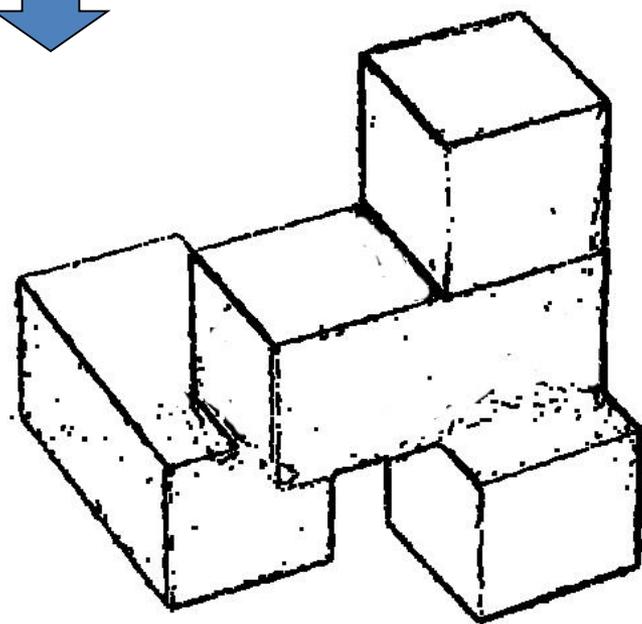
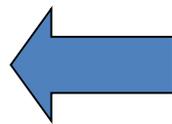
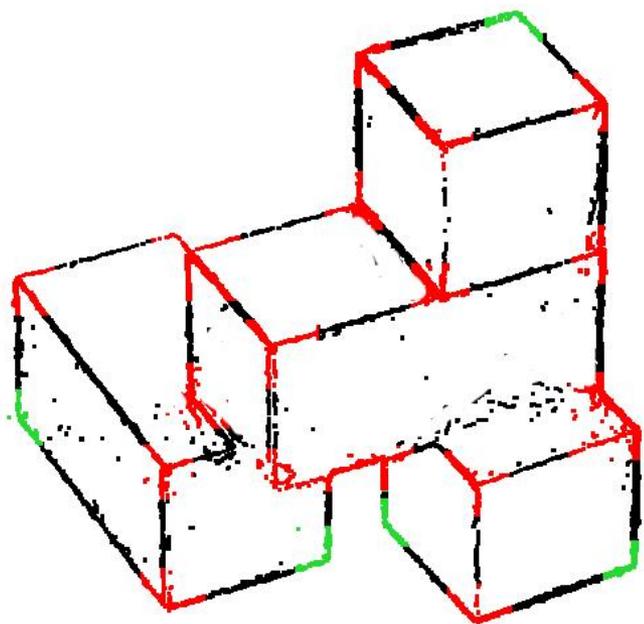
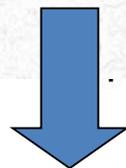
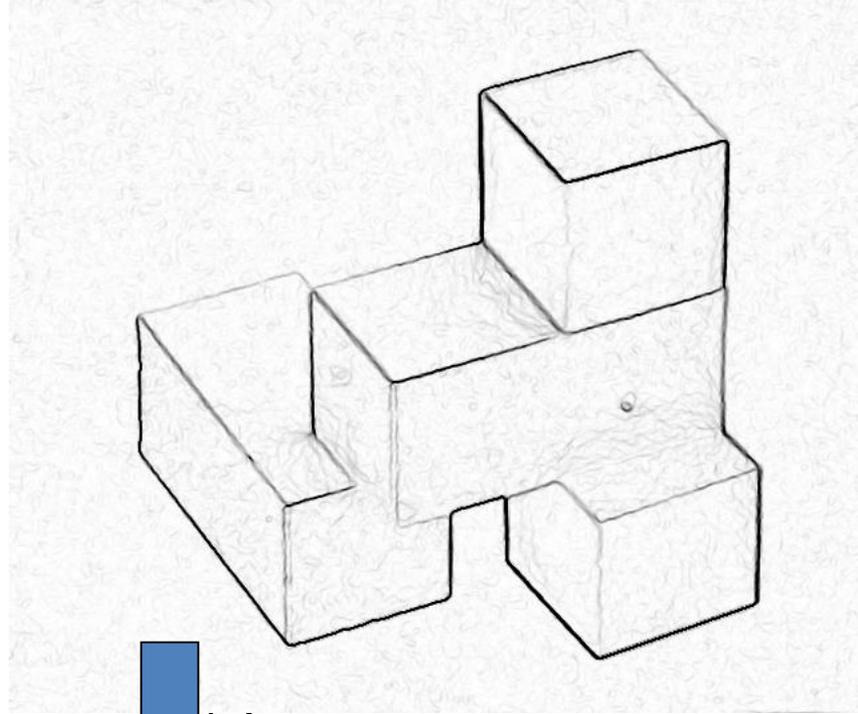
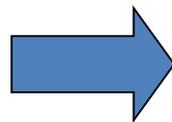
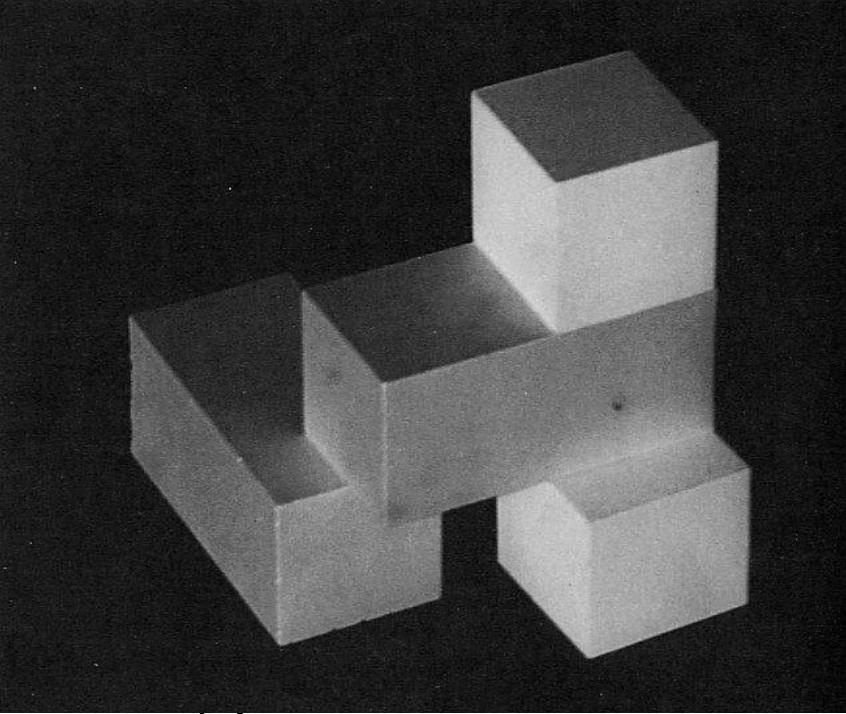
- Sensation → provides a transduction → inner signals
 - *Sense data*
- Perception → maps the sense data to representations
 - *Perceptual representations are compositional*

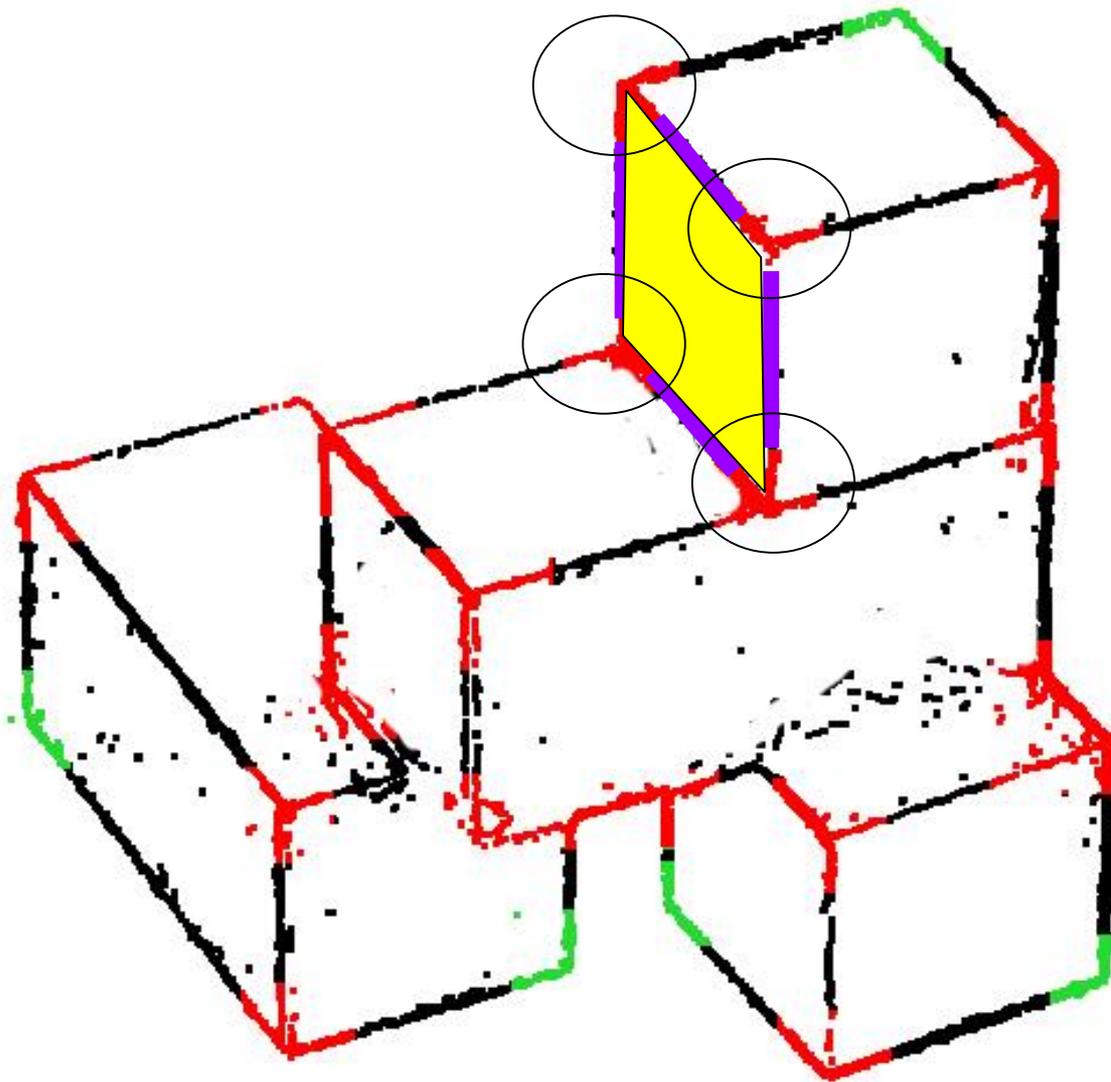


- » Percepts → elementary perceptions
- » Percepts can be composed to form complex perceptual representations
- » Rules for composition → *Gestalt* rules
 - Principles of well-formed perceptual groupings

- So, we have an alphabet, a vocabulary and a grammar

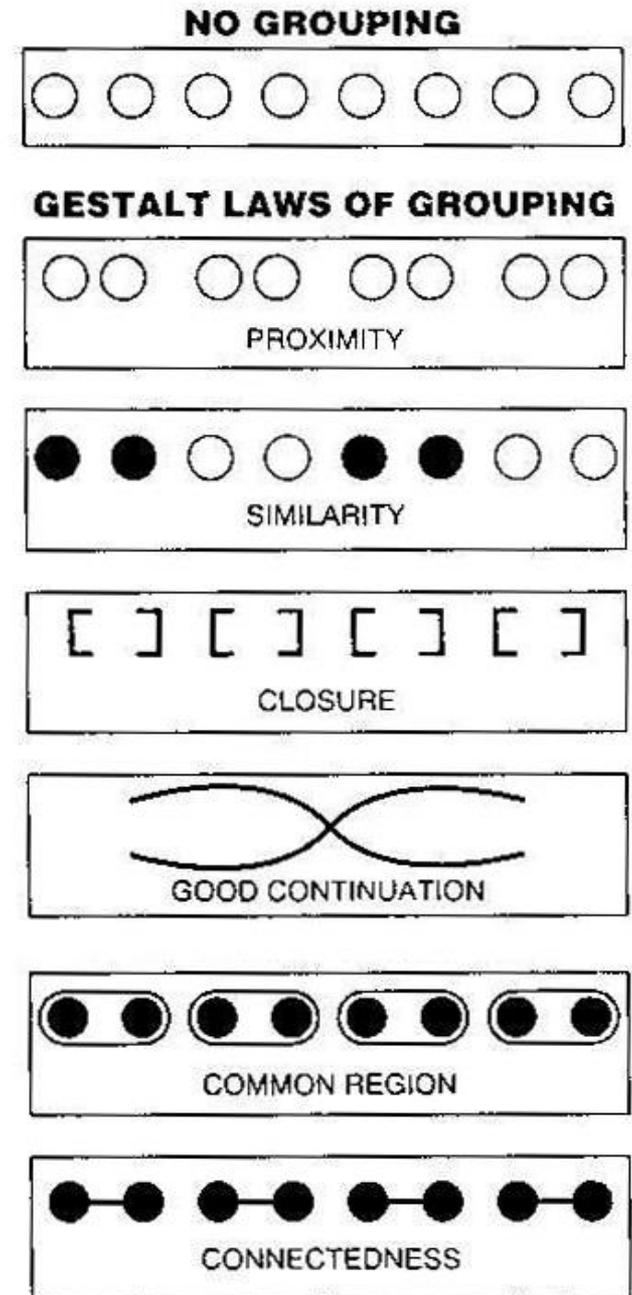
- Perception is a candidate for the L.O.T.





Gestalt

- Grouping rules
 - Proximity
 - Similarity
 - Closure
 - Smooth continuity
 - Common region
 - Connectedness



What is cognition

- Concept of cognition (commonsense)
 - Representations
 - Sensation → provides a transduction → inner signals
 - *Sense data*
 - Perception → maps the sense data to representations
 - Action → takes perceptual representations and maps them to behaviors
 - Perception-action coupling
 - Is action compositional ?
 - Elementary actions compose complex actions

What is cognition

- Concept of cognition (commonsense)
 - Is action compositional ?
 - Elementary actions compose complex actions
 - Rules for composition → motor program
 - Actions are contextual
 - Motor context
 - So, actions are candidates to the L.O.T.
- History of actions → behavior

Modelling behavior

- Behavior components
 - Agent → produces actions
 - Action → observed response of the agent to a stimulus
 - Stimulus
 - Response
- Modelling behavior
 - Variables → coordinates for describing stimuli and responses
 - Determination of correlations between variables
 - Input / Output description

Kinds of agent's behaviors

- Reactive agent
 - Built on reactions
- Perceptive agent
 - Built on predictions
 - Estimates of successful responses
- Cognitive agent
 - Built on simulations and plans
 - Construction of action strategies
 - Depends of **knowledge**

The bounds of cognition

- Philosophical schools of thinking
 - The issue of the site of cognition
 - Bounded cognition
 - The brain is the site of cognition
 - » All cognitive processes take place in the brain
 - Embodied cognition
 - The body affects cognition in the sense that
 - » Cognitive processes can take place in the body parts
 - Extended cognition
 - Cognitive processes can be extended to tools and artifacts
 - Embedded cognition
 - Cognitive processes can be extended to the surrounding environment
 - Distributed cognition
 - Cognitive processes can be extended over a system of agents

Coffee break

10 minutes