COGSCI 300

Week 3: Imagery & Google Cars

"They shouldn't allow humans to drive!"

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Brain Mechanisms

1. Sensation: stimulation of bodily receptors (external and internal) to produce nerve signals
2. Perception: brain's interpretation of sensory signals
3. Imagery: stored perceptions are retrieved and modified

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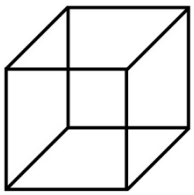
Perceptual Inference (parallel constraints)



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Imagery Operations

1. Intensify: make stronger, e.g. louder sound
2. Focus: concentrate, e.g. zoom in
3. Combination: put together, e.g. sweet + salty
4. Juxtaposition: join in space or time, e.g. jump shot
5. Decomposition: take apart, e.g. song

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Imagery Mechanisms

1. Intensify: increase firing in neural groups
2. Focus: competition among semantic pointers
3. Combination: binding
4. Juxtaposition: binding with spatial/ temporal relations
5. Decomposition: decompress (unbind) semantic pointers

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Discussion Question

How well do semantic pointers explain the full range of human imagery capabilities?

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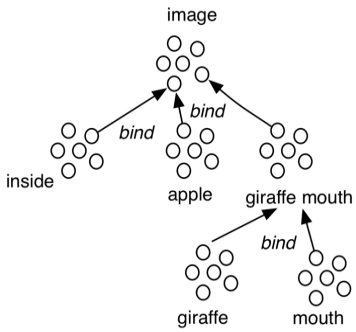
Juxtaposition



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Questions about AI Systems

1. What does it do?
2. How does it do it: representations + procedures?
3. What are its strengths?
4. What are its limitations?
5. How does it compare to humans and animals?

What Google cars do

They drive effectively around California and Nevada streets with no accidents and rare human interventions!

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How Does it Work?

Representations:

- Variables representing sensory inputs (camera, laser, GPS)
- Probabilities (number between 0 and 1)
- Rules

Procedures:

- Update probabilities for sensory variables
- Make inferences about environment
- Make inferences about actions, e.g. steering
- Learning to make inferences better

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Discussion Question

How do Google cars compare to human drivers with respect to strengths and weaknesses of driving capability?

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Google Car Strengths

1. Drives effectively with little intervention
2. Integrates multiple sensors tied to the world (unlike Watson, which lacks world-based semantics)
3. Links sensing with action
4. Learns to improve performance
5. Problem solving
6. Learning

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Google Car Limitations

1. Semantics: has mathematical symbols that relate to the world, but not linguistic structures
2. Requires heavy preprocessing of environments, not just maps
3. Incapable of recursive binding, imagery
4. Limited capability for: problem solving, causal reasoning, emotions, consciousness, creativity.

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Google Cars Vs. Humans

1. Advantages of Google cars: laser, GPS; no distractions, fatigue, emotions
2. Humans may be better at dealing with novel situations, e.g. road closures
3. Humans are motivated for safety
4. Animals: more senses (smell, sonar, electromagnetic), reinforcement learning

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