Representations

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The Oranges Puzzle

**GOAL** Order the oranges by size: largest-to-smallest, left-to-right

**RULE 1** Only one orange can be transferred at a time

**RULE 2** An orange can only be transferred to a plate on which it will be the largest

**RULE 3** Only the largest orange on a plate can be transferred to another plate
The Donuts Puzzle

**GOAL** Order the donuts by size: largest-to-smallest, left-to-right

**RULE 1** Only one donut can be transferred at a time

**RULE 2** A donut can only be transferred to a peg on which it will be the largest

**RULE 3** Only the largest donut on a peg can be transferred to another peg
The Coffee Cups Puzzle

**GOAL** Order the coffee cups by size: largest-to-smallest, left-to-right

**RULE 1** Only one cup can be transferred at a time

**RULE 2** A cup can only be transferred to a plate on which it will be the largest

**RULE 3** Only the largest cup on a plate can be transferred to another plate
What Did We Learn?

**GOAL** Order the coffee cups by size: largest-to-smallest, left-to-right

**RULE 1** Only one cup can be transferred at a time

**RULE 2** A cup can only be transferred to a plate on which it will be the largest

**RULE 3** Only the largest cup on a plate can be transferred to another plate
Learning Through Doing
Let’s play a card game!

- Two players
- One the table, there are nine cards, numbered 1 to 9
- Players draw alternately
- The objective is to make a “book” – a set of 3 that adds to 9
How ‘bout Tic-Tac-Toe?
These Games are Isomorphs

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  4  9  2
  3  5  7
  8  1  6
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Problem Solving as Representation

“Solving a problem simply means representing it so as to make the solution transparent”

—Herbert Simon, The Sciences of the Artificial
Epistemic Action
Working Memory
Getting Things Done
A Good Representation...

...shows all of the relevant information, and nothing else. Should enable:

- Comparison
- Exploration
- Problem solving
Invisibility
Csikszentmihalyi Classroom Study
Attention, Stress, and Risk
Smart Cars

Anti-lock Brakes
Traction & Stability Control
Automatic Cruise Control
Lane-keeping systems
Tradeoffs

LOW RISK

Divergent Thought

Exploration/Simulation

Safety/Playfulness

Freedom to Act

HIGH RISK

Convergent Thought

Concentration/Commitment

Exhilaration

Forced to Act
Commitment
Ideally, we want a one-to-one mapping between concepts and gestures. User interfaces should be designed with a clear objective of the mental model we are trying to establish. Phrasing can reinforce the chunks or structure of the model.
Announcements

- Assignments are due at 11am
- cs547 tomorrow: Ed Chi, PARC - Augmented Social Cognition
Further Reading

- Don Norman, Things that Make Us Smart
- Ed Hutchins, Cognition in the Wild
- Herbert Simon, Sciences of the Artificial
- Ed Hutchins, How a Cockpit Remembers its Speed
- Herbert Simon, Why a Diagram is (Sometimes) Worth 1000 words