The Power of Representation

Representation is a relation among...
1. A represented world
2. A representing structure
3. An interpretive process that associates the representing thing to the represented thing
   • The representing thing is “seen as” the represented thing
   • What information is lost?
   • What inferences are afforded by the representation?

Representing Ordinal Relations
(natural mappings from concept of level to density of fill)

Cholera Outbreak in London 1854
Sayeki's Mental Imagery to fix his Bicycle Turn Signal Interface

Space Shuttle Challenger

Shuttle SRB Blow By History

Go Ahead Memo

Graph Showing O-Ring damage as a function of temperature
Norman’s action cycle

Determine which actions are possible?
Determine the mapping from intention to physical action?
Perform the action?
Determine the function of the device?
Tell if system is in the desired state?
Determine mapping from system state to interpretation?
Tell what state the system is in?

Properties of Interfaces

- Visibility: extent to which information about the system is available to the senses of the operator
- Feedback: a signal from the system output that affects what the system does with the input
- Affordance: a relation between an actor and the world that facilitates or invites certain actions
- Constraint: an aspect of a system that makes some states or actions impossible
- Mapping: systematic relations between two domains
- Representation: a mapping relation between entities and patterns that “stand for” the entities
Intelligent use of Space

• “How we manage the space around us is not an afterthought; it is an integral part of the way we think, plan, and behave, a central element in the way we shape the very world that constrains and guides our behavior.” David Kirsh

Two main Ideas

1 Our physical environment constrains and guides our behavior
2 We may take an active role in arranging spatial aspects of the physical environment in ways that can constrain and guide our behavior. We can make ourselves smarter by constructing good environments for thinking.

Some Intelligent Uses of Space

• Establishment of categories
• Facilitate memory storage
• Facilitate memory retrieval
• Control the sequential ordering of action
• Enable computation via spatial reasoning and manipulation

Establishment of categories

• Sorting tasks. E.g., laundry
• Files and Piles
• Alphabetizing your papers
• Recording grades

Doing the Laundry

Files
File Index

Ad hoc piles

Alphabetizing Papers

Controlling action sequences
- Weekly Planner
- Assembly sequence
- Standing in line

Weekly Planner
Remembering Assembly Sequence

Standing in Line

Order of arrival = order of service

Organizing Space for action

- Stove controls
- Sliderule

Stove Controls

Slide rule

Principles of use of space

- space to support efficient allocation of attention
- in support of monitoring dynamic processes
- categories defined in speed space support decision making
- detection of deviation from target via spatial inferences
Principles of use of space
• stimulus-response compatibility
• left/right confusions and natural mappings in support of action specification
• labels plus mappings for redundant specification

So What does this have to do with technology?
• Suppose you wish to design a virtual space. What principles will you use?
• Suppose you need to design an interface to a task. How will you know what sorts of spatial features will make the task easy to do?

Adjust the temperature of the refrigerator

A conceptual model of refrigerator temperature control

A second conceptual model of refrigerator temperature control
Whose conceptual model?

Quiz 2

1. Define the terms “affordance” and “constraint.”
2. Give an example of an affordance and an example of a constraint that were NOT presented in the lectures or readings.