# How Minds Work
# The Copycat Architecture

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# Copycat Architecture

- Hi-level perception
- Analogy making
- Creative
- Parts—Slipnet, workspace, codelets
- No central executive
- Decisions made by codelets

# Alphabetical Analogies

- `abc —> abd`    `ijk    —> ?`
- `abc —> abd`    `xyz    —> ?`
- `abc —> abd`    `iijjkk —> ?`
- `abc —> abd`    `srqp   —> ?`

# Slipnet

- Directed graph of nodes, representing concepts, and labeled links
- Links represent relations between nodes
- Nodes support activation, links pass it
- Slipnet does not learn
- Nodes don't decay, but activation does
- Slipnet is long-term memory

# Slipnet at Work

- Relevant nodes activated by codelets
- Nodes spread activation to neighbors over links, starting with nearest
- Concepts close to relevant concepts become relevant
- Slipnet settles, activation pattern becomes stable

# Fluid Concepts

- Region of the Slipnet
- Concept node at the core (center)
- Neighboring nodes included stochastically by context dependent similarity
- Fluid concepts vary over time, are emergent, and aren't explicitly represented

# Workspace

- Codelets build perceptual structures using information from the Slipnet

- Information—nodes, links, labels

- Structure represents Copycat's current appraisal of the situation

# Interactive Problem Solving

- Bottom-up workspace influence activates relevant Slipnet nodes

- Spreading activation identifies other relevant nodes

- Top-down Slipnet influence activates relevant codelets who change the workspace

- Eventually, some codelet decides to stop

# Temperature Control

- High temperature = more randomness in choices of codelets & their actions

- Low temperature = more stability

- Temperature inversely measures system's understanding of the situation

- Temperature controlled, parallel terraced scan

- Example run in *Artificial Minds*

# Readings

## Copycat Architecture

- Hofstadter, D. R. The Copycat Project:An Experiment in Nondeterminism and Creative Analogies. AI Memo 755. Artificial Intelligence Laboratory, Mass. Institute of Technology

- Mitchell, M. 1993. *Analogy-Making as Perception*. Cambridge MA: The MIT Press

- Franklin, S. 1995. *Artificial Minds*. Cambridge MA: MIT Press

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