



How Minds Work

The IDA Model of Cognition

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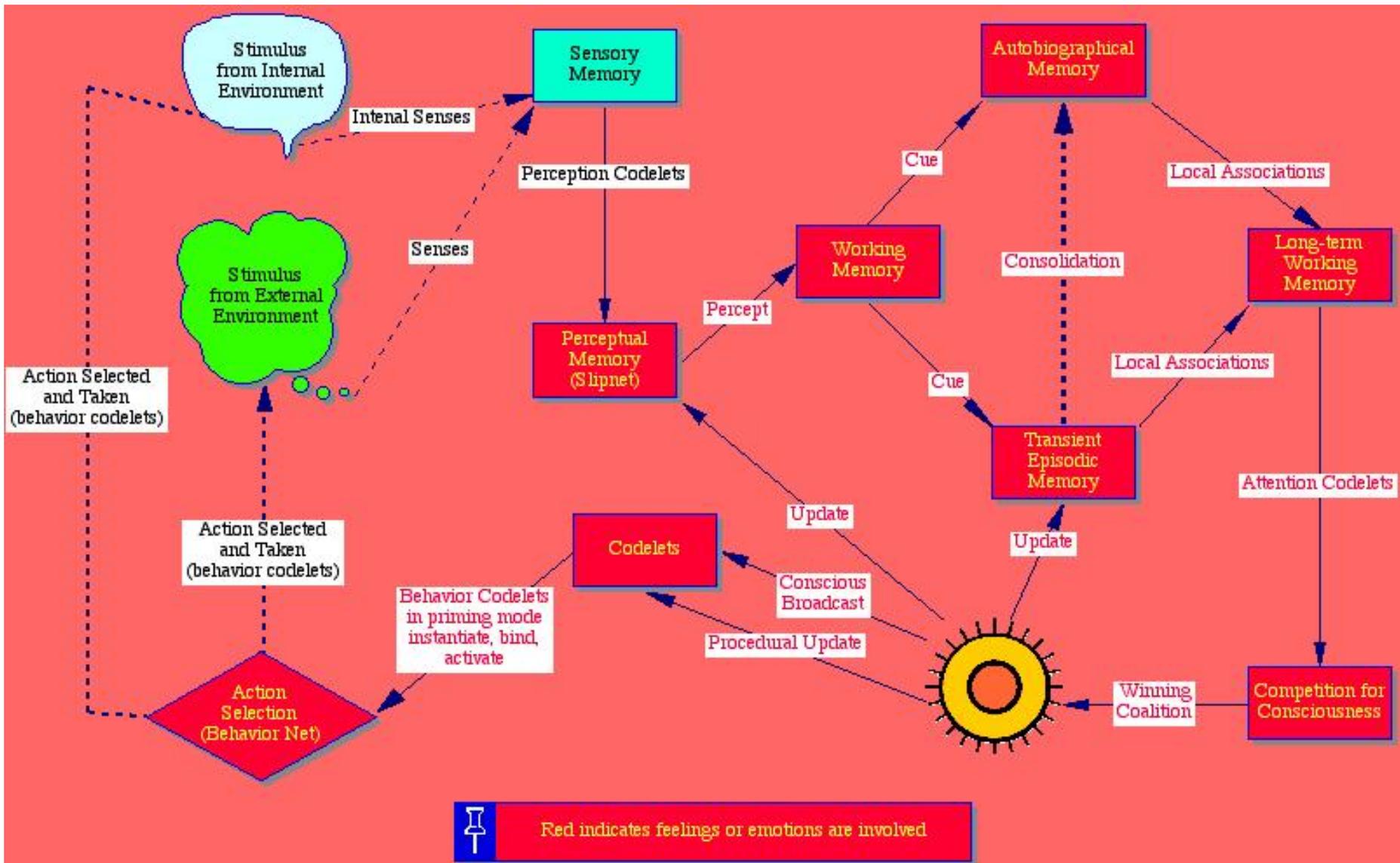
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Cognitive Processes

- Are always cyclic—executing through a continuing sequence of cognitive cycles
- May complete during a single cycle—bottom up
- May require a number of cycles to complete—multicyclic—top down



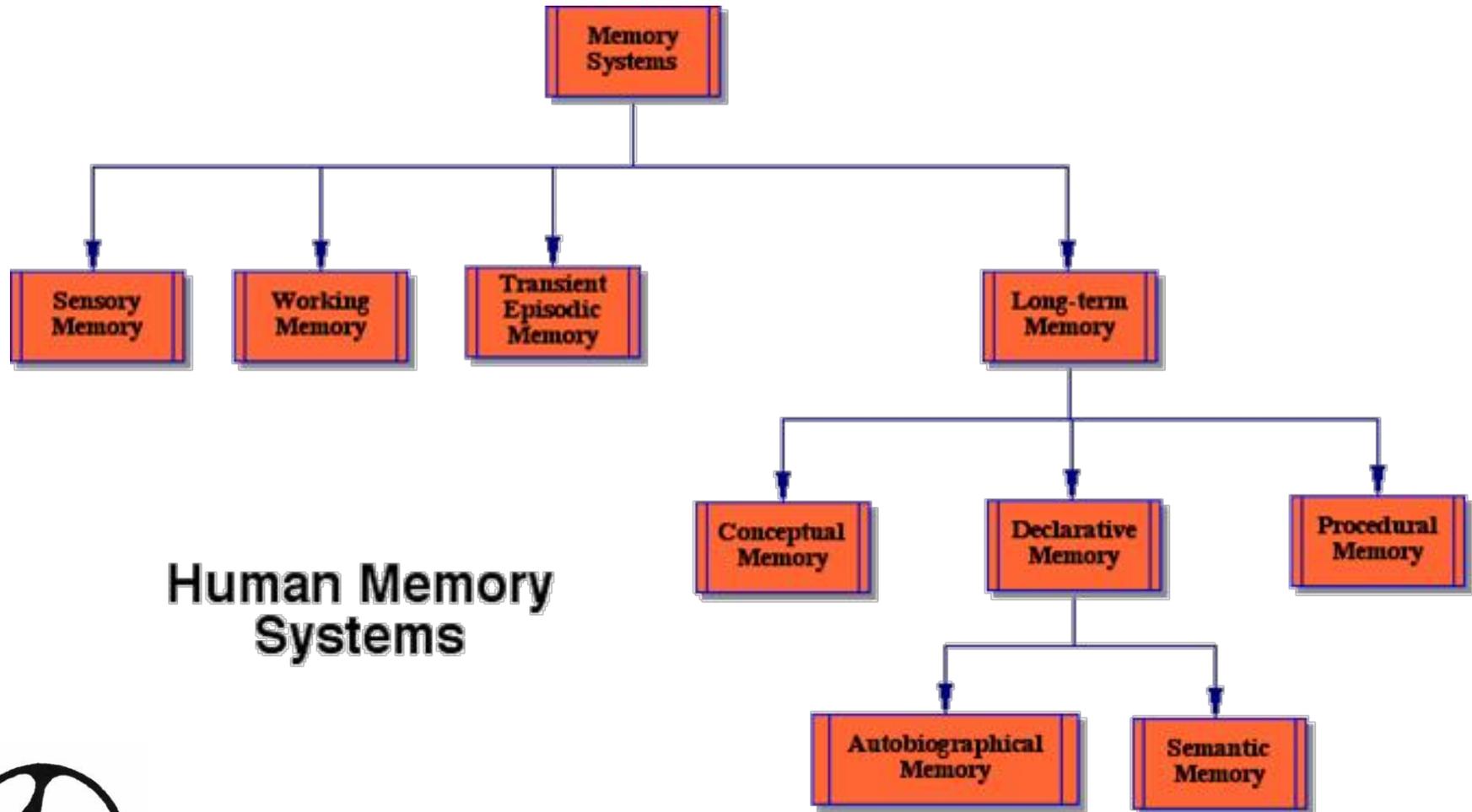


Cognitive Cycle Processing

- Hypothesis— Like IDA's, human cognitive processing is via a continuing sequence of Cognitive Cycles
- Duration— Each cognitive cycle takes roughly 200 ms with steps 1 through 5 occupying about 80 ms
- Overlapping— Several cycles may have parts running simultaneously in parallel
- Seriality— Consciousness maintains serial order and the illusion of continuity
- Start— Cycle may start with action selection instead of perception



Memory Systems



Human Memory Systems



Single Cycle Processes

- Sensation
- Perception
- Feeling & Emotion
- Working memory
- Episodic memory
- Consciousness
- Perceptual Learning
- Episodic Learning
- Procedural Learning
- Action Selection
- Action



Types of Multicyclic, Topdown Processes

- Cognitive processes that depend on memory—for example, perception using episodic memory
- Cognitive processes that depend on behavior streams (goal context hierarchies)—for example, volition or metacognition



Multi-Cyclic Cognitive Processes

Depends on memory

- Perception
- Working memory
- Declarative memory
- Learning
- Action Selection

Depends on behavior streams

- Deliberation
- Volition
- Automization
- Problem solving
- Metacognition



What Deliberation Does

- Faced with a goal or problem
- Imagine possible plans or solutions
 - Scenarios
 - Routes
 - Internal virtual reality—Dawkins
- Evaluate them
 - Using reason
 - Using emotions
- Choose among them



More Specifically, Deliberation

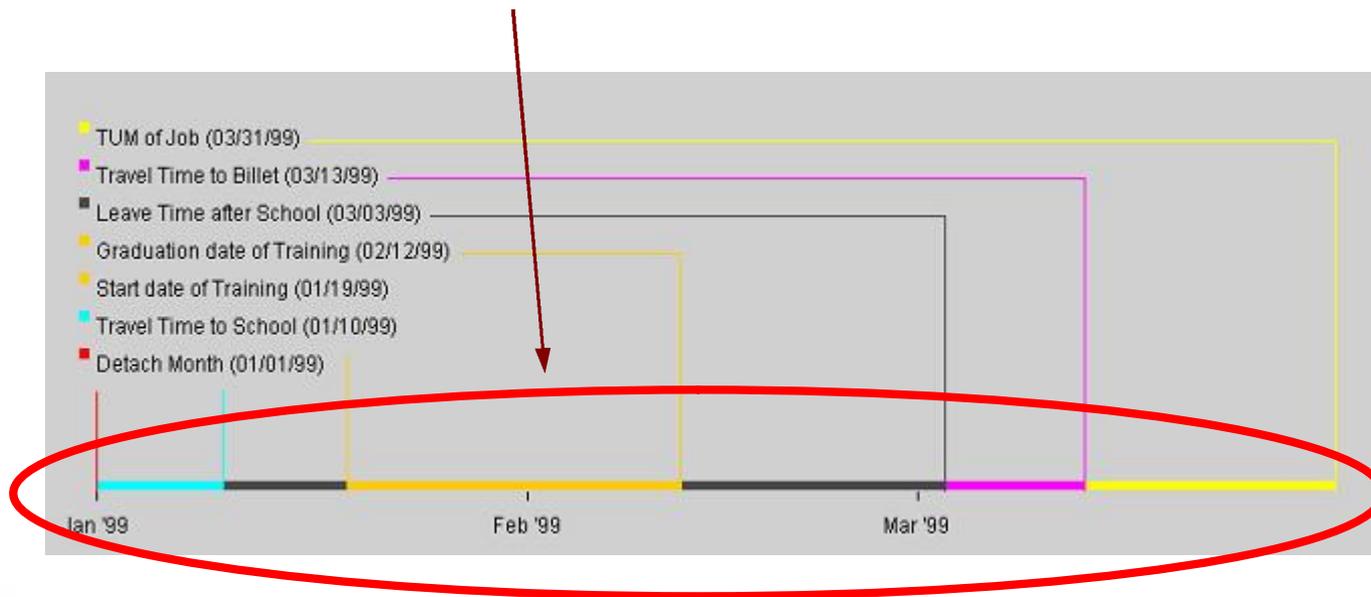
- Creates scenes
 - May require objects, actors, concepts, relations, frames
 - Organized around events
- Builds scenarios as sequences of scenes
- Chooses between scenarios, discarding some



How does IDA deliberate?

- Create and Adjust Job Transition Timelines

Timeline is displayed as dates are adjusted



Categories of Action Selection

- Volitional—conscious decision making process
- Consciously (informationally) mediated—unconscious process uses conscious information
- Automated—unconscious choice not using conscious information



Volition via Ideomotor Theory

William James (circa 1890)

Bernard Baars (1988)

Theory of voluntary action

- Proposers—propose a course of action
- Objectors—raise objections to such a course of action
- Supporters—lend support to such a course of action
- Auctioneer—wields the gavel



Ideomotor Theory in Action

Idea pops to mind (proposer)—no objection (objector)—do it

Objection (objector)—don't do it

Objection then support (supporter) do it

Different proposal—no objection—do it

Different proposal—original proposal—no objection—do it

Last unopposed proposal is acted upon



Automization

- Habituation is about perception, automization is about action
- Automization—the process of learning to act in certain contexts without conscious input
- Some of walking, much of speaking



Non-routine Problem Solving

- Glenberg's shoe under the bed problem
- Solution may involve
 - Current knowledge and skills
 - Deliberation
 - Planning
 - Trial and error (generate and test)



Metacognition

- Thinking about thinking
- What Sloman calls meta-management
- Influences action selection strategies
 - More or less opportunistic, thoughtful or goal-oriented
- Influences resource allocation



Modeling Cognition

- Situated (embodied) cognition — Varela, Thompson & Roach
- Perceptual symbol systems — Barsalou
- Memory via actions —Glenberg
- Global workspace theory—Baars
- Cognitive architecture—Sloman



Readings

- **Varela, F. J., E. Thompson, and E. Rosch. 1991. *The Embodied Mind*. Cambridge, MA: MIT Press.**
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