How Minds Work
Consciousness

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Philosophical Consciousness

- Phenomenal (subjective) consciousness
- Qualia – the stuff of experience
- The mind-body problem
- (Philosophical) zombie
  - Acts indistinguishably from a human
  - Claims subjective consciousness
- Can zombies exist?
- The hard problem

Scientific Consciousness

- Avoided for a century by behaviorists
- Claimed to be impossible
- Rekindled by Baars, Mandler & others via a twenty-year effort
- Going concern today with journals, organization, conferences, etc.
- Pursued by philosophers, neuroscientists, psychologists, AI researchers

Scientific Study of Consciousness

- Philosophers   – clarifying concepts
- Neuroscientists – neural correlates
- Psychologists   – functional models
  - Baars, Global Workspace Theory
- AI researchers – computational models
  - Franklin, IDA Model

Functions of Consciousness

- Produce internal virtual reality
    – create a world

- Inform action selection

- Seize opportunities, avoid dangers

- Recruit internal resources

- Learn

Functional vs Phenomenal

- Functional consciousness – performs roles that consciousness plays in agents

- Phenomenal consciousness – subjective experience, qualia

- Only functional claimed for software agents and robots

- What about non-human animals?

Spatially Sensitive Senses

- Sense organ movement produces apparent motion at its surface

- E.g. human vision—*press eyeball*

- Bacterium nutrient gradient sensing is not spatially sensitive

- Temperature sensing by a thermostat is not spatially sensitive

Merker's Solution

- Agents with spatially sensitive senses must compensate

- Provides pressure for evolution of phenomenal consciousness

- Earthworms may use other mechanisms or may be phenomenally conscious

- Artificial agents (IDA & robots) not yet phenomenally conscious

Codelets

- Small pieces of code each performing a simple, specialized task

- Often waits as a demon, watching for a chance to act

- Implement processors from Global Workspace theory
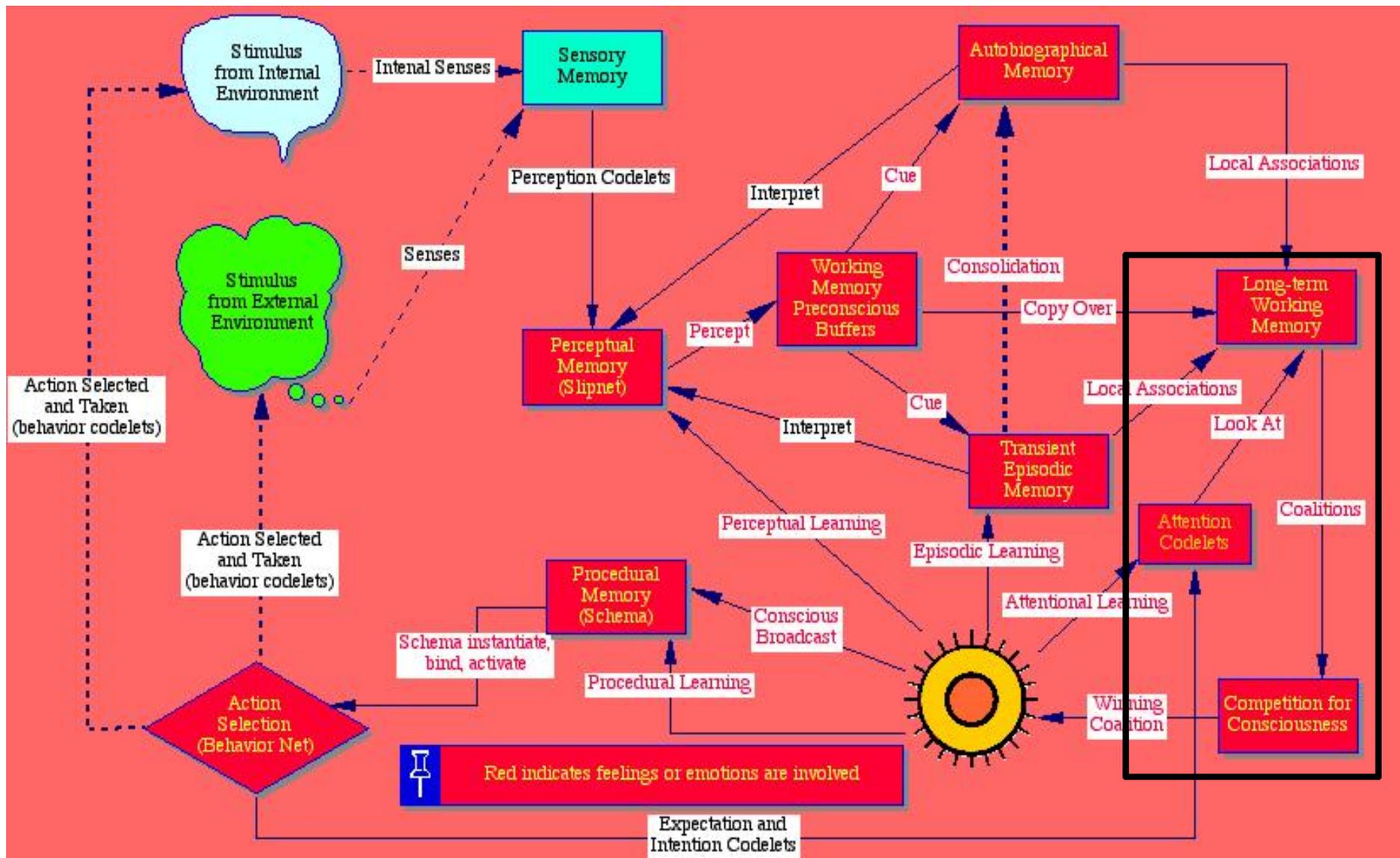
Attention Codelets

- Attention—process of bringing to consciousness

- Look at Long-Term Working Memory

- Form coalitions with information codelets

- Information codelets = slipnet nodes = perceptual symbols

Attention Codelets look for

- Conflicts between current and past events (CMattie)
- Particular kinds of information
  - Find me a job (IDA)
  - Work on an F-16 preference (IDA)
- Contiguous motion
- Causation (temporal contiguity)

Particular Information Codelets

- Intention codelet
  - Generated at each volitional goal selection
  - Looks for opportunities to approach goal

- Expectation codelet
  - Generated with each action selection (behavior net)
  - Looks for outcome of the action
  - More active with unexpected outcome

Competition for Consciousness

- Coalitions compete for consciousness
- Relevance, importance, urgency, insistence, etc., measured by affect
- Coalition with highest average activation wins
- Contents of winning coalition broadcast

Conscious Broadcast

- Winning coalition of codelets occupies the Global Workspace (a tautology)

- The contents of Global Workspace are broadcast to every codelet

- The result is learning of several kinds, and the recruitment of resources

Readings

- Read about Philosophical Consciousness in
  - Dennett, D. 2005. *Sweet Dreams : Philosophical Obstacles to a Science of Consciousness*. Cambridge, MA: MIT Press.
- Read about Merker's Solution in
  - Baars, B. J., and S. Franklin. 2003. How conscious experience and working memory interact. *Trends in Cognitive Science* 7:166-172.

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