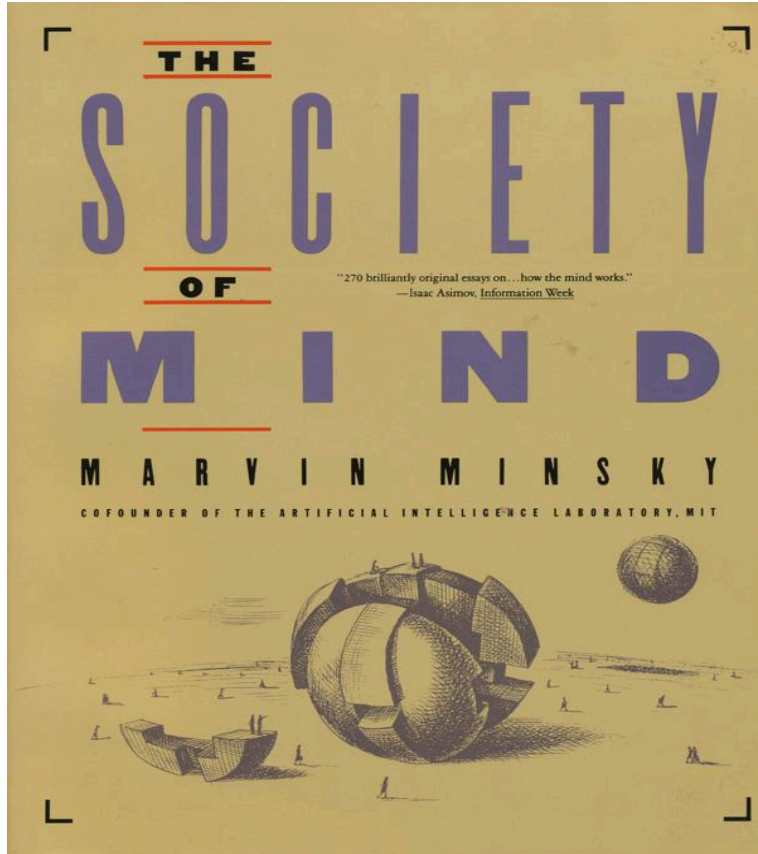


The Society of Mind

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Fall 2015

What is “Society of Mind” ?



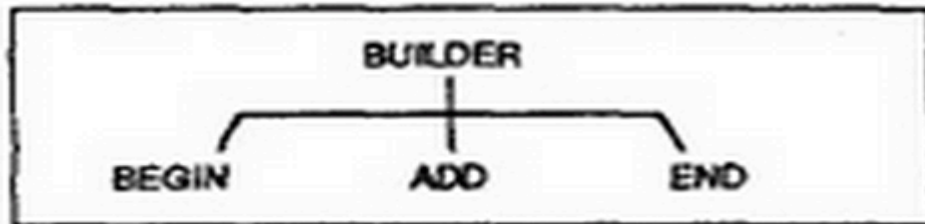
- What is the human mind?
- How does it work?
- One-page long essays
- One idea per essay (at least)

Agents

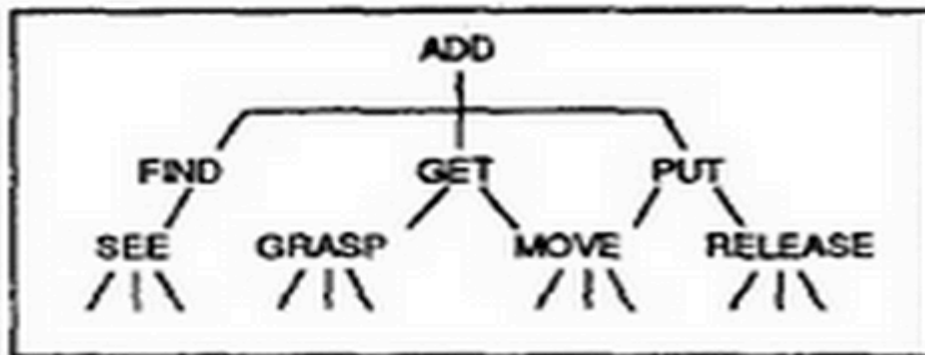
Mind made of smaller processes → agents

Agents organized in Societies → intelligence

The world of blocks



*Choose a place to start the tower.
Add a new block to the tower.
Decide whether it is high enough.*

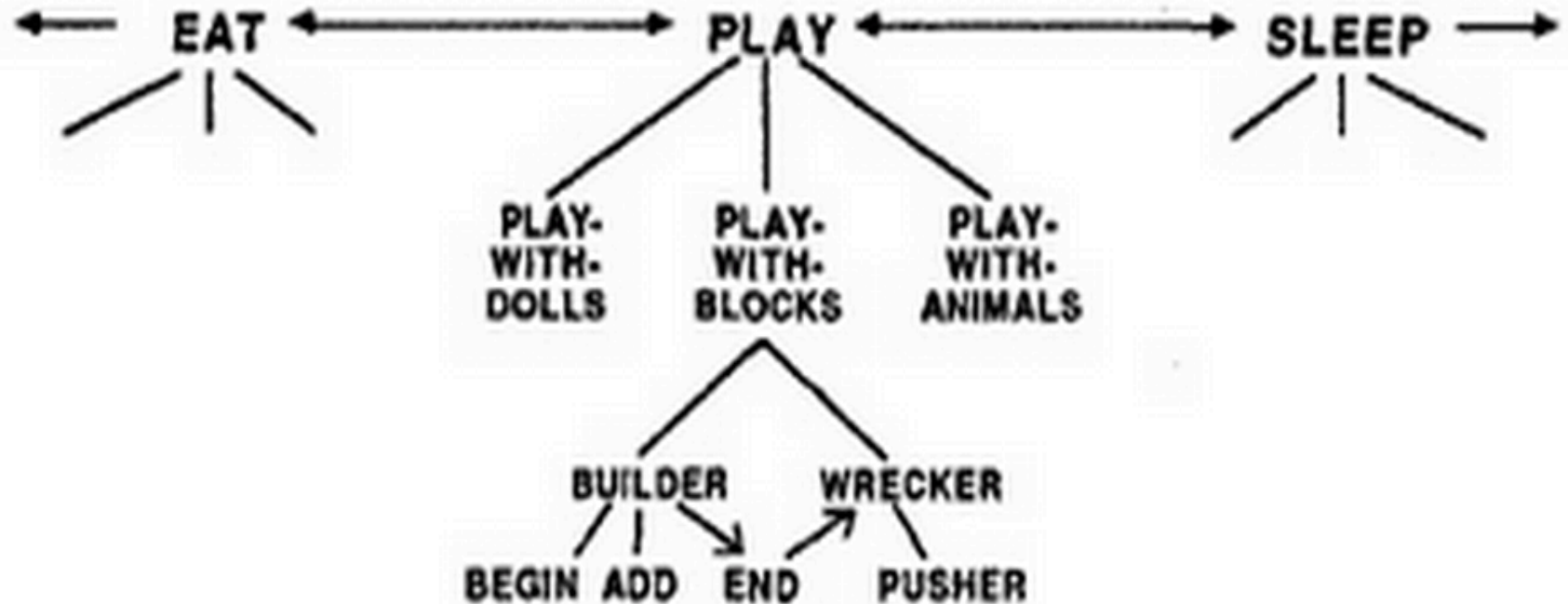


*First ADD must FIND a new block.
Then the hand must GET that
block and PUT it on the tower top.*

Organization

- (imperfect) Hierarchy : loops
 - agents can do different jobs at the same time
- Bureaucracy

Interactions between agents : CONFLICT



Noncompromise : weakening agent

The longer an internal conflict persists among an agent's subordinates, the weaker becomes that agent's status among its own competitors. If such internal problems aren't settled soon, other agents will take control and the agents formerly involved will be dismissed.

Exploitation

Professor X : agents WORK and SLEEP conflict

WORK exploits agent ANGER to counter SLEEP, using indirect pathways.

Fantasies provide missing pathways.

Why not direct? Directness is dangerous!

Self-control, Long-term plans

Similar to human societies, exploit fear, desires, loss, etc.

There are agencies that operate on large spans of time → character

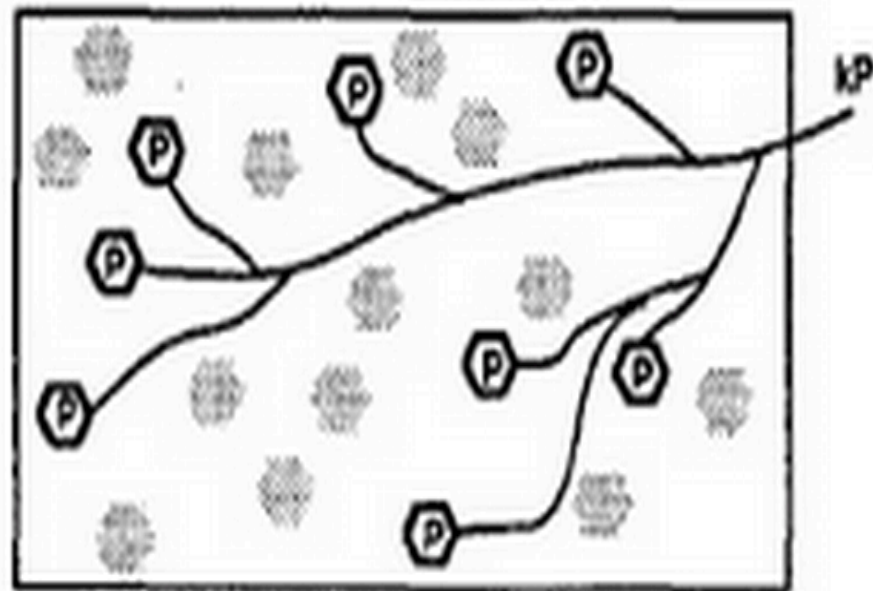
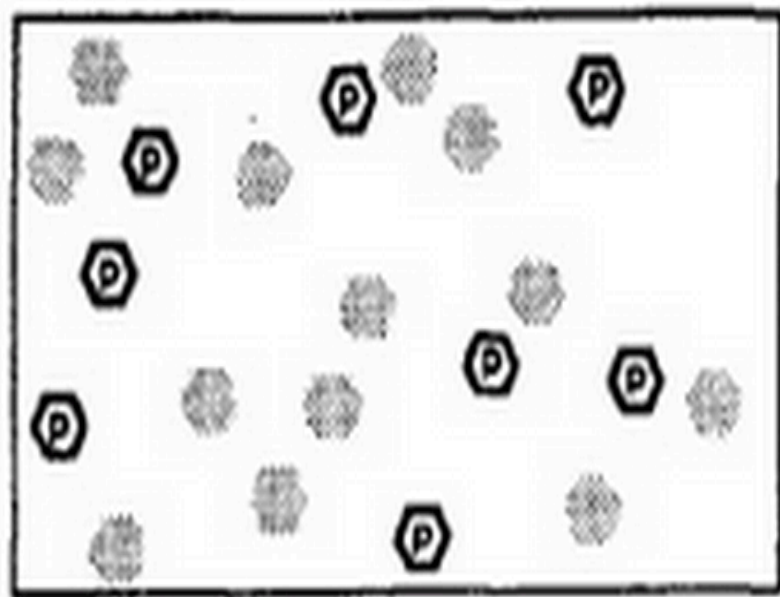
Simple Agents: K-Lines

Whenever get a good idea or solve a problem, activate a k-line to represent it.

K-line: wire-like structure that attaches itself to whichever mental agents are active when you solve a problem.

When k-line is later activated, agents attached are aroused, putting you in the “mental state” you were when you solved that problem. You can solve similar problems now.

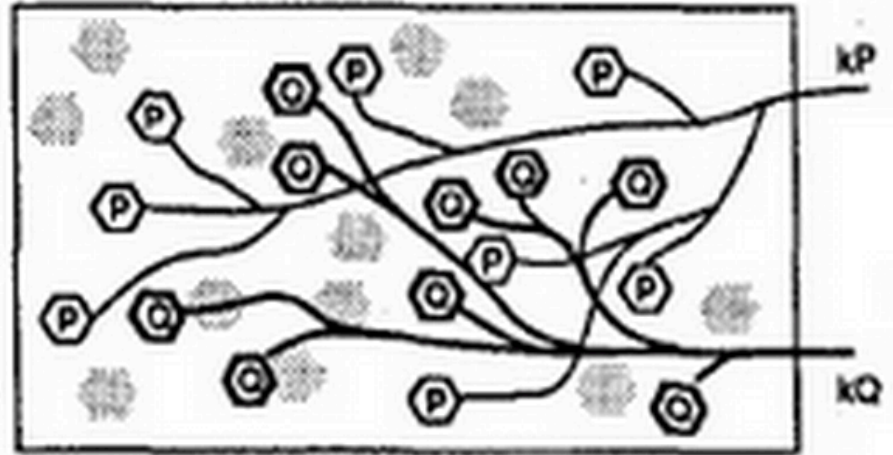
K-line



Policies for k-lines

Repair a bicycle - paint every used tool red (not good)

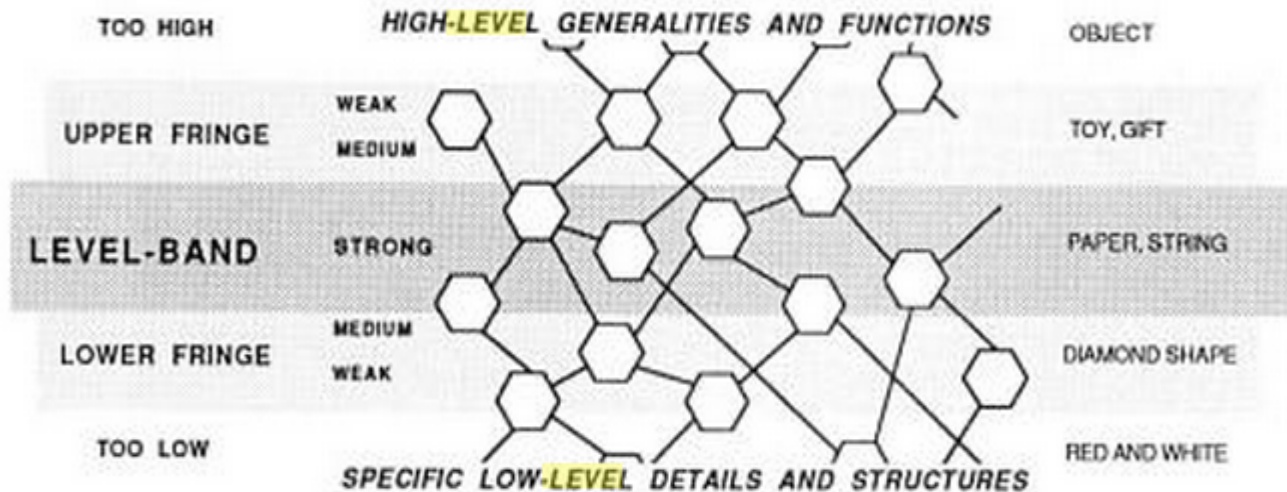
How do we balance between kP line and kQ line (line for a new problem Q)?



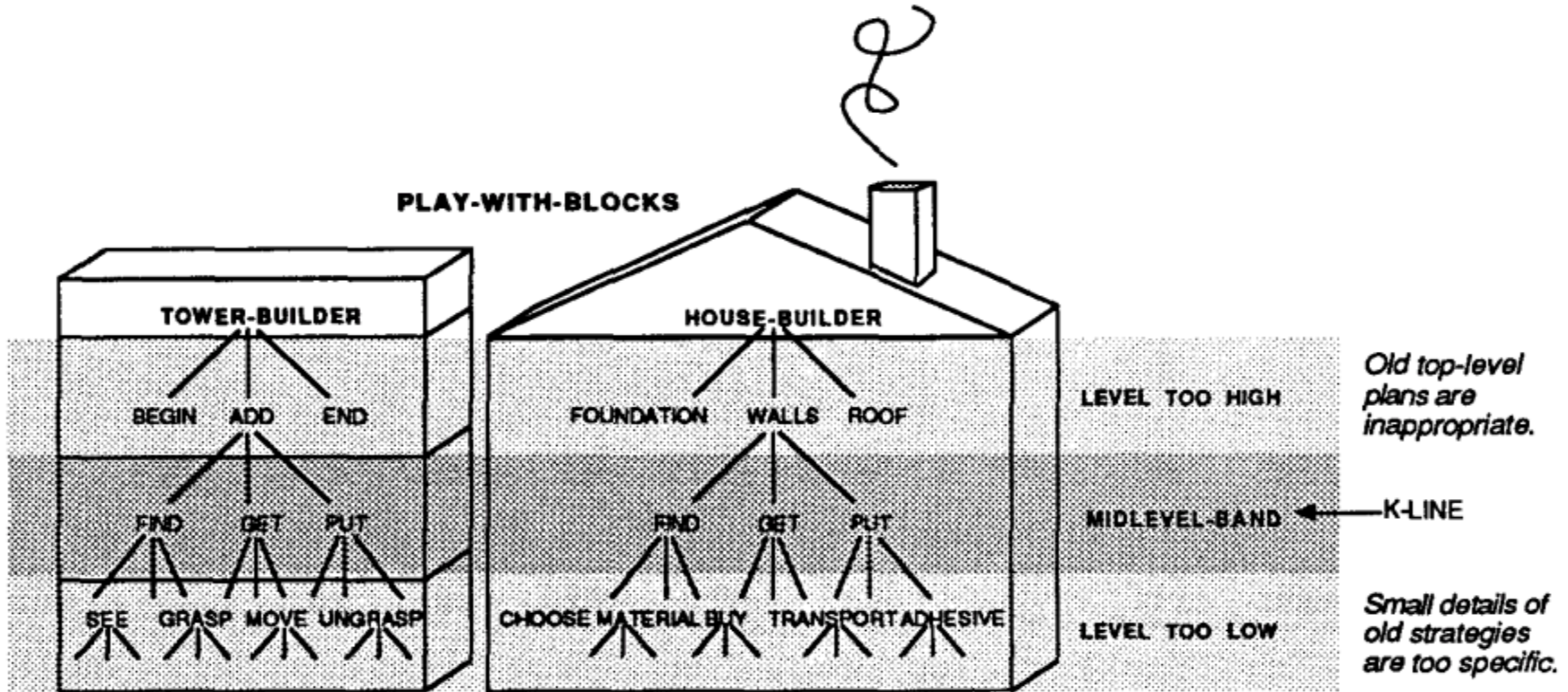
Level-bands

we learn by attaching agents to K-lines, but we don't attach them all with equal firmness. Instead, we make strong connections at a certain level of detail, but we make weaker connections at higher and lower levels.

Weak connections - assumptions by default, knowing what is usual or typical

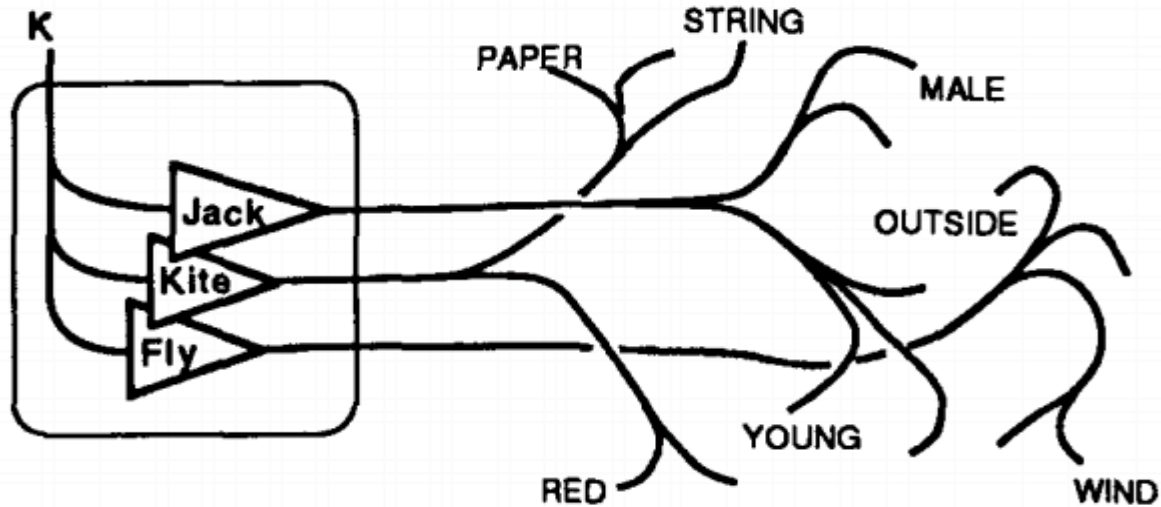


LEVELS: Describing and Doing things



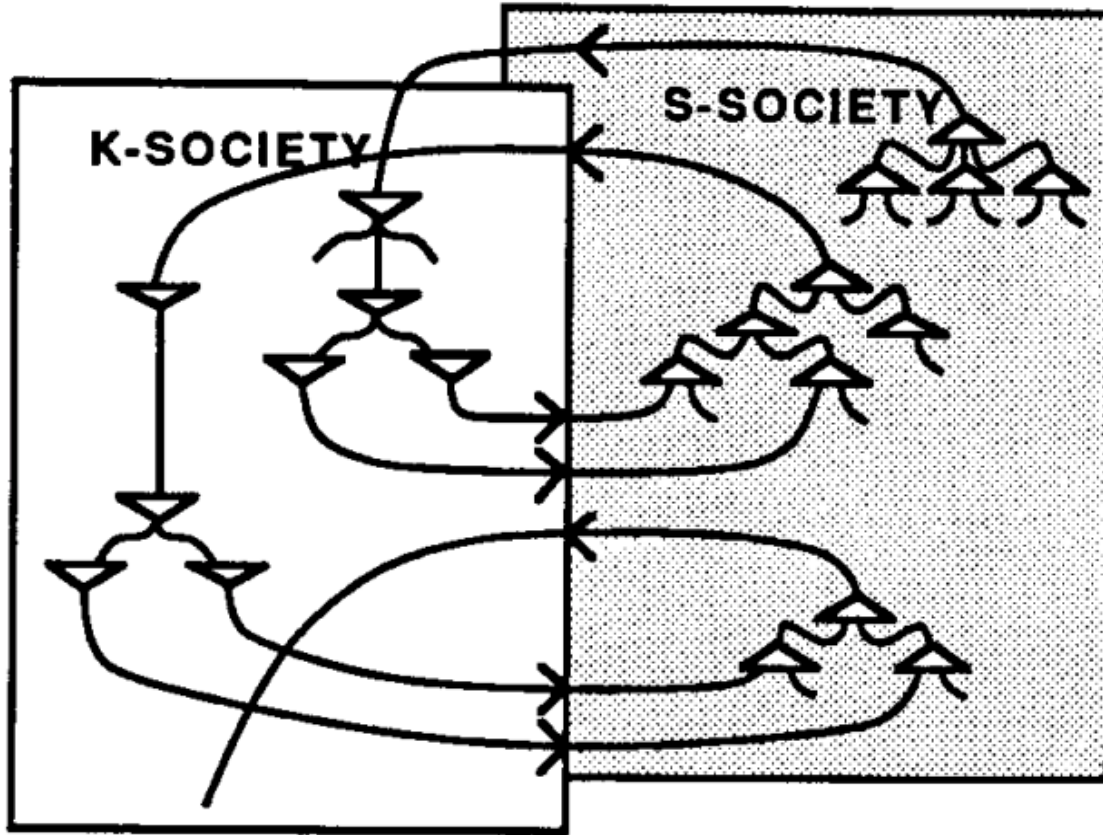
Societies of Memories

“You will tend to remember only what you recognized at the time” - detail loss



K-line attached to three K-lines.

Layers of Societies



The connections in the K-society are similar to those in the S-society, except that the signals tend to flow in opposite directions.

Simple Agents: Nemes

Invoke representations of things, and are mostly produced by learning from experience.

Polynemes:

- permanent K-lines. They are long-term memories.
- invoke partial states within multiple agencies, where each agency is concerned with represented different aspects of a thing.
- Ex: 'apple-polyneme', invokes properties of color, shape, taste, etc.

Micronemes: inner mental context clues that shade our mind's activities in ways we can rarely express.

Simple Agents: Nomes

Control how representations are manipulated.

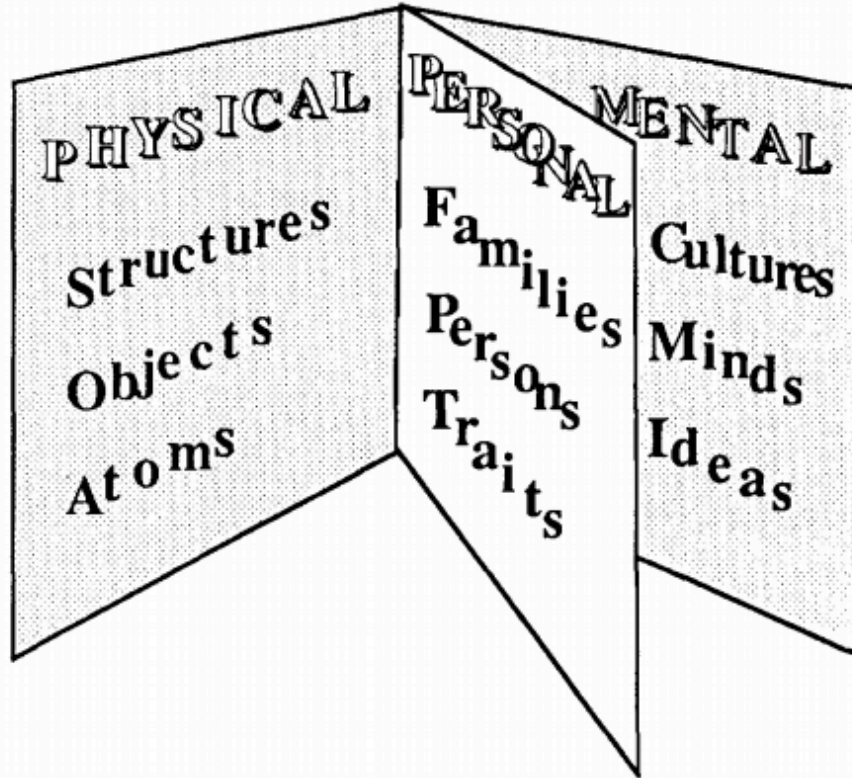
Pronomes:

- temporary K-lines. They are short-term memories.
- associated with a specific role (see Trans-Frames)

Isonomes: similar built-in effect on each of its recipients. It applies the same idea to many different things at once. (common genetic origins for agents)

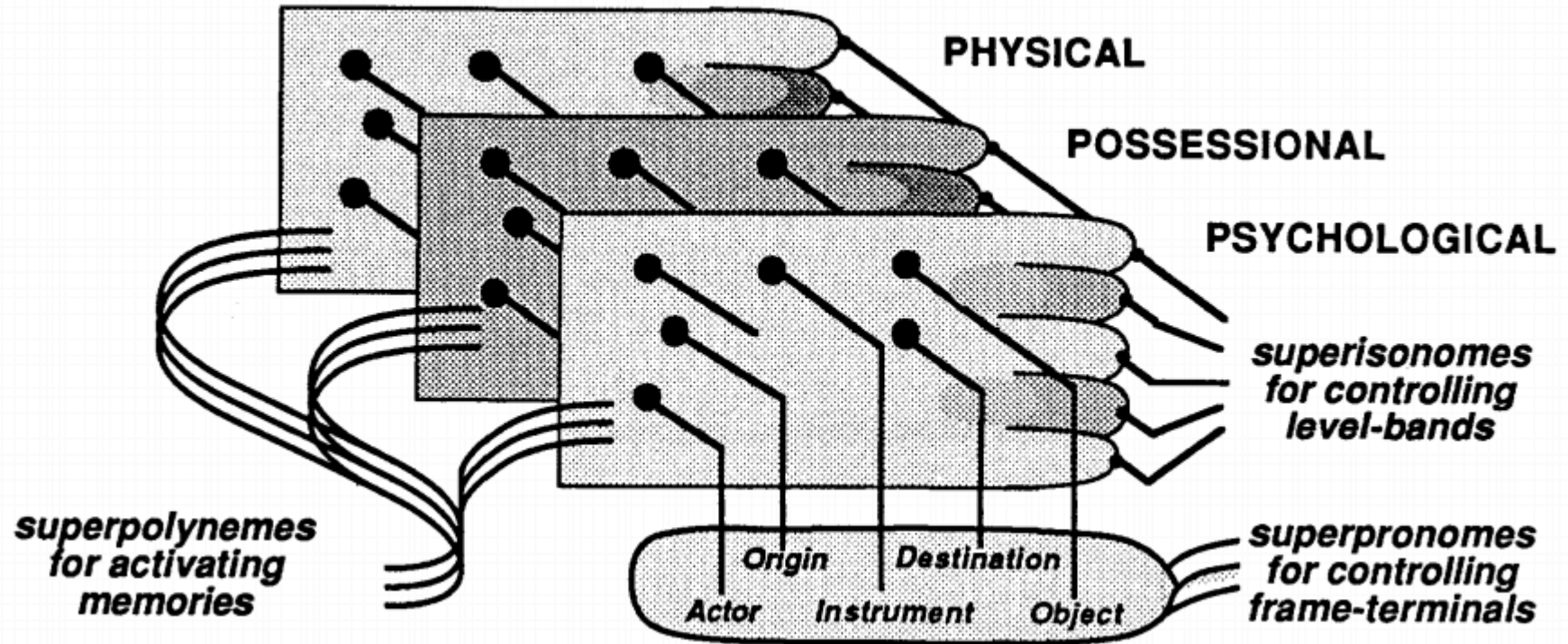
Paranomes: pronomes that operate in several different realms at once.

Realms of thought



This suggests how people think about the world. The "pages" represent our physical, personal, and psychological conceptions, while the lines on each page correspond to the levels of detail that are distinguished in each realm.

“Mary gives Jack the kite”



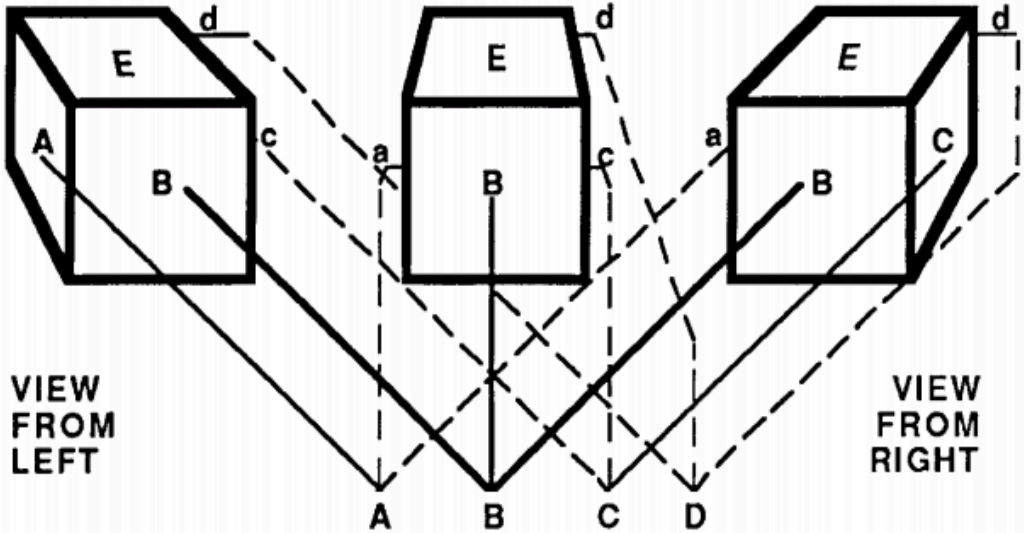
Combination: Frames

A frame is a sort of skeleton, somewhat like an application form with many blanks or slots to be filled. We'll call these blanks its terminals; we use them as connection points to which we can attach other kinds of information.

In principle, we could use frames without attaching their terminals to anything. Normally, though, the terminals come with other agents already attached - and these are what we called "default assignments" when we first talked about level-bands.

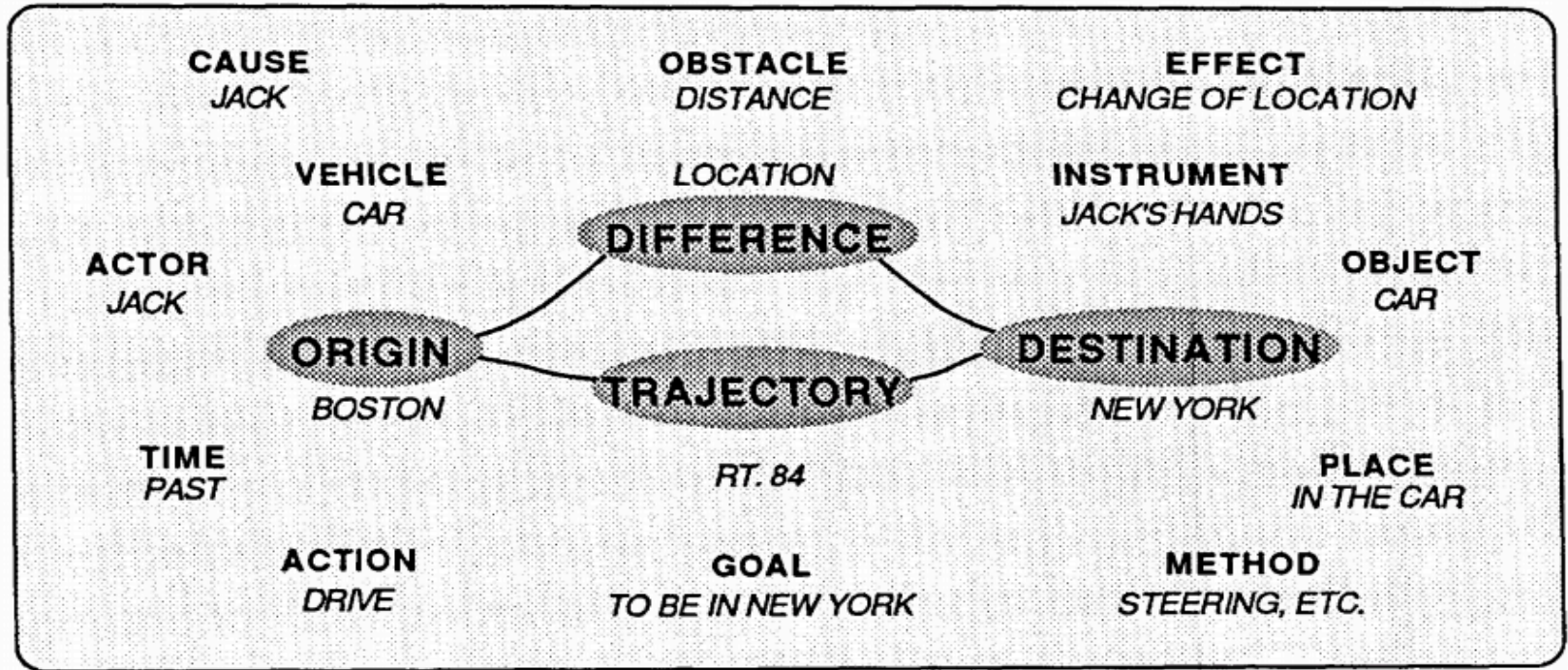
Combination: Frame-Arrays

Frame-Arrays. *When we move, our vision-systems switch among a family of different frames that all use the same terminals.*



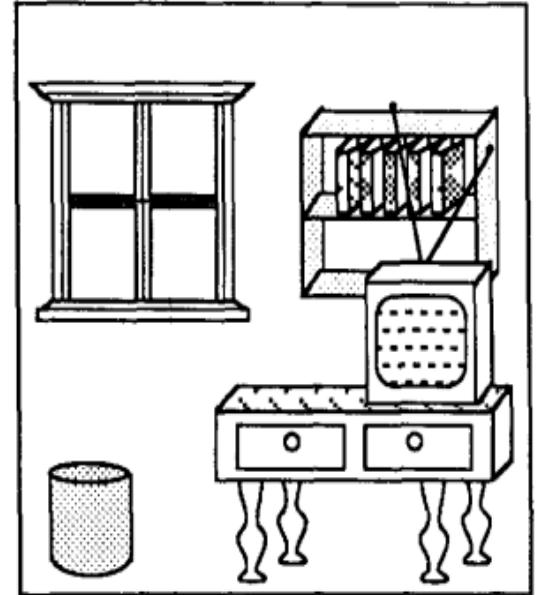
Combination: Trans-frames

Trans-frames represent events and all of the entities that were involved with or related to the event.



Combination: Picture Frames

NW	N	NE
W	+	E
SW	S	SE



Combination: Story Frames

Terminal or Concern

Time Setting?

Place Setting?

Protagonist?

Central Concern?

Antagonist?

Assignment

The past

Jack's home

Mary is heroine

Mary's subjective reaction

Indicated by

Past tense of verb

Destination

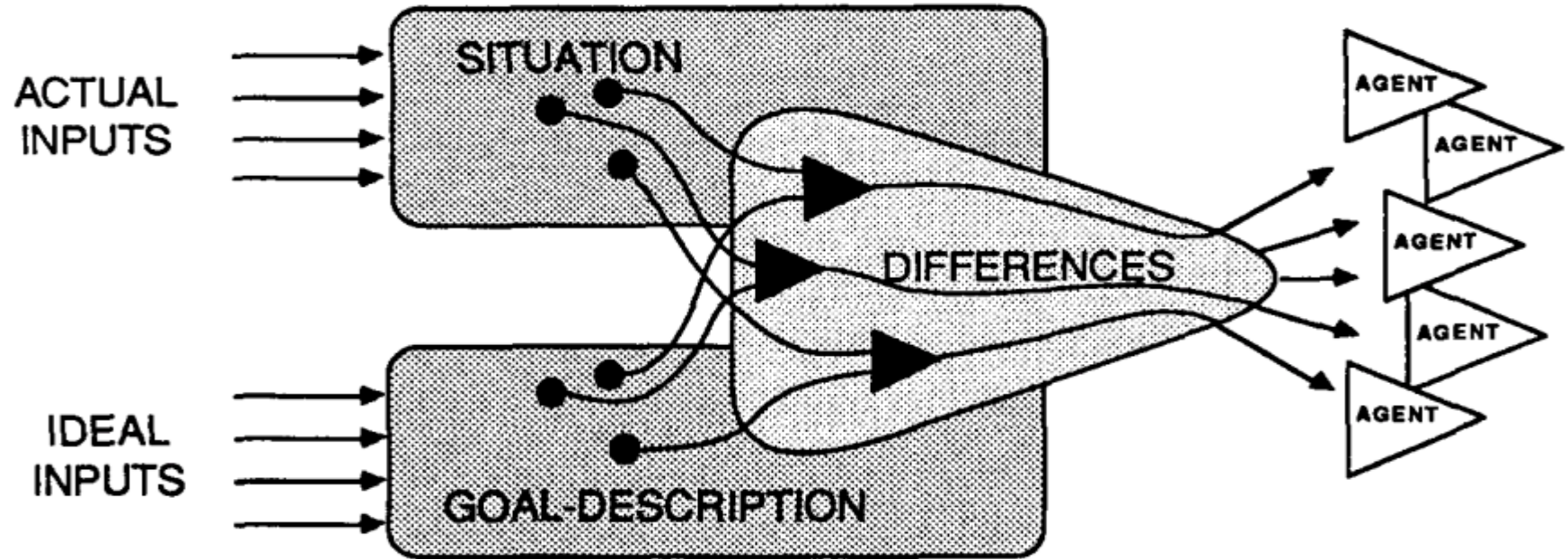
Syntactic emphasis

Default assumption

Not yet mentioned

Solving Problems: Difference Engines

Solving a problem: reducing or eliminating the important differences between the current state and some desired goal state.



Solving Problems: Censors, Suppressors

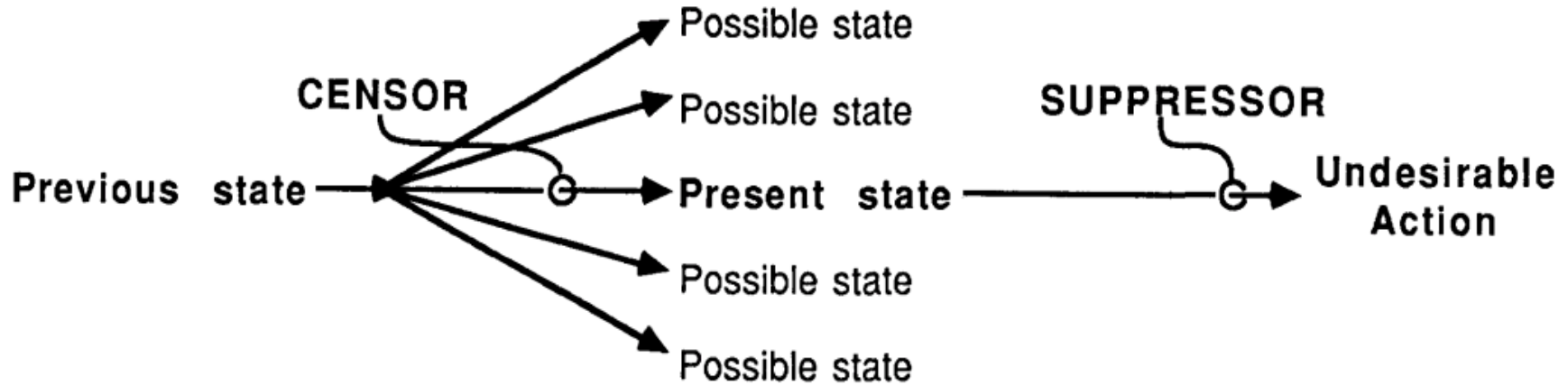
Suppressor-agents:

Wait until you get a certain "bad idea." Then they prevent your taking the corresponding action, and make you wait until you think of some alternative. If a suppressor could speak, it would say, "Stop thinking that!"

Censor-agents:

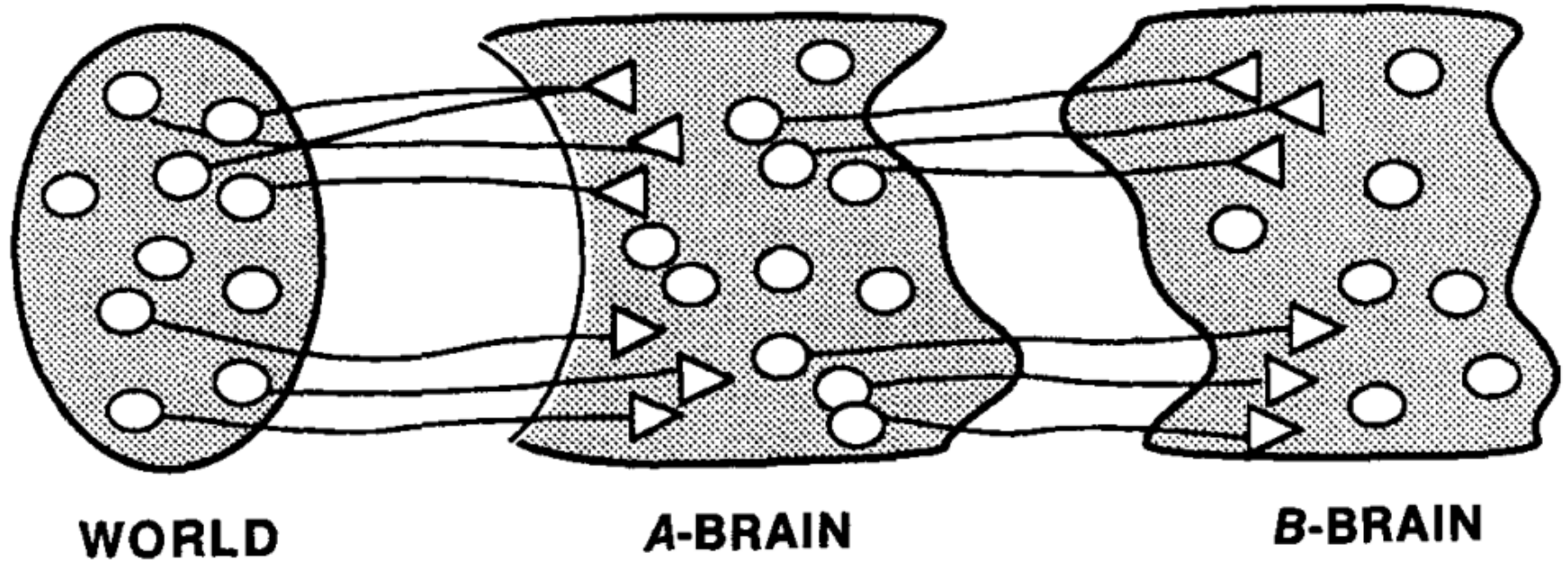
Need not wait until a certain bad idea occurs; instead, they intercept the states of mind that usually precede that thought. If a censor could speak, it would say, "Don't even begin to think that!"

Solving Problems: Censors, Suppressors



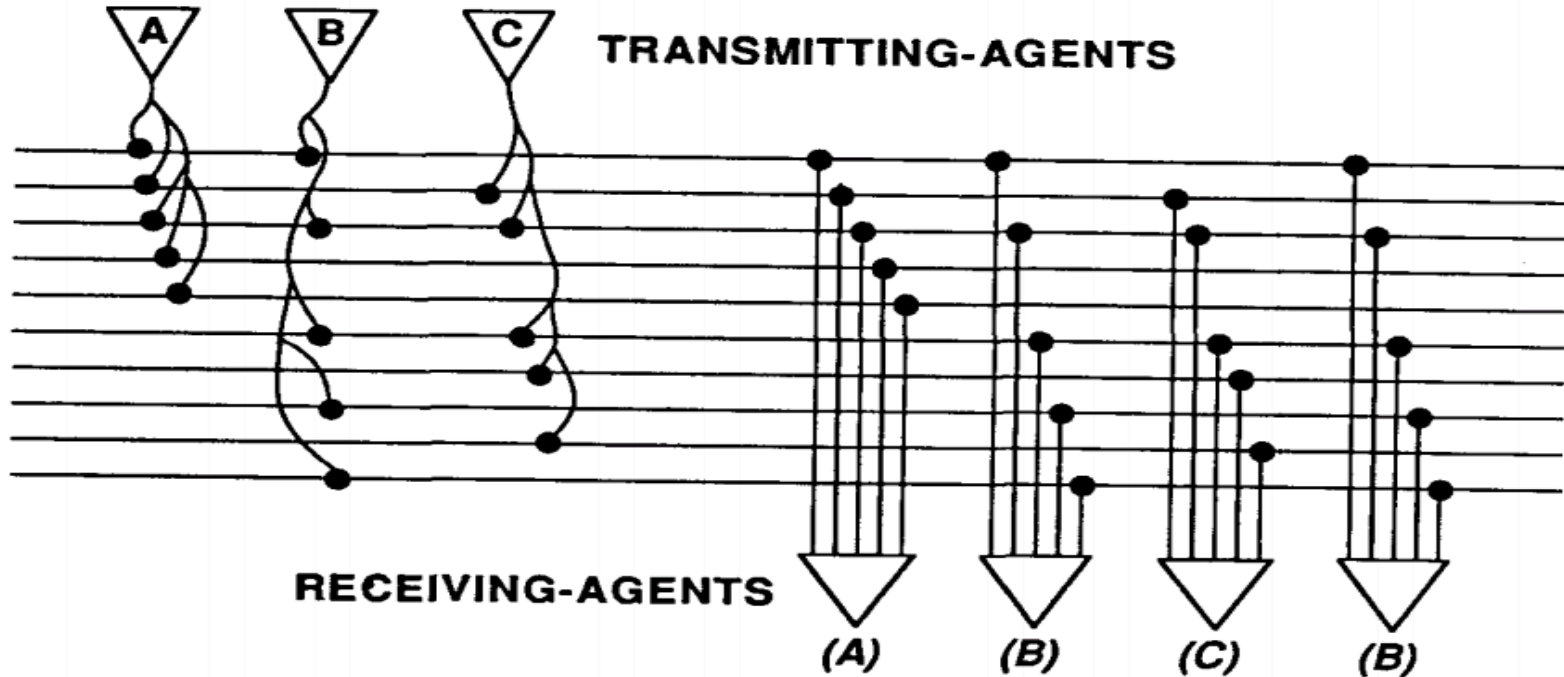
Solving Problems: A-brain, B-brain, ...

“Reflective mind-society”



Communication: K-lines, Connection Lines

Connection-Scheme by Calvin E. Mooers



Communication: Internal Language

- If one agent wishes to convey a complex idea to another, it attempts to *re-construct* the idea expressed in its own representational system by a sequence of frame retrieval and instantiation operations. This method of communication requires that the two communicating agents agree well enough on the meanings of these 'words' or representation-construction operations.
- Probe into details (high - low) -- the smaller the agent the harder to comprehend the language.

Communication: Paranomes

No active communication at all.

Instead, agents often find that the information they need is already available when they need it. This is the result of the use of paranomes.

When one pronome of a paranome produces a particular state in terms of one representation, the other pronomes simultaneously update their representations so that they enter corresponding states.

Communication: Ambiguity

Precise communication may be unnecessary, and in fact, impossible between different agents.

Growth of Mental Societies

Protospecialists: highly evolved agencies that produce behaviors providing initial solutions to problems like locomotion, obtaining food and water, staying warm, etc.

Predestined learning: many of the kinds of abilities that are shared among all people, e.g. language or walking, are the result of *predestined learning*, learning that develops under just enough internal and external constraints that the end result is more or less guaranteed.

Growth of Mental Societies: Types of Learning

Unframing: combining several descriptions into one (observing all arches have common parts).

A IS SUPPORTED BY B

A TOUCHES B

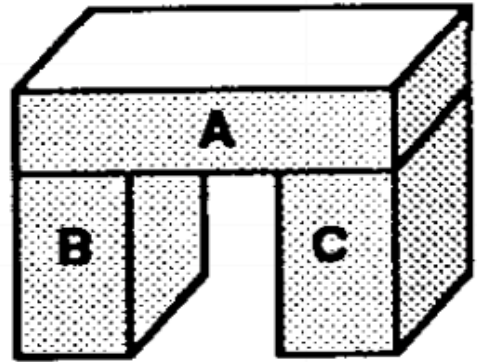
A ABOVE B

SYMMETRICAL

CONNECTED

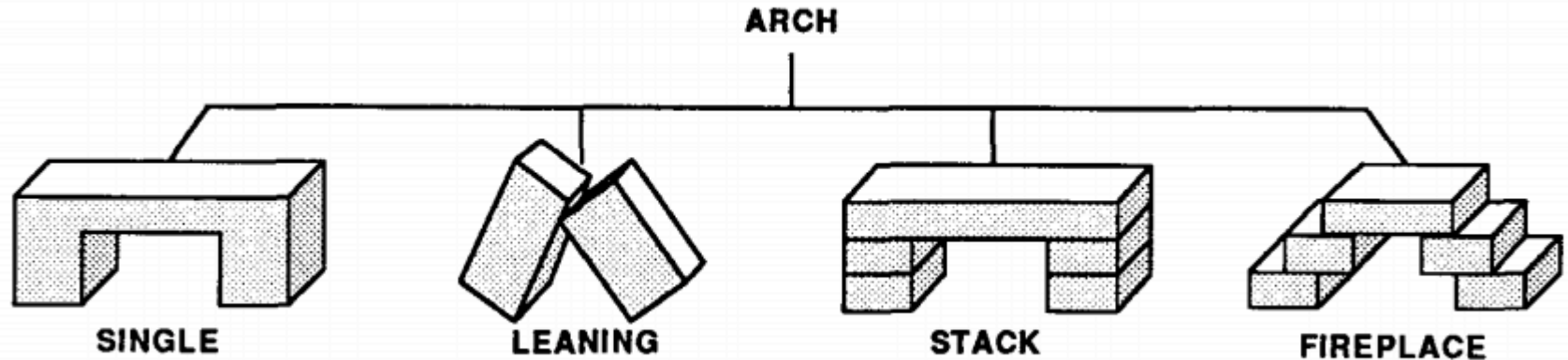
TWO ON GROUND

A IS BETWEEN B AND C



Growth of Mental Societies: Types of Learning

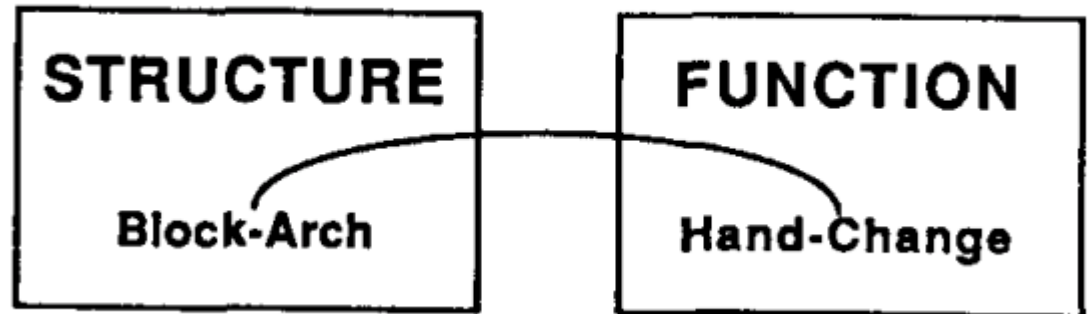
Accumulating: is the simplest form of learning, where you simply remember each example or experience as a separate case.



Growth of Mental Societies: Types of Learning

Reformulating: modifying a description's character (describing the separate blocks, rather than the overall structure).

Trans-framing: bridging between structures and functions or actions (relating the concept of arch to the act of changing hands).



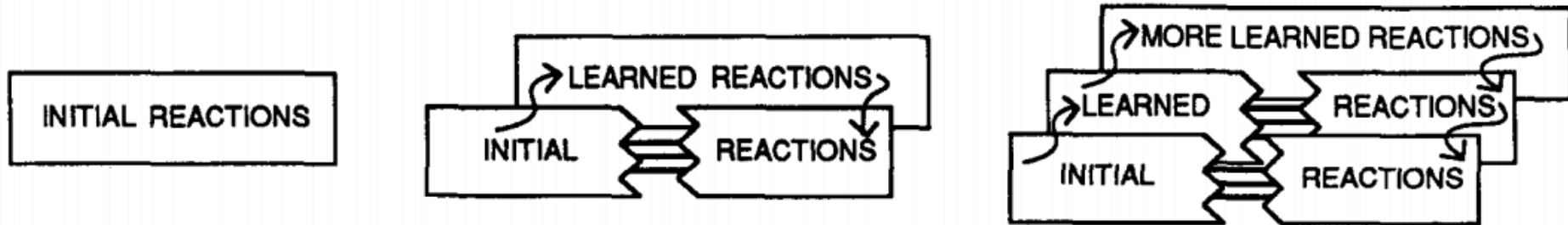
Growth of Mental Societies

Learning from attachment figures: (ideals, censor, praise, etc)

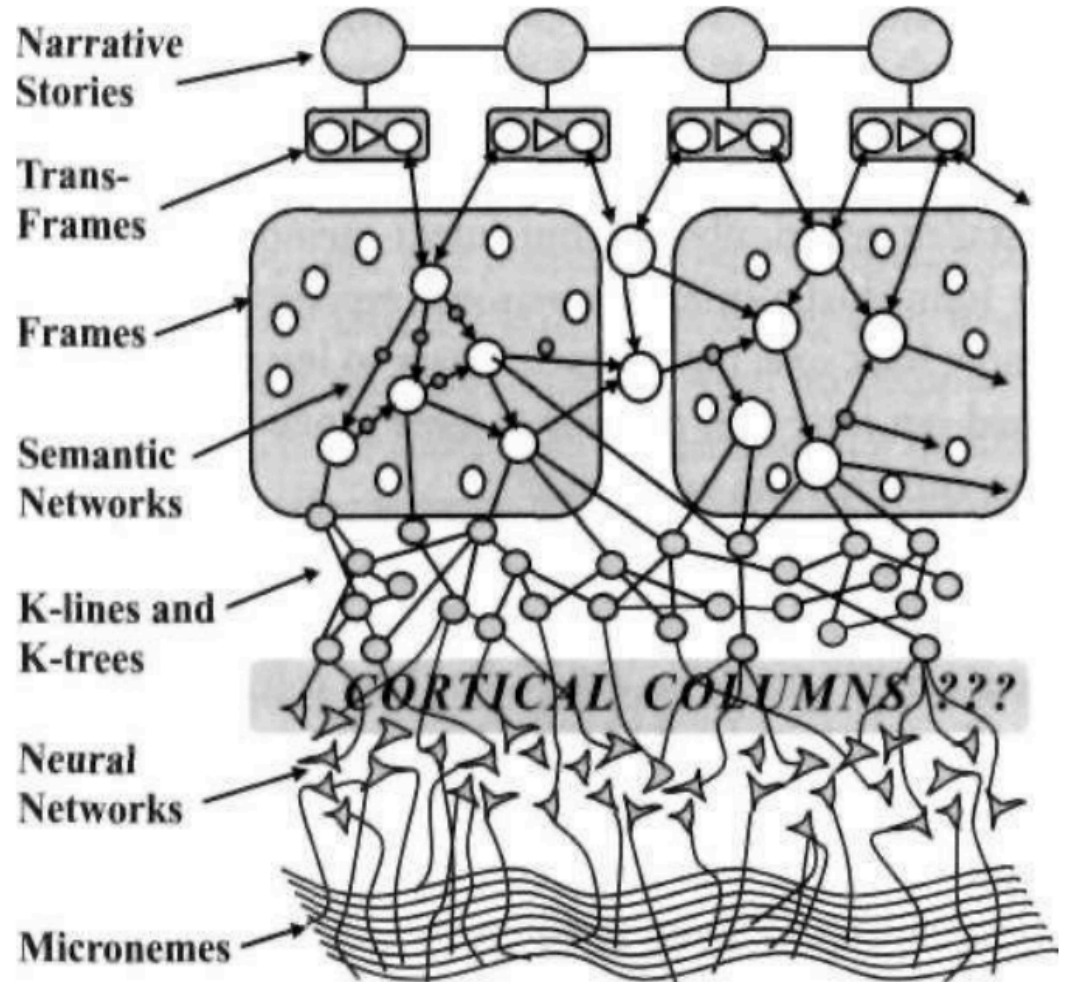
Learning mental managers:

“Some of the most crucial steps in mental growth are based not simply on acquiring new skills, but on acquiring new administrative ways to use what one already knows.”

Developmental stages: Student-Teacher (see Layers of Societies)



Ways the brain might represent knowledge



Commonsense

- Not as simple thing. Instead, it is an immense society of hard-earned practical ideas, of multitudes of life learned rules and exceptions, dispositions and tendencies, balances and check.
- Easy things are hard! (we're least aware of what our minds do best)

Uncommon sense

- Expert thinking → simpler than thinking involved when ordinary children play.
 - needs a large amount of knowledge of only a few varieties
- Commonsense → larger variety of different types of knowledge; more complicated management systems

How do we understand anything?

Analogies

Represent something new as though it resembles something we already know

The self

- Single self doesn't explain anything -- no parts we can use as pieces of explanation
- Why do we use the idea of single self?
 - Physical World
 - Personal Privacy
 - Mental activity (hard to think two different thoughts at once)

Thought experiment

Thinking affects our thoughts.

How to study consciousness then?

Intelligence and Consciousness

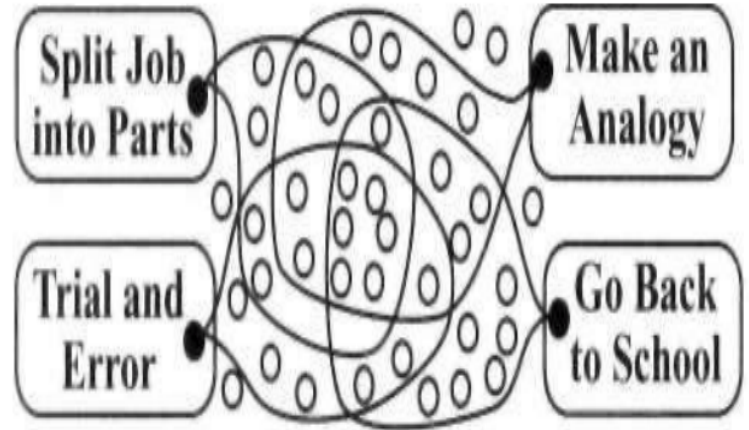
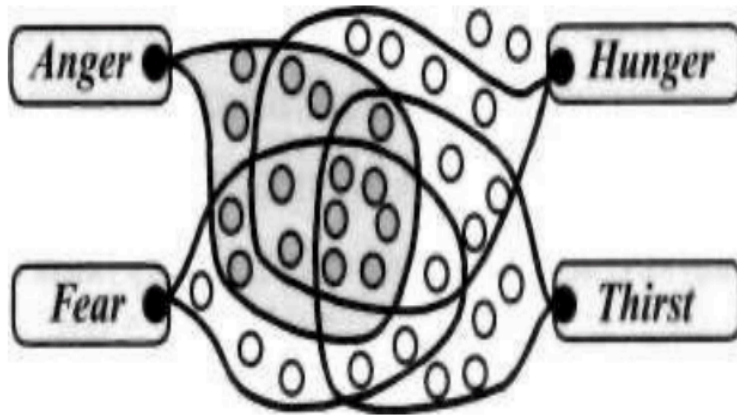
- Mind contains processes that enable us to solve problems we consider difficult.

Intelligence → name for whichever of these processes we don't understand

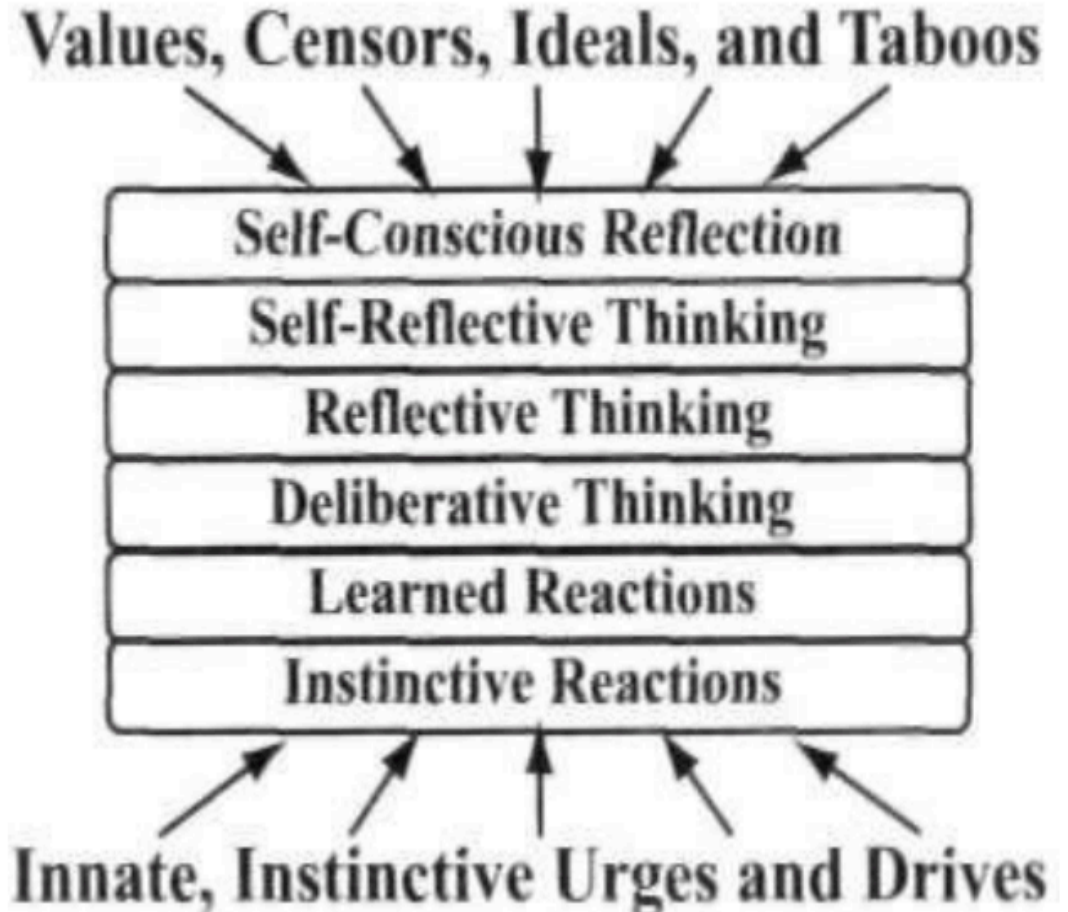
- Consciousness: Our conscious thoughts use signal-signs to steer the engines in our minds, controlling countless processes of which we're never much aware.

Emotions VS Intellect (Thought)

Each of our major “emotional states”/”ways to think” results from turning certain resources on while turning certain resources off; thus changing the ways that our brains behave.



Mental Models



Mental Models

Joan is starting to cross the street on the way to deliver her finished report. While thinking about what to say at the meeting, she hears a sound and turns her head - and sees a quickly incoming car. Uncertain as to whether to cross or retreat, but uneasy about arriving late, Joan decides to sprint across the road. She later remembers her injured knee and reflects upon her impulsive decision. “If my knee had failed, I would have been killed. Then what would my friends have thought of me?”

Mental Models

- What caused Joan to turn toward the sound? [Instinctive]
- How did she know it was the sound of a car? [Learned]
- What resources were used to make her decision? [Deliberative]
- How did she choose which resources to use? [Reflective]
- Did she feel that she made a good decision? [Self-reflective]
- Did her actions live up to her principles? [Self-conscious]

Further readings:

The Emotion Machine -- Marvin Minsky

The Harmonic Mind -- Paul Smolensky, Geraldine Legendre
(combining symbolic and connectionist methods)