

Topics for today

- Beyond the centralized mindset
- A few words about the next reading and the first exercise

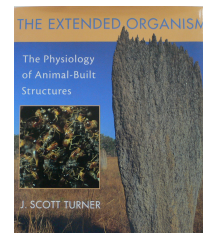
Beyond the Centralized Mindset

How shall we explain behavior?

- What background assumptions guide our thinking?
- A long tradition of centralized thinking with linear causality
- Sometimes this works well

Another way to explain behavior

- What about decentralized thinking?
 - Emergence and mutual causality rather than linear causality
 - Self-organization rather than imposed organization
 - Local interactions instead of global plans



Emergent Phenomena

- Synchronized applause
 - A propensity to coordinate with others
 - Deciding on a frequency
- Everyone say a number
 - Convergence in information cascades
- Stadium Waves
 - Structure emerges from the interactions of simple agents

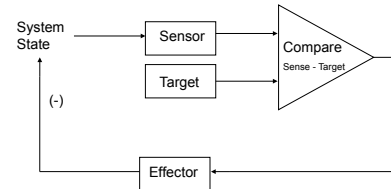
Resnick's five heuristics for moving beyond the centralized mindset

- Positive feedback is not always negative
 - Positive feedback can play a role in creating and extending patterns.
- Randomness can lead to order
- A flock of birds is not a big bird
 - Don't confuse the properties of the individuals with the properties of a group.
- A traffic jam is not a collection of cars
 - Some objects have an ever-changing composition.
- The hills are alive
 - Interactions with the environment can shape behavior in surprising ways

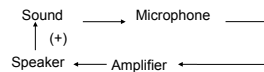
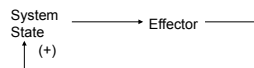
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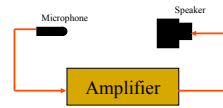
Negative Feedback



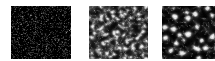
Positive Feedback



Some Positive Feedback loops



- Fires
- Washboard roads
- Structure of the galaxies
- Coral branching
- Cities and roads
- Slime molds



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System levels and emergent properties

- **Aggregation**
 - Molecules/pressure
 - Cars/density
 - Voters/election result
- **Emergence**
 - cars/traffic jams
 - fans/stadium waves
 - neurons/brain states
 - social practices/institutions
 - cultural practices/human cognition

Ideas as pathogens

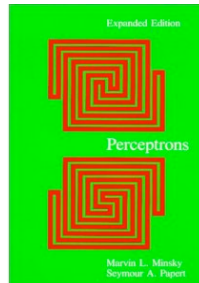
- Anthropology: Psychology
- Epidemiology: Pathology

Society of Mind (Minsky)

- Our minds are composed of hundreds of specialized agents.
- These specialists get combined into organized interactions to produce our mental abilities.
 - "...each brain contains hundreds of different types of machines, interconnected in specific ways which predestine that brain to become a large, diverse society of partially specialized agencies" (Minsky, 1988)
- This means that an individual person's mind is a system of distributed cognition

A special relation between society of mind and mind in society

- How do the internal agencies get organized?
- Biological maturation (by seed?)
- By interaction with the social and material world while engaging in cultural practices.
- Each society of mind develops in a society of other societies of mind.



Mind in Society (Vygotsky)

- High level cognitive processes always appear twice:
 - First as interpsychological process
 - Only later as intrapsychological process
- A social group may have cognitive properties different from the properties of the individuals in the group.

How to organize a scientific community

- Have everyone believe the most likely hypothesis
- Have all scientists work on the method that is most likely to produce results
- Offer prizes for getting the best answer

Individual and group rationality

- Prisoner's dilemma
- Tragedy of the commons
- The recent economic crash

	Cooperate	Defect
Cooperate	3, 3	0, 5
Defect	5, 0	1, 1

Society of societies of mind

(parallel emergence on adjacent levels, Resnick)

- In many animal systems, there are two types of emergence.
- First, the behavior of each individual creature emerges from interactions among the "agents" that make up the creature's mind.
- At the same time, the behavior of the entire animal colony or society emerges from the interactions among the individual creatures.
- In short: the colony level emerges from the creature level, which in turn emerges from the agent level.

Society of societies of mind (networks of mutual constraint, Hutchins)

- Cultural practices assemble agencies into functional systems and put the systems to work.
- Some of these functional systems may be entirely contained in an individual, and some may span several individuals and material artifacts.
- The patterns of activity that are repeatedly created in cultural practices may lead to the consolidation of functional systems, the atrophy of agencies that are rarely used, and the hypertrophy of agencies that are frequently employed.
- The result can be individual learning or organizational learning, or both.

Where could language come from?

- There was no original teacher
- Interactions among members of a community
- Expect symbols to arise at information bottlenecks

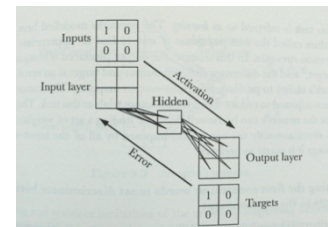


Figure 9.2 Autoassociator network.

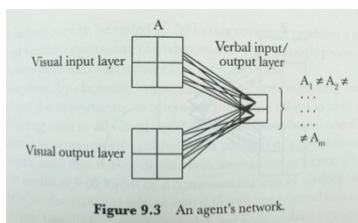


Figure 9.3 An agent's network.

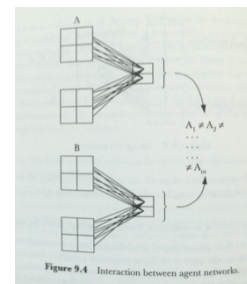


Figure 9.4 Interaction between agent networks.

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"Things" that have ever-changing composition:

- Waves
- Clouds
- Language
- Culture



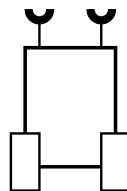
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The attribution problem

- If mind is caused by something inside of us, what exactly is it that one must assume is IN THERE in order to account for the organized behavior one can observe?
- Valentino Braitenberg *Vehicles: Experiments in Synthetic Psychology*, MIT Press 1984.
 - A robot that loves light

Braitenberg's Vehicle 2

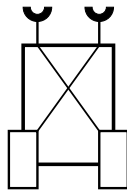


Loves Light

What is the source of the observed patterns of behavior?

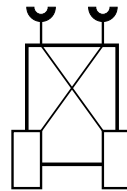
- Inside the creature? A program?
 - If light-left, turn left;
 - if light-right, turn right;
 - else, go-straight
- Behavior organized by the interaction of agent anatomy and environmental patterns

Braitenberg's Vehicle 2

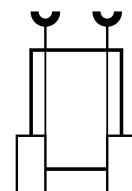


Loves Light

Braitenberg's Vehicle 2



Loves Light



Hates Light

How do you remember what you heard in lecture?

- Taking notes.
- Does this amplify your memory?
- Have you “off loaded” memory into the environment?
- It is a cultural practice that creates a new functional system.
- We must distinguish
 - the cognitive abilities needed to engage in the cultural practice
 - the abilities that are achieved by engaging in the practice.

For Thursday

- Read *CITW* Introduction and Chapter 1
- Start thinking about writing project 1.

Exercise 1: Meaning and space

Physical space
Social space
Conceptual space