

Topics for today

- Beyond the centralized mindset
- A few words about the next reading

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 interactions

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

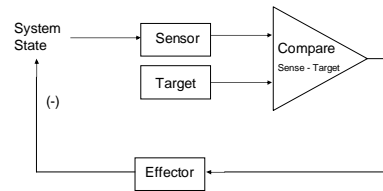
Resnick's five heuristics for moving beyond the centralized mindset

- 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
 - The environment can shape behavior

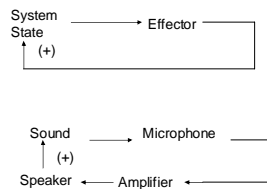
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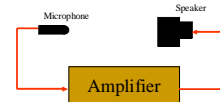
Negative Feedback



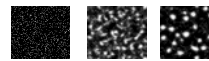
Positive Feedback



Some Positive Feedback loops



- Fires
- Washboard roads
- Structure of the universe
- Coral branching
- Cities
- 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.
- This means that an individual person is a system of distributed cognition

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.

Society of societies of mind (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.

A special relation between society of mind and mind in society

- How do the internal agencies get organized?
- By interaction with the social and material world while engaging in cultural practices.

Systems that can be studied as distributed cognition

- Brain area
- Brain
- Brain plus body
- Whole person
- Groups of persons
- Groups of groups

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"Things" that have ever changing composition:

- Waves
- Clouds
- Language
- Culture

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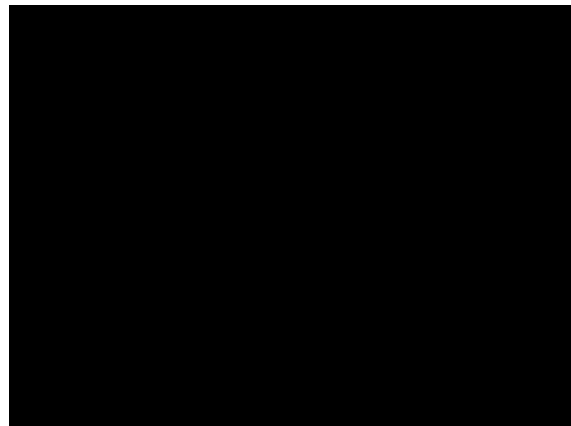
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How do you remember what you heard in lecture?

- Taking notes.
- Does this amplify your memory?
- It is a cultural practice that creates a new functional system.
- We must distinguish the cognitive abilities needed to engage in the cultural practice from the abilities that are achieved via the practice.

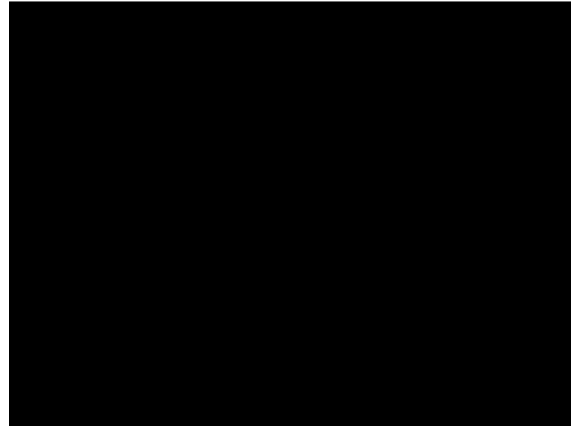
The attribution problem

- 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

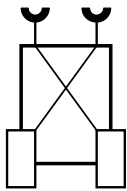


Environmental patterns organize behavior

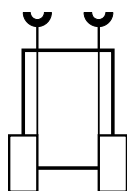
- Where is the source of the observed patterns of behavior?
- Inside the creature? A program?
 - If light-left, turn left;
 - if light-right, turn right;
 - else, go-straight



Braitenberg's Vehicle 2



Loves Light



Hates Light

How to read a paper in this class

- Consult the guidance for the reading on the web site
- Check out the organization of the paper
- Read the abstract or introduction – what do the authors think the paper is about?
- Read the conclusions – what do the authors think they can claim?
- Go back and read the rest of the paper – are the claims justified?

Questions to ask about any system

- What does the system do?
- What information is encoded?
- How is information represented (formally)?
- How is information represented (physically)?
- How are representations propagated through the system?
- Are there any closed loops?
- Are there patterns in the distribution of representations within the system?
- How is cognitive labor distributed?

For Thursday

- Read CITW Introduction and Chapter 1
- Midterm exam in class covering all the readings to date, including CITW.