Emergence and Dynamics
Types of Emergence

• Collective self-organization (applause, stadium wave)
• Unprogrammed functionality (cricket phonotaxis)
• Interactive Complexity (baby stepping)
• Uncompressible unfolding (prediction requires simulation)
Is mind lifelike?

- Self-organizing
- Collective dynamics
- Circular causality
Wideware
Powerful Synergies in Cognitive Science

- Neuroscience (of all kinds)
- Computational modeling
- Robotics
- Dynamical systems theory
- Embodiment
Lead to rapid advances in

- Psychophysics
- Object/event recognition
- Motor control
- Memory
- Spatial processes
- Inter-modality relations

- The mind is bag-of-tricks that exploits subtle properties of all aspects of the cognitive system.
Where’s the rest of me?

Where is reasoning, problem solving, conceptual integration, discourse processes - what we used to call high-level cognition?
High-level cognition is

- In the brain in the form of symbols that ride on top of the sub-symbolic substrate (PSSH).
- In the brain in the form of more bags-of-tricks (cognitive incrementalism).
- In the interaction between the brain and the body and the environment (Wideware).
Some proposals

• **Neural Constructivism** *(Quartz and Sejnowski)*
  – Cortical development is experience-dependent throughout life
  – Learning does not just alter the knowledge base, it alters the computational architecture

• **Wideware** *(Clark)*
  – Low-level processes interact with cognitive technology, wideware, to produce advanced cognition

• **Cognitive Dovetailing** *(Clark)*
  – Neural resources become structured so as to factor reliable external resources and operations into the very heart of their problem solving routines.
Dovetail Joint
Where are the high-level processes?

- Cultural practices organize the engagement of low-level cognitive processes to produce high-level cognitive processes.
The next steps in writing your paper

- Skeptical review of your own paper (not to be turned in).
- Write a first draft (due next Thursday, Nov.10)
Skeptical review of your own ideas

- Clark’s example of a cognitive task
- Making an argument or telling a story
- Claims and evidence
Writing a first draft: Don’t…

• Don’t focus on how long it is.
• Don’t focus on how many references you have.
• Don’t worry about how pretty it is.
• Don’t try to cover up gaps in your knowledge.
Writing a first draft: Do…

• Remember this is only a first draft – it is a step on the way to a better paper.
• Do focus on substance over form, ideas over appearance, depth of insight over fancy language.
• Do try to be clear about what you want to say.
• Do be sure you can understand it. You are the first audience. Can you understand it?
• Do include notes to yourself or to us concerning ways to move forward or additional needs.
• Do allow yourself to be creative.
The parts of a paper: What should I write first?

- Introduction
  - Topic
  - Prior research
- Method
  - Where you found information, how you put the pieces together.
- Analysis
  - Description of the system
  - Interpretation the system in terms of distributed cognition
- Results: what you learned
- Significance: how what you learned relates to other knowledge or how it can be applied.
- Figures: additional material that helps the reader understand the paper
- References
First draft evaluation criteria

• Does the draft show progress since project 3?
• Is the topic clear? What is the system? How is it bounded?
• Does the paper go somewhere? Does it have an idea or make a claim?
• Are claims supported by evidence?
• Is the paper organized in a way that makes the argument easy to recognize and follow?
• Is the connection to distributed cognition clearly stated?