Modeling the emergence of language
The Cognition of Language is Distributed

- It is a cultural practice shared by members of a community
- It is learned from social others
- It continuously changes
- It must have emerged somehow from the interactions of many people over long periods of time
- “What sort of process could lead to the development of a shared language?”
Computational models

• Always oversimplified
• Never a proof that something happened a particular way
• Demonstrations that things could have happened in particular (sometimes very surprising) ways
• Also add an element of persuasiveness in scientific arguments
A new wrinkle in an old challenge

• How do we explain the origin of symbolic communication and symbolic thought in a species whose thinking continues to this day to be embodied and situated?
Three kinds of sign relations

• Icon (form) denotes an object (meaning) by virtue of resembling the object
• Index denotes an object by virtue of some causal connection to the object
• Symbol denotes an object by virtue of a conventional agreement
Core modeling assumptions

• community of agents

• language behavior in interactions between pairs of agents
  – messages are passed from speaker to listener
  – forms (the messages) have meanings
  – the first problem is achieving stable shared form-meaning mappings

• every interaction can change the language a little bit by changing each agent a little bit
What should change as the models “learn” language-like behavior?

• Mutual targeting of behavior
• Each agent imitates the behavior of the others with whom it interacts
• Modulated positive feedback loop
  – form-meaning mappings used by others should be preserved
  – form-meaning mappings not used by others should dissipate
• And it works!
Forms and meanings

• Symbolic forms – symbolic meanings
  – imitation mechanisms to produce well-structured form-meaning mappings.

• Symbolic forms – embodied meanings
  – emerging shared language conventions shape, but do not determine, embodied conceptual structures

• Embodied forms – embodied meanings
Bonobo Carries
Action: the root of enaction

• Complementary action rather than imitation
• Action stands for itself (form and meaning are the same thing)
• Distinguishable and recognized activity frames
• Negotiations concerning What we are doing now.
Decontextualization
Separating form from meaning

• Time
  – action in the subjunctive mood

• Space
  – away from the location of the actual carry or pickup

• Temporal dynamics
  – fluid course of motion “frozen”

• Modality
  – mother experiences the carry as haptic and proprioceptive. The signal is visual
• complementarity and imitation
Two more removes

- from iconic to non-iconic forms
- Impersonal forms
Embodiment implies new challenges for computational models of the emergence of language

• Embodied multimodal interaction with the world
• Intra-agent and inter-agent coordination of multiple modalities
• Cross-modal signals
• No a priori distinction between signals and other phenomena in the world
• Signals as action (opens new forms of emergence followed by appropriation)
More challenges

- Both imitation and complementarity of behaviors
- Recognition of activity frames
So what?

• Embodiment requires us to reshape our understanding of agent environment interactions.
• Agent agent interactions
• And the things that can arise from both of these through history.