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# Embodiment As A Basis For Cognition

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## Abstract

The dominant model of cognition is based upon amodal symbol systems. We support an alternative model that places embodiment at the center of cognition. On this view, sensorimotor experiences of actions form the basis of linguistic and nonlinguistic understanding.

### 1. A Foundation for Intentionality -- Newton

The nature of intentionality (the understanding of meaning) has been a philosophical issue for centuries. What makes things meaningful to us? I propose that intentionality is founded on the performance of goal-directed actions, and that this ability, which makes use of action representations (images) in the initiation and control of actions, involves a primordial form of understanding. All other understanding, including that of language and abstract ideas, develops from this foundation by means of sensorimotor imagery.

### 2. Perceptual Symbol Systems – Barsalou

During this century, developments in logic, statistics, and programming languages have inspired amodal theories of cognition, with perceptual theories viewed as untenable. A modern theory of perceptual symbols is presented that rests on six core properties: neural representation, schematicity, multi-modality, simulation competence, frames, and linguistic indexing. These properties establish a basic conceptual system from which four further properties can be derived: productivity, propositions, variable embodiment, and abstract concepts. Together these ten properties establish a fully functional conceptual system. Empirical support for this approach is summarized briefly, as are implications for cognition, neuroscience, evolution, development, and artificial intelligence.

### 3. The Emergence of Language from Embodiment -- MacWhinney

Symbolic models usually describe thought and language using propositional representations. However these models fail to capture crucial facts about the embodied nature of thought and language. In fact, language is strongly oriented about a core active human perspective that imposes itself

upon the world at four levels: affordances, spatiotemporal maps, causal action chains, and social perspective-taking. On each of these levels, the dynamics of perspective shifting, focusing, coordination, and maintenance induce a variety of alternative linguistic constructions; these, in turn, provide memorial and representational structure to the flexible, embodied perspective that operates on each of the four levels. This approach shows how language structure emerges from the embodied nature of cognition, and points to specific neural mechanisms supporting these integrative systems.

### 4. Indexical Understanding: An Embodied Approach to Meaning -- Glenberg

Consider "After wading in the lake Erik used his shirt/glasses to dry his feet." Why is the sentence sensible with 'shirt' but nonsense with 'glasses?' Both versions are grammatical, both can be represented by connected propositions, and 'shirt' and 'dry' are no more associated than are 'glasses' and 'dry.' I will present data demonstrating a) that people reliably distinguish between these types of sentences, but machines can't. b) People read and understand the sensible version as quickly as control sentences. Thus, judging the sensibility of a sentence is not based on deriving a long sequence of inferences such as 'shirts are made of cloth; cloth is absorbent; absorbent things can be used to dry feet.' c) Sensibility judgments are highly correlated with how easily the actions described by a sentence can be envisioned. Apparently, a reader indexes the words to objects or analog representations such as perceptual symbols. These then determine affordances, that is, how the reader can interact with the objects. If the reader can use the affordances (not the words) to create a sequence of doable actions, the sentence is declared sensible. The process of creating the sequence is what Barsalou calls simulation competence, Glenberg calls mesh, MacWhinney calls taking a perspective, and Newton calls imagining.