

Conceptual Grounding in Cognitive Processes

Arthur M. Glenberg (GLENBERG@WISC.EDU)
Department of Psychology, University of Wisconsin
1202 West Johnson Street, Madison, WI 53706, USA

Stevan Harnad (HARNAD@ECS.SOTON.AC.UK)
School of Electronics and Computer Science
University of Southampton, SO17 1BJ, UK

Robert L. Goldstone (RGOLDSTO@INDIANA.EDU)
Department of Psychology, Indiana University
1101 E 10th St., Bloomington, IN. 47405-7007, USA

Katja Wiemer-Hastings (KATJA@NIU.EDU)
Department of Psychology, Northern Illinois University
DeKalb, IL 60115, USA

Rolf A. Zwaan (ZWAAN@PSY.FSU.EDU)
Department of Psychology, Florida State University
Tallahassee, FL 32303-1270, USA

Grounded Representations

Cognitive Scientists have long grappled with the question how concepts are grounded in experiences. Recent years have witnessed a surge of interest in the grounding of conceptual knowledge in perceptual processes and actions. Important questions that have been part of the debate range from the necessity of grounding (from a theoretical perspective) to possible mechanisms (from an empirical perspective). This symposium addresses new evidence relevant to the grounding of cognition in perception and action from a variety of perspectives. Stevan Harnad will serve as symposium discussant.

Knowing That Is Knowing How (Harnad)

There is a tendency to partition cognition into sensorimotor skills and abstract knowledge, but knowing is a skill too, and abstractness is just a matter of degree. I will discuss the sensorimotor grounding of categorization and language.

On the limits of covariation: How much grounding is enough? (Glenberg)

Do all concepts need to be grounded for the cognitive system to work? Can some concepts be grounded by their relations to other concepts that are themselves grounded in sensorimotor experience? If so, what proportion of the cognitive system needs to be grounded for the whole system to work? Claims about the success of ungrounded systems (e.g., HAL, LSA) in accounting for human cognition suggest that little or no grounding in sensorimotor experience is necessary. In contrast, data on the embodiment of cognition demonstrate that simple language and many concepts are firmly grounded in sensorimotor experience. It has been difficult to come to any consensus between these positions because there have been no empirical methods for answering questions about the extent of grounding needed. I will describe research using a new paradigm designed to determine how much grounding is necessary for people to use newly learned symbolic relations.

Connecting Concepts to the World and Each Other (Goldstone)

Two kinds of information can be used to translate between the concepts in two persons' minds: the relations between concepts within each person's mind, and external grounding of the concepts. I describe two variants of a computational model that integrates internal and external determinants for concept translations. The first variant represents systems in terms of similarity relations between concepts within the system. The second variant represents systems by graphs representing within-system relations. The models show that appropriate translations can often be found by considering only relational information within systems. However, simulations also indicate synergistic interactions between internal and external sources of information. Implications for analogical reasoning, translation, subgraph matching, and object recognition are considered.

Access to perceptual features during word recognition (Wiemer-Hastings & Kurby)

The sharing of neural systems by cognitive and sensorimotor processes has been considered an indicator for perceptually grounded representations. However, this is only true if it can be established that the sensorimotor processes are activated as part of the concept's activation. An adaptation paradigm was applied to test this empirically. Participants were slower to recognize names of objects when adapted to perceptual features (orientation, color) of these objects. Thus, our data supports the view that perceptual representations are activated during conceptual access. More broadly, these findings are consistent with models that conceptualize representations as perceptual simulations.

Seeing, Acting, Understanding: Evidence for a Simulationist Account of Language Comprehension (Zwaan & Taylor)

An emerging perspective in the literature conceptualizes language comprehension as a form of mental simulation involving sensorimotor representations and processes. Here,

we explore a new topic: the relation between visual and motor representations in language-induced mental simulations. In Experiment 1, we show that a rotating visual stimulus affects manual rotation, such that congruent rotations are faster than incongruent rotations. In Experiment 2, we show that comprehending a sentence about manual rotation (e.g., "Eric turned down the volume") affects actual manual rotation speed. Finally, in Experiment 3, we show that a rotating visual stimulus affects the comprehension of manual rotation sentences. We discuss these findings in the context of theories and models of multisensory integration and action understanding.