11/30/11: Embodiment

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology, 59*, 617-645.

Standard theory

Modal system representations → amodal symbols = Knowledge

Perceptions → thought

Problems:

1. Little empirical evidence for the presence of amodal symbols.
2. Fails to explain how cognition interfaces with perception and action.
3. Where the brain stores amodal symbols.

Grounded cognition

Modal system representations + symbols

Knowledge

-Mechanisms central to cognition: Simulation, Situated action, Bodily states

Simulation: "reenactment of perceptual, motor, and introspective states acquired during experience with the world, body, and mind." (Ex: Chair)

-Instead of fixed representations, multiple systems implement perception, action, and cognition with an infinite number of combinations or states.

Learning: Coupling between these states

-Perceptual symbol systems (PSS): retains the symbols of traditional theories but implements them with simulation and dynamic systems.

Evidence

Perception

-Retrieving stimuli activate the perceptual states in which they were encoded.

-Distort the recall of a red square towards the dark red square previously seen.

-A gray banana is recalled as a bluish banana.

-Perception-action

-Handle of a cup activates a grasping action.

-Space

-Locating objects is easiest along the vertical axis, then front-back axis, then left-right axis.

Memory

-Implicit memory results from the simulation of perceptual memories.

-Repetition priming is strongest with the modalities of the memory and stimulus match.

-Explicit memory

-Similar neural pattern when studying faces as when remembering them.

-Greater activation in modal areas when remembering an item that actually occurred compared to when remembering an item that did not actually occur.

-Working memory

-To maintain a working memory, neurons in the frontal lobes simulate the absent stimulus in the modal system that originally encoded it.

Conceptual Processing
-Behavioral evidence
-Switching from one modality to another while simulating properties incurs a switch cost.
-Lesion evidence
-Lesions in a modality increase the likelihood of losing categories that rely on it.
-Neuroimaging evidence
-When performing the property verification task, modal areas for the properties tested become active.

Language Comprehension
-Replacing words with pictures does not disrupt processing.
-"The ranger saw the eagle in the sky." Faster to name the eagle with outstretched wings.
-Motor system becomes active when reading the word for an action.
-When people read taboo words, increase skin conductance.

Thought
-Physical reasoning
-When viewing a static gear, people simulate its movement. (The slower its movement, the more time to draw an inference.)
-Inferences suffer when WM is filled with visuospatial information compared to verbal.
-Abstract reasoning
-"Next Wednesday's meeting has been moved forward two days."
-"Foot of a mountain."
-"She ran like the wind."

Social Cognition
-Embodiment effects
-People walk slower after activating the elderly stereotype.
-When forced to smile, people report increased positive affect.
-Pattern completion: You smile because you smiled there before.
-Social mirroring
-Mirror neurons
-Infer the intentions of others by simulating their actions.

Discussion points

Is there a difference between simulation that includes a stimulus that actually occurred and simulation that includes a stimulus that did not actually occur?

-Modal areas are still activated

-"…internal states such as meta-cognition and affect constitute sources of knowledge no less important than external experience."

Abstract concepts
Do metaphors actually represent how people think?
"Foot of a mountain."

Physical reasoning
Can we never view a gear without simulating its motion?

Social Cognition
Do we need to simulate their actions to infer their intentions?

Are simulations and embodiments causal or epiphenomenal?