Metaphor in the Mind and Hands

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Introduction

Do metaphors in language reveal the structure of abstract concepts? One possibility is that linguistic metaphors are only important for understanding cognition in the way that fossils are important for understanding biology. On this *Cognitive Archaeology* view the fact that people describe things they can never see or touch (e.g., emotions, prices) by using metaphors to more perceptible phenomena (e.g., objects rising or falling) merely reveals inert evolutionary or historical connections between abstract and concrete domains of knowledge. On another possibility, the *Representational Recycling* view, linguistic metaphors indicate that people reuse the same mental representations that support reasoning about physical domains (e.g., *space*, *motion*) whenever they instantiate abstract concepts like *value* or *time*. This view cannot be tested with linguistic data alone since, by hypothesis, people recycle perceptual representations to support abstract thought even when they're not using metaphorical language. In the present study, we examined spontaneous gestures during storytelling to elucidate relationships between linguistic metaphors and abstract concepts.

Experiment 1: Spatializing the Non-Spatial

Fourteen pairs of Stanford University undergraduates took turns reading and retelling brief stories. Participants were aware that they were videotaped, but were unaware that the experiment had anything to do with gestures. Each participant retold three types of stories, which contained either (a) literal spatial language (e.g., The rocket *went higher*) (b) metaphorical spatial language (e.g., The temperature *went higher*) or (c) non-spatial language (e.g., The temperature *got hotter*). Literal Spatial Language (LSL) stories described physical objects and events oriented along either a horizontal or vertical axis, and directed either upward, downward, right, or left. Metaphorical Spatial Language (MSL) stories described non-spatial phenomena that are nevertheless commonly expressed using spatial metaphors implying both orientation and direction (e.g., *looking forward to* the future; the price *went lower*). Non-Spatial Language (NSL) stories were identical to the MSL stories, except that all metaphorical spatial language was replaced with non-spatial language conveying nearly the same meaning (e.g., *anticipating* the future; the price *got cheaper*). The LSL condition was included to confirm that participants would produce spontaneous gestures consistent with the direction and orientation of the physical spatial scenario described in the story. For the MSL condition, we hypothesized that if people not only talk about abstract

concepts using spatial words but also *think* about them using 'recycled' spatial representations, then participants should produce gestures consistent with the metaphorical spatial schemas implied by the stories. The NSL condition provided a stronger test of this hypothesis.

Results overwhelmingly supported the *Representational Recycling* view. The majority of participants' gestures were consistent with the orientations and directions of the spatial schemas implied by the stories they retold (Figure 1). This was true not only in the Literal Spatial Language condition (e.g., upward gesture accompanying "the rocket *went higher*"), but also in the Metaphorical Spatial Language condition (e.g., upward gesture accompanying "the temperature *went higher*"), and critically in the Non-Spatial Language condition, as well (e.g., upward gesture accompanying "the temperature *got hotter*"). Even when participants used no spatial language, their gestures revealed the spatial nature of the abstract concepts they expressed.
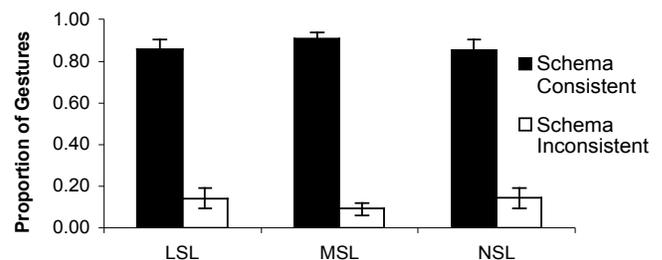

Figure 1. Results of Experiment 1. The proportion of Schema-Consistent gestures was significantly greater than the proportion of Schema-Inconsistent gestures for all conditions (p<.00001). Proportions did not differ significantly between conditions.

Experiment 2: Functional or Epiphenomenal?

A second experiment explored the functional significance of these gestures. Materials and procedures were identical to those used in Experiment 1, with one exception: participants (twelve pairs of Stanford University undergraduates) held down buttons with both hands during storytelling to prevent them from gesturing. We hypothesized that if gestures aid speakers in accessing spatial words or schemas, then preventing gestures should increase verbal disfluency when expressing target ideas (e.g., *lower* floor, *lower* price, *cheaper* price).

Results showed that participants who were prevented from gesturing were dramatically more disfluent for target ideas (but not for non-target ideas) compared with participants who were allowed to gesture. This was true even in the NSL condition, suggesting that gestures help speakers to access spatial schemas -- not just spatial words.