Title
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Asymmetry in analogical reasoning has generally been assumed to occur at the post-mapping inference stage, with the mappings themselves being inherently symmetric. However, unlike previous theoretical explanations and computational models, the LISA (Learning and Inference with Schemas and Analogies) model of analogical reasoning (Hummel & Holyoak, 1997) makes the unique prediction of asymmetry at the mapping stage. This prediction is a direct result of LISA's mapping algorithm. LISA performs mapping based on a process of limited-capacity guided pattern recognition, where a *driver* analog creates a pattern of activation through sequential firing of its propositions which is received in parallel by a *recipient* analog. This mapping algorithm predicts an asymmetry in mapping between two analogs with differing levels of causal semantic content, depending on which analog is the driver and which is the recipient.

In previous work (Kubose, Holyoak, & Hummel, 1997), we tested this prediction by measuring mapping performance between two structurally isomorphic analogs with differing levels of causal content (using a task similar to that of Keane, 1997). Both simulation results and human performance revealed asymmetry, with mapping being more accurate when the driver analog contained causal semantic content and the recipient analog contained noncausal semantic content and less accurate when the driver analog contained noncausal semantic content and the recipient contained causal semantic content. That is, there was an asymmetry in mapping accuracy between two analogs with different levels of causal content.

To replicate and extend these findings, we constructed a similar mapping task using more meaningful materials, Duncker's (1945) Tumor problem, and the analogous Fortress story (Gick & Holyoak, 1980). While analogous, these materials also contain different amounts of causal information. The Fortress story, because it includes a solution to the problem, is more structurally and causally coherent than the Tumor story, which lacks a solution. We predicted that this difference in structural and causal coherence would generate an asymmetry in mapping accuracy when the roles of driver and recipient analog are varied betweem the two stories. The greater causal coherence in the Fortress story leads to more optimal processing when it is the driver analog, which should generate more accurate mappings. In contrast, when the Tumor problem is in the role of driver analog, its lower coherence should result in suboptimal processing, and hence less accurate mappings. We also predicted that, due to the asymmetry in mapping accuracy, the solution rate of the Tumor problem would also differ as a function of the mapping direction, with a higher frequency of correct solutions when the Fortress is the driver analog than when the Tumor is the driver analog.

We tested these predictions, and found that mapping performance for both LISA and college students was significantly more accurate when the Fortress story was the driver analog and the Tumor problem was the recipient analog (88%) than when the Tumor problem was the driver and the Fortress story the recipient (76%). In addition, the solution rate for the Tumor problem was greater when the Fortress was the driver and the Tumor the recipient (45%) than vice versa (31%).

In addition to providing additional evidence of asymmetries in mapping, for both human reasoners and LISA, our results have educational implications regarding the optimal focus of attention during analogical problem solving.

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