NORTH IS UP: Spatial metaphor, geography knowledge, and language use

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Recent studies in geographical and spatial cognition provide evidence for a variety of findings related to the mapping NORTH IS UP. For example, participants infer greater effort for travel northward (Nelson and Simmonds, 2009), even when southern routes involve greater elevation gain (Brunye, et al., 2012). The current study explored how mapping cardinal directions onto egocentric space affects participants' ability to report geographic relationships in a mousetracking paradigm (Freeman and Ambady, 2010), and how individual differences in geography knowledge and language use interact with this mapping.

In this study, participants from a California university decided which of two locations is either farther north, or farther south. See Figure 1 for an example trial. When the participant clicked the "start" box, the question (either "Which one is farther NORTH?" or "Which one is farther SOUTH?") and the two images of California locations appeared. These images were either in a map-canonical configuration, with the northern location at the top of the screen, or reversed (as in Fig. 1). The mouse's trajectory as the participant clicks their response allows indexing of uncertainty and attraction towards the competitor response.

Initial results demonstrate that spatial metaphor affects geographic relationship decisions. The map-reversed orientation resulted in significantly more attraction to the incorrect response: Participants' average trajectory from start to correct response was closer to the distractor in reversed-orientation trials, and the closest point along the trajectory to the competitor was also closer in reversed trials. Participants also made more y-axis reversals, revealing increased uncertainty in reversed trials. As a control condition, participants were also asked to make decisions about east-west geographic relationships. For these trials, images' position on the screen did not increase uncertainty or attraction to competitor responses.

To assess the role of individuals' language use patterns, we asked each participant to fill in the prepositions of their choice in a cloze task describing a road trip. Participants' frequency of using "up" and "down" for north and south predicted their overall degree of attraction towards competitor responses. To assess the role of individuals' geography knowledge, we asked each participant how familiar they were with different regions of the state. Participants relied more on the NORTH IS UP mapping when they are less familiar with the locations. So, someone from the Los Angeles area and unfamiliar with the Sierra showed more competitor attraction for trials with unfamiliar locations (Yosemite above Lake Tahoe), than familiar locations (Disneyland above Hollywood).

The result that spatial metaphor influences geographic decisions provides evidence for nonlinguistic conceptual metaphors; however, the individual difference effects can only be accommodated within dynamical systems accounts of conceptual metaphor (e.g., Gibbs and Cameron, 2008), which emphasize interactions of causal factors at multiple time scales. Here, metaphorical thinking depends on cultural factors (the conceptual metaphors available within the culture), ontogenetic factors (familiarity with different locations), and experiential factors (in-the-moment word choice). These factors interact to drive metaphorical thought during the geographic decision task, just as they do during figurative language interpretation.

Figure 1: Reversed-orientation trial, Disney above Alcatraz