Embodied and disembodied cognition: Spatial perspective-taking

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ABSTRACT

Although people can take spatial perspectives different from their own, it is widely assumed that egocentric perspectives are natural and have primacy. Two studies asked respondents to describe the spatial relations between two objects on a table in photographed scenes; in some versions, a person sitting behind the objects was either looking at or reaching for one of the objects. The mere presence of another person in a position to act on the objects induced a good proportion of respondents to describe the spatial relations from that person's point of view (Experiment 1). When the query about the spatial relations was phrased in terms of action, more respondents took the other's perspective than their own (Experiment 2). The implication of action elicits spontaneous spatial perspective-taking, seemingly in the service of understanding the other's actions.

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1. Introduction

The mind is locked in a body that, at any time, occupies a specific place and faces a specific direction. These undeniable facts form part of the basis for embodied cognition. It is natural, then, to think that an egocentric perspective on space has primacy: that is, that an egocentric perspective is immediate, and that taking other perspectives requires extra mental effort. Indeed, the premise of egocentric primacy pervades theories of spatial cognition (e.g., Golledge, 1992; Hart & Moore, 1973; Levelt, 1989; Piaget & Inhelder, 1956; Pick & Lockman, 1981; Shelton & McNamara, 1997). Yet, to navigate in and communicate about the world, other representations of space are needed. The primacy of egocentric perspective has been challenged by research showing that rats, monkeys, and people on first encountering an environment immediately form multiple representations of space, in particular, allocentric representations (e.g., Graziano & Gross, 1994; Mou, McNamara, Valiquette, & Rump, 2004; O'Keefe & Nadel, 1978; Tipper & Behrmann, 1996; Tversky, Lee, & Mainwaring, 1999). In an egocentric perspective, objects are represented or described with respect to the body, using terms like *front, back, left,* and *right*. In an allocentric perspective, objects are represented or described with respect to each other, using an environmental frame of reference such as north–south–east–west. Indeed, people often spontaneously choose allocentric perspectives to describe environments, even those experienced only from exploration (e.g., Taylor & Tversky, 1996).

Egocentric and allocentric perspectives are not the only possible perspectives on space. Importantly, there is my (egocentric) perspective and yours, self and other. People are inherently social beings. Consequently, people find themselves in situations requiring taking another's perspective. One such situation occurs commonly in conversation; for example, when one person asks another where something is. In this kind of situation, people typically favor the other's perspective to their own, (e.g., Mainwaring, Tversky, Ohgishi, & Schiano, 2003; Schober, 1993, 1995). But because in these situations, the descriptions were designed for others, the preference for describing spatial relations from the other's perspective does not imply that taking the other's perspective is immediate or primary.

Could there be spatial situations in which people spontaneously adopt another's perspective rather than their own, even when not communicating to other person? Con-

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Fig. 1. Scenes used in Studies 1 and 2. Participants in Study 1 were shown one of the three scenes, depending on condition: *reaching* scene (a), *looking* scene (b), or *no person* scene (c). Participants in Study 2 were shown only the scene of an actor reaching for an object (a).

versation is only one example of a social situation that encourages perspective-taking. Another situation is interaction of bodies rather than voices. Even simple social interactions, such as accepting a cup of coffee from someone or negotiating the crowd on the street, require anticipating the actions of others in order to coordinate our own. Anticipating others' actions may also help to understand those actions even without the intent or immediate need to respond. Watching a tennis serve, observing how to buy a train ticket in a foreign country, studying an effective public speaker are examples. Taking the perspective of the other may be effective both for planning responses to others' actions and for understanding and learning them. Thus, it is possible that simply seeing another person in a scene near objects in grasping range will elicit some spontaneous perspective-taking.

Would the mere presence of another in a scene with the potential for action elicit taking that person's perspective, without any demand to communicate to that person? This is the first question addressed here, in a simple, direct task. A questionnaire included a photograph of a bottle and a book on a table, with or without a person behind the table (see Fig. 1), below which was a question: In relation to the bottle, where is the book? Would participants respond using their own right and left, or use right and left with respect to the other's perspective? The expectation was that the presence of another person in the scene, especially one related to and likely to use the objects whose spatial relations are queried, would induce some participants to take the other person's perspective rather than their own.

If perspective-taking is related to understanding or anticipating another's actions, then calling attention to action by phrasing a question about the spatial relations between the objects in terms of action should increase perspective-taking. Thus a second study compared static questions like that of the first experiment to action questions.

2. Study 1: mere presence of another elicits spatial perspective-taking

Does the mere presence of a person in a scene with two salient objects placed on a table near the person cause some respondents to spontaneously take the spatial perspective of the other person rather than their own?

2.1. Method

One hundred Stanford and 90 University of Oregon undergraduates were presented with one of the three pho-

tographs in Fig. 1 and asked: "In relation to the bottle, where is the book?" The *no person* ($n = 64$) photograph showed a bottle and a book on a table. Two other photographs included a person sitting behind the table, either *looking* ($n = 64$) at the book or *reaching* ($n = 62$) for it. In both studies, the photograph and question were part of a large set of unrelated questionnaires students completed for course credit, at Stanford, a paper booklet, and at University of Oregon, online. There were no differences between Stanford and University of Oregon undergraduates in any of the results in either study so the results were combined.

2.2. Results

The responses were scored as *self* perspective if the answer provided was from the viewer's viewpoint, *other* if the answer was from the person in the scene's viewpoint, and *neutral* if the answer gave spatial information from neither perspective, for example, "next to." Examples of responses scored as *self* include: "right," "on the right," "about a foot to the right," "to the right of the bottle from my perspective." Examples scored as "other" include: "left," "to his left," "to the left according to the way he is facing," "to the left (relative to his perspective)." Four participants (one other perspective and 3 self perspective) used both perspectives in their response, writing, for example, "my right, his left." In those cases, the first perspective mentioned determined the coding category. Examples scored as neutral include: "across the table," "to the side," "parallel," "a foot away." In describing spatial relations, people often avoid using *left* and *right* (e.g., Mainwaring et al., 2003) because these terms are more difficult than other spatial relation terms, like *front, across,* or *near* (e.g., Franklin & Tversky, 1990).

Scored responses were converted into two binary variables for analysis: one variable was coded 1 if the response was *self* perspective and 0 if it was not; the second variable was coded 1 if the response was *other* perspective and 0 if it was not. These variables were each analyzed with a one-way Analysis of Variance, followed by two planned contrasts: one comparing the *no person* photograph to the photographs depicting a person (*looking* and *reaching*) and another comparing the *looking* to the *reaching* photograph. For all analyses, the criterion for significance was alpha level less than .05. We report partial eta squared (η_p^2) as an estimate of effect size for significant ANOVA effects, and Cohen's *d* for significant *t*-test effects.

The photograph viewed affected the frequency of *other* perspective, $F(2, 187) = 8.26$, $p < .05$, $\eta^2 = .08$. As evident