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The conversational partner's perspective affects spatial memory and descriptions

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ABSTRACT

We examined whether people spontaneously represent the partner's viewpoint in spatial memory when it is available in advance and whether they adapt their spontaneous descriptions accordingly. In 18 pairs, Directors studied arrays of objects while: (1) not knowing about having to describe the array to a Matcher, (2) knowing about the subsequent description, and (3) knowing the Matcher's subsequent viewpoint, which was offset by 90°, 135°, or 180°. In memory tests preceding descriptions, Directors represented the Matcher's viewpoint when it was known during study, taking longer to imagine orienting to perspectives aligned with it and rotating their drawings of arrays toward it. Conversely, when Directors didn't know their Matcher's viewpoint, they encoded arrays egocentrically, being faster to imagine orienting to and to respond from perspectives aligned with their own. Directors adapted their descriptions flexibly, using partner-centered spatial expressions more frequently when misaligned by 90° and egocentric ones when misaligned by 135°. Knowing their misalignment in advance helped partners recognize when descriptions would be most difficult for Directors (at 135°) and to mutually agree on using their perspective. Thus, in collaborative tasks, people don't rely exclusively on their spatial memory but also use other pertinent perceptual information (e.g., their misalignment from their partner) to assess the computational demands on each partner and select strategies that maximize the efficiency of communication.

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Introduction

When people provide driving directions, describe places they have been to, or instruct a colleague about where to locate a folder in the office, they rely on their ability to recall accurately and communicate effectively spatial information. In such situations, where people try to achieve mutual understanding or a joint goal, they routinely consider their conversational partner's specific needs, knowledge, or per-

spective and adjust their behavior accordingly (Clark, 1996; Clark & Carlson, 1982; Clark & Murphy, 1982). For example, they may consider how familiar their partner is with the environment and adjust the detail of their descriptions (Hölscher, Tenbrink, & Wiener, 2011; Isaacs & Clark, 1987). Or, if they occupy a different vantage point than their partner, as they often do when providing directions over the phone or when moving a piece of furniture together, they may tailor their spatial descriptions to their partner's perspective (e.g., Schober, 1993, 1995).

Making a spatial judgment, and presumably also communicating spatial information, involves accessing memory representations that maintain the spatial relations between objects and are organized around a preferred

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direction (e.g., McNamara, 2003; Mou, McNamara, Valiquette, & Rump, 2004). The preferred direction of these representations is determined by various sources of information, including their initially experienced perspective (Shelton & McNamara, 2001), the environment's geometry (Shelton & McNamara, 2001), the symmetry or intrinsic structure of the spatial configuration (Li, Carlson, Mou, Williams, & Miller, 2011; Mou & McNamara, 2002), the functional features of landmarks in the configuration (Taylor & Tversky, 1992), as well as instructions emphasizing a particular orientation (Greenauer & Waller, 2008). In other words, the preferred organizing direction that people adopt is not limited to egocentric experience, but can be aligned with non-experienced perspectives reinforced by other cues.

In this work, we examine whether the partner's viewing perspective also serves as such a cue (when available), contributing to how people spontaneously organize spatial information in memory and how they subsequently describe this information. We begin by surveying studies using collaborative tasks that highlight some of the cognitive and social factors that influence spatial perspective-taking. These studies underscore that, on the basis of a number of cognitive and social constraints, people make attributions about the partner's ability to contribute to the task at hand, which influence whether they adopt their partner's perspective. Because these studies typically focus only on people's linguistic choices, it remains unclear (a) whether the partner's perspective is encoded in the memory representations supporting perspective-taking in communication, and (b) the extent to which, when communicating spatial information, people rely on the organization of these memory representations that potentially encode their partner's perspective. With this motivation, we then present our study and, using theoretical frameworks from conversational perspective-taking, make predictions about the circumstances under which the partner's viewpoint is represented in spatial memory and affects spatial descriptions.

Cognitive and social constraints on spatial perspective-taking

There has been some debate about the extent to which people readily adopt their partner's perspective in conversation. When people share the same linguistic or physical perspective, adopting the partner's perspective may be trivially easy. Under these circumstances of having same viewpoint (whether spatial or conceptual), linguistic or behavioral adjustments may be generic and not specific to the partner's needs (Brown & Dell, 1987; Dell & Brown, 1991). When people have perspectives or knowledge distinct from their partner's, some studies suggest that speakers initially behave egocentrically, failing to take the partner's perspective into account and considering it only later in order to repair misunderstandings (Horton & Keysar, 1996; Keysar, Barr, Balin, & Paek, 1998; Keysar, Barr, & Horton, 1998; Pickering & Garrod, 2004). However, other studies demonstrate that under the right circumstances people can adapt early and flexibly to their

partner's perspective (e.g., Hanna, Tanenhaus, & Trueswell, 2003; Metzger & Brennan, 2003). According to this latter view, failures in perspective-taking occur when executive functioning is taxed (Brown-Schmidt, 2009) or when information about the partner isn't available early enough (Kraljic & Brennan, 2005) or requires complex inferences (Gerrig, Brennan, & Ohaeri, 2000). But when information about the partner can be represented as simple, relevant distinctions, it can have an immediate effect on behavior, particularly if these distinctions are computed easily and known early (e.g., Brennan & Hanna, 2009; Galati & Brennan, 2010).

Our hypothesis is that the factors predicting adaptation during non-spatial perspective-taking predict adaptation in spatial perspective-taking as well. Thus, speakers' cognitive constraints should influence not only whether they readily consider their partner's conceptual perspective, knowledge, or agenda (see Schober, 1998) but also whether they consider their partner's spatial viewpoint. More specifically, both the speaker's own and their partner's cognitive constraints in adopting the other's perspective should influence whose perspective is selected in conversation. Indeed, the relative cognitive demands of partners, depending on their misalignment, influence speakers' descriptions: compared to when partners share the same perspective, speakers with misaligned partners are more likely to adopt their partner's perspective and use partner-centered descriptions (e.g., "to your left" or "in front of you") than egocentric ones (Schober, 1993, 1995). The partners' relative cognitive demands, depending on the framing of the task, also influence spatial descriptions (Mainwaring, Tversky, Ohgishi, & Schiano, 2003). Replicating Schober (1993, 1995) and Mainwaring and colleagues (2003) found that when speakers described spatial information to a misaligned imaginary partner, who presumably bore more of the cognitive burden, they were more likely to adopt their partner's perspective than their own. Conversely, when speakers described spatial information for themselves, thus bearing the cognitive burden exclusively, they were more likely to adopt their own perspective than their partner's. And when the cognitive burden was presumably more equally distributed, when speakers formulated yes/no questions to request spatial information, they were more likely to use neutral perspectives (including landmarks and compass directions) than person-centered ones.

These findings are consistent with the proposal that partners follow the *principle of least collaborative effort*: they share responsibility for mutual understanding and adapt their behavior to maximize the efficiency of communication, while minimizing the collective effort of themselves and their partner (Clark, 1996; Clark & Wilkes-Gibbs, 1986). Such adaptation is especially evident when the partners' respective ability to contribute to the task differs, as when there are asymmetries in visual evidence about the partner's progress in a task (Brennan, 2004), or when interacting with a non-native speaker (Bortfeld & Brennan, 1997). Evidence for such adaptation in spatial perspective-taking comes from a task where partners were preselected to have matched or mismatched spatial abilities, assessed by a mental rotation task

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