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Privileged versus shared knowledge about object identity in real-time referential processing

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ABSTRACT

A central claim in research on interactive conversation is that listeners use the knowledge assumed to be shared with a conversational partner to guide their understanding of utterances from the earliest moments of processing. In the present study we investigated whether this claim extends to cases where shared vs. private knowledge is discrepant in terms of the identity assigned to a mutually seen object that could be misidentified on the basis of its appearance. Eye movement measures were used to evaluate listeners' ability to integrate a speaker's perspective as they identified the referent for an unfolding expression. The results reconfirmed previous findings showing that listeners can rapidly take into account a speaker's awareness of the *existence/presence* of a referential object. In contrast, however, listeners showed strong consideration of their private knowledge about the *identity* of an object during referential processing. Strikingly, this tendency was found even when speaker-produced discourse reinforced the way in which the speaker's understanding of the object's identity differed from that of the listener. Together, the results reveal clear and important differences in the way in which distinct types of perspective-based cues are integrated in real-time communicative interaction.

1. Introduction

Successful communication requires conversational participants to differentiate between what is known to all interlocutors (shared information) vs. what is known to only themselves (privileged information). Indeed, numerous psycholinguistic studies have shown that speakers take shared knowledge into account when constructing utterances, and that addressees use shared knowledge to guide their understanding of utterances (e.g., Clark, Schreuder, & Buttrick, 1983; Fussell & Krauss, 1989; Gerrig & Littman, 1990; Gibbs, Mueller, & Cox, 1988). For a given conversational participant, determining what information is likely shared and what is privileged is itself a complex process that draws on multiple sources of information such as community membership as well as the situational and linguistic context (Clark & Marshall, 1981) and, accordingly, entails various cognitive demands. Consequently, one question that is still widely discussed in contemporary work on real-time referential processing involves the extent to which shared and privileged knowledge are effectively differentiated in the earliest moments of comprehension (e.g., Barr, 2008b; Brown-Schmidt, 2012; Brown-Schmidt, Gunlogson, & Tanenhaus, 2008; Ferguson & Breheny, 2011; Ferguson & Breheny, 2012; Hanna & Tanenhaus, 2004; Hanna, Tanenhaus, & Trueswell, 2003; Heller, Grodner, & Tanenhaus, 2008; Keysar, Barr, Balin, & Brauner, 2000; Keysar, Barr, & Horton, 1998; Keysar, Lin, & Barr, 2003; Lin, Keysar, & Epley, 2010).

In most experimental studies addressing this question, the status of knowledge as privileged vs. shared is manipulated by varying the *physical co-presence* of the entities that are available for reference. For example, an object may be visually occluded from the perspective of one conversational partner, thereby preventing that partner from knowing whether there is an object behind the occluder (and what it is). By incorporating this individual's perspective, the other partner should, in turn, reduce any expectation for that object to be referred to. In the current study, knowledge differences are instead manipulated by varying interlocutors' understanding of the "identity" of entities in a situation where their existence and physical co-presence is already established. This is achieved through the use of objects whose outward appearance is potentially deceptive when it comes to the task of determining the category to which the object belongs (e.g., a candle that looks like a lightbulb). As we will show, a direct comparison of perspective differences involving physical co-presence vs. the identity of entities can provide new and important insights into

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the underlying processes used to manage knowledge discrepancies in conversational contexts.

In the following sections, we provide a brief overview of research examining listeners' use of perspective information in the course of real-time referential interpretation, as well as research examining the ability to overcome misleading visual cues about an object's true nature. We then describe a series of experiments investigating listeners' ability to coordinate shared and privileged knowledge about object identity in the course of real time spoken language comprehension.

1.1. Perspective and common ground in real-time comprehension

As mentioned earlier, a core issue discussed in many recent studies of common ground in comprehension is the time course with which comprehenders can integrate knowledge about a conversational partner's knowledge and beliefs as language is heard. This is an important question because establishing the timing of common ground integration relative to other processes involved in language comprehension, such as syntactic and semantic analyses, is critical for delineating the architecture of the language comprehension system. To address this question, studies typically use a visual-world eye tracking methodology to measure the point at which shared knowledge (i.e., "common ground") is used in the course of interpreting an unfolding referential expression. Some studies have suggested that a listener's egocentric perspective predominates during language processing and that the integration of common ground occurs only if linguistic input fails to disambiguate the referent (e.g., Barr, 2008b; Keysar et al., 1998; Keysar et al., 2000; Keysar et al., 2003; Kronmüller & Barr, 2007; Pickering & Garrod, 2004). For example, in Keysar et al. (2000), critical displays included multiple objects from the same category, such as three candles that differed in size (e.g., small, medium, and large). On critical trials, the addressee/participant was directed by a physically co-present speaker/confederate to *pick up the small candle* in a situation where the smallest candle visible to the addressee was not visible to the speaker. The authors reported that addressees' eye movement behavior reflected an initial tendency to first consider this "privileged-perspective" object (smallest candle) as a referential candidate, and only well past the offset of the critical adjective did addressees identify the smaller of the two mutually-visible candles as the intended referent.

However, evidence from other studies has challenged the egocentric-first view by showing that, although addressees do not inhibit their egocentric perspective completely, shared knowledge does have a measurable influence on referential mappings from the earliest moments of interpretation in a variety of circumstances involving different types of referring expressions (e.g., Brown-Schmidt, 2012; Brown-Schmidt et al., 2008; Ferguson & Breheny, 2011; Ferguson & Breheny, 2012; Hanna & Tanenhaus, 2004; Hanna et al., 2003; Heller et al., 2008). For example, Heller et al. drew on known properties of referential contrast to test whether addressees are sensitive to the distinction between shared and privileged knowledge as temporarily ambiguous modifiers were heard in real time. Critical displays contained two sets of objects contrasting in size (e.g., big box vs. small box and big duck vs. small duck). A member of one of the contrasting pairs was visible only to the addressee (e.g., the small box was hidden from the speaker's view) whereas both members of the other pair (big duck and small duck) were mutually visible. The authors showed that, upon hearing the temporarily ambiguous contrastive adjective in instructions such as *pick up the big duck*, addressees rapidly limited consideration to the intended target object due to its membership in the mutually known contrast set. The other object that was semantically compatible with the adjective (big box) was not considered because this item would not require a modifier from the speaker's perspective (and instead would simply be called *the box*). This growing body of work suggests that shared and privileged knowledge about referential candidates is effectively managed at both larger and smaller time scales, including temporary indeterminacies in the unfolding signal.

It is important to consider, however, other kinds of knowledge discrepancies that might be more challenging for comprehenders to manage, perhaps because they involve different kinds of underlying mechanisms. In the studies described above, knowledge differences across speakers and listeners were manipulated by varying what we will call the "existence" of referential entities in the situational context. In a typical experiment, the speaker (a confederate) instructs the addressee (the actual participant) to move objects located in open shelf compartments, some of which are not visible from the perspective of the speaker because a cover occludes the contents of the shelf compartment. As such, one interlocutor essentially possesses more knowledge than the other, and this knowledge pertains to the existence of referential entities in the relevant context. Although this approach has provided an important methodological template for numerous studies, including work on cognitive development and individual differences in perspective taking (e.g., Hanna et al., 2003; Keysar et al., 2000; Nadig & Sedivy, 2002), it provides only one means to explore the coordination of shared vs. privileged knowledge. In fact, as recognized by theory of mind researchers (e.g., Apperly, 2011; Apperly and Butterfill; 2009; Baron-Cohen, Tager-Flusberg, & Lombardo, 2013; Low & Watts, 2013) and psycholinguists alike (e.g., Frisson & Wakefield, 2012; Hanna et al., 2003; Keysar et al., 2003; Schober, 1998) knowledge discrepancies often involve other kinds of perspective differences that go beyond awareness of the existence of referents. For example, Schober (1998) outlined a number of other factors that conversational partners need to consider to successfully coordinate their perspectives, including time, place, identity, and conversational agenda, among other things. Thus, in order to understand the inferential paths that conversational partners can follow to take each other's perspective, and to develop a complete theory of perspective taking in conversation, it is necessary to study cases that reflect qualitatively different types of knowledge discrepancies.

The current paper focuses on situations where knowledge differences involve the *identity* ascribed to referents whose presence and availability for reference is known to all conversational participants. The question of how individuals manage knowledge about object identity is of broad importance, playing a key role in various phenomena in theoretical semantics and pragmatics as well as in the theory of mind literature. For example, a number of language philosophers have pointed out that terms that objectively might refer to the same entity in a given scenario such as *watch* and *present* cannot be straightforwardly substituted in certain contexts without potentially creating an untrue statement (e.g., Davidson, 1984; Ludwig & Ray, 1998; Ray, 1980; Roberts, 1993). To illustrate, the statement *Tom believed that the watch looked expensive* cannot be substituted with *Tom believed that the present looked expensive* in a circumstance where Tom may have had no idea that the watch is also a present for someone. Thus, the correct linguistic encoding of this event requires a direct consideration of Tom's knowledge when deciding on a relevant referring expression, which may differ from the knowledge of the speaker or the speaker's addressee. These "referentially opaque" contexts show that successful reference involves not only a specific mapping between a term and a corresponding entity, but also a consideration of how the identity of the entity is or should be represented by the speaker or addressee (Kamawar & Olson, 1999).

In the theory of mind literature, a number of developmental studies have suggested that perspective differences involving