Chapter 8

# The relation between language and mental state reasoning

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## Introduction

Languages vary in the way they encode different aspects of the world. Do such cross-linguistic differences affect how the world is represented in the minds of speakers of different languages? And how do linguistic and conceptual representations make contact during the acquisition of different languages? These questions have been of interest to several researchers who have studied language with the goal of uncovering the inner workings of the human mind. For recent reviews, see Gentner & Goldin-Meadow (2003), Gleitman & Papafragou (2005, 2012), Gumperz & Levinson (1996), Landau, Dessalegn & Goldberg (2010), Levinson (2003), Ünal & Papafragou (2016a), and Wolff & Holmes (2011).

Language has the potential to influence cognitive processes for two reasons. First, language is selective in the features, properties, or meaning distinctions it encodes. There are considerable cross-linguistic differences with regard to where category boundaries are placed, which conceptual distinctions are encoded, and how often this is done. As a result, language may direct speakers' attention to those categorical distinctions that are encoded, and away from those distinctions that are not encoded. According to this hypothesis, language affects conceptual representations by highlighting certain categories over others (Gentner & Goldin-Meadow, 2003; Gleitman & Papafragou, 2005; Landau et al., 2010; Wolff & Holmes, 2011).

Second, language offers a representational medium in which concepts can be encoded, stored, or manipulated in an efficient way. This abstract representational medium might form stronger and more durable representations compared with non-linguistic representations alone. In this view, language is a type of tool that augments or enriches the human computational and representational resources (Gentner & Goldin-Meadow, 2003; Frank, Everett, Fedorenko & Gibson, 2008; Landau et al., 2010; Wolff & Holmes, 2011).

In this chapter, we discuss how conceptual representations make contact with language to evaluate the two hypotheses proposed. We focus on the domain of mental state reasoning, broadly known as *theory of mind* (Baron-Cohen, Leslie & Frith, 1985). Theory of mind refers to the understanding that other people can have beliefs, desires, intentions, or—more generally—mental states that can be used to explain or predict behavior. Theory of mind includes our ability to reason about the sources of our beliefs (Johnson, 1988; Johnson, Hastroudi & Lindsay, 1993), that is, those conditions or experiences from which we gain information (e.g., visual or auditory perception, hearsay, or inference). A critical piece of theory of mind is the ability to understand that access to information and the resulting beliefs in other people's minds may be different from one's own (e.g., Wellman, 2014), and that sometimes other people can hold beliefs that are false (see, among many others, Baron-Cohen et al., 1985).

Within the broad domain of mental state reasoning, we select different subdomains to test each of the hypotheses about the language–cognition interface outlined already. To explore the hypothesis that the linguistic encoding of a theory of mind distinction might make the distinction more salient in nonlinguistic cognition (see also Ünal & Papafragou, 2018), we examine evidentiality, the linguistic encoding of information sources, and the way it interfaces with nonlinguistic source monitoring. The semantic domain of evidentiality is characterized by striking cross-linguistic differences. For instance, in English, information sources are encoded only optionally through lexical or syntactic devices, as in the following sentences:

1. I saw Ali eat an apple.
2. I heard Ali eat an apple.

However, in Turkish, there is an obligatory choice between two verbal affixes (*–dı* or *–mış*) for all past events, depending on whether the speaker gains information directly through (visual) perception, as in sentence 3, or indirectly through hearsay or inference, as in sentence 4 (Aksu & Slobin, 1986; Kornfilt, 1997; cf. Aikhenvald, 2004, 2014):

3. Ali elmayı ye-di. /'Ali ate an apple (I saw).
4. Ali elmayı ye-miş. /'Ali ate an apple (I heard/inferred).

Could cross-linguistic differences in the encoding of linguistic evidentiality influence how source concepts are represented in the minds of speakers of different languages? If so, then one might expect speakers of a language such as Turkish that encodes source distinctions obligatorily to be more sensitive to the features that are relevant for source-monitoring decisions compared with speakers of a language such as English that encodes source distinctions optionally and less systematically. Alternatively, evidential distinctions in language might build onto conceptual representations of information sources that are shared by speakers of different languages. In the first part of this chapter, we evaluate these possibilities, focusing on comparisons of source-monitoring abilities in children and adults who belong to different linguistic communities.

To test the hypothesis that language might augment the cognitive ability to handle mental state representations, we focus on the role of verbs that explicitly encode mental states such as *think, know*, and *believe*. These verbs differ from verbs that encode actions such as *eat, walk*, and *put* in terms of their semantic and syntactic properties. Most notably, mental state verbs require complex syntactic constructions in which a sentence or clause is embedded in a main sentence:

5. Sally thinks that the marble is in the basket.

In sentence 5, the embedded clause, "(that) the marble is in the basket," acts as a complement of the verb "think." Semantically, even though the complement itself is a false proposition, the main sentence is still true. This syntactic structure, known as sentential complementation, allows for the linguistic expression of a false belief embedded into someone else's perspective. Some commentators have proposed that the syntax of complementation provides the format *necessary* for representing mental states (de Villiers, 2007; de Villiers & de Villiers, 2000, 2009). According to an alternative possibility, the complex syntactic properties of mental verbs may not create the resources necessary for representing mental states, but might nevertheless *facilitate* or scaffold mental state representations. In the second part of this chapter, we evaluate these possibilities, focusing on developmental and adult evidence on epistemic (specifically, false-belief) understanding.

## Encoding sources of information in language and cognition

### Developmental evidence

Studies with young children have shown that the development of source monitoring follows a lengthy timetable. Children demonstrate an understanding of the connection between seeing and knowing by age three: children can pick someone who has looked inside a container as knowledgeable about the contents of the container over someone who has done an irrelevant action (e.g., pushed the container; Pillow, 1989; cf. Pratt & Bryant, 1990). Younger children's ability to link seeing to knowing in others improves when they share others' perceptual access (Ruffman & Olson, 1989) or receive training on how to interpret the task (Pratt & Bryant, 1990). Between the ages of four and five, children understand that someone who has been told what is inside a container knows what is inside it (Wimmer, Hogrefe & Sodian, 1988). Full understanding of inference as a source of knowledge does not develop until age six (Sodian & Wimmer, 1987; cf. Miller, Hardin & Montgomery, 2003; but see Keenan, Ruffman & Olson, 1994). However, even children of this age do not always distinguish justified inference from mere guessing in others (Pillow, Hill, Boyce & Stein, 2000).

Could linguistic evidentiality affect the salience of nonlinguistic source concepts during development? If so, one might expect sensitivity to the different sources of knowledge to develop earlier in learners of languages such as Turkish that mark these distinctions obligatorily or grammatically compared with learners of languages such as English that mark these distinctions optionally and less systematically. Some developmental work has reported early source-monitoring success in Turkish learners and has tentatively attributed this success to learning a language with obligatory evidentiality (Aksu-Koç, Ögel-Balaban & Alp, 2009; Lucas, Lewis, Pala, Wong & Berridge, 2013). However, this work lacks the full empirical evidence necessary to argue for linguistic effects (e.g., there is no direct comparison of English- and Turkish-speaking children, nor is there any independent measure of children's knowledge of evidential language; for a detailed review, see Ünal and Papafragou, 2018).

More systematic comparisons of the source-monitoring abilities of learners across language communities argue against the idea that learning a language that encodes evidential distinctions in its grammar increases sensitivity to different information sources. One set of such studies (Ünal, 2016; Ünal & Papafragou, submitted) evaluated Turkish children's sensitivity to visual perception and inference as sources of knowledge in themselves and others. In the Self task, children were presented with pairs of photographs: a face-up photograph giving either visual or inferential evidence for an event, and a "mystery," face-down photograph. Then, children were given a verb that either matched or did not match the face-up photograph and were asked to "find its picture." The results revealed that four-year-old Turkish learners were highly successful in linking the evidence provided by the face-up photograph to the events encoded by appropriate (matching) verbs; furthermore, their success in acquiring knowledge about the events was similar for visual and inferential evidence (e.g., they could identify "drinking" when the face-up photograph depicted someone drink a glass of milk and "cracking" when the photograph depicted a cracked walnut). In the Others task, children of similar ages observed as one puppet gained access to the face-up card and another puppet peeked under the face-down card. Then, children were given the same verb as in the Self version of the task and had to identify the puppet who was more knowledgeable about the event described by the verb. These children had difficulty attributing either perception-based or inference-based knowledge to the right puppet, despite succeeding in the Self version of this task. Importantly, an age-matched group of English learners who were tested with the very same method performed just like the Turkish group.

Another series of experiments (Papafragou, Li, Choi & Han, 2007) compared three- and four-year-old learners of English and Korean—also a language with grammaticalized evidentiality—in two source-monitoring tasks. In the Self task, children were asked to identify how they found out what was hidden in a container. In the Others task, children were presented with a puppet that either saw or was told about what was inside a box and another puppet that performed an irrelevant action (e.g., pushed the box); children had to pick the puppet that knew what was in the box. English- and Korean-speaking children were equally successful in these tasks; furthermore, as in the studies reviewed already (Ünal, 2016; Ünal & Papafragou, submitted), both groups were more successful in the Self task than in the Others task. The fact that leaners of languages with grammaticalized evidentiality were no more successful than English learners in source-monitoring tasks argues against the possibility that linguistic evidentiality affects the salience of nonlinguistic source concepts. It appears that linguistic evidentiality builds on and is possibly constrained by nonlinguistic source concepts (as opposed to shaping source concepts themselves).

Two further pieces of evidence are consistent with this conclusion. First, studies that assessed how the acquisition of grammatical evidentiality relates to the development of source monitoring in learners of Turkish (Ozturk & Papafragou, 2016) and Korean (Papafragou et al., 2007) have found that, cross-linguistically, children perform better in nonlinguistic source-monitoring tasks than in tasks testing knowledge of linguistic evidentiality. These results suggest that children have difficulty mastering the evidential distinctions in language even after they have developed the corresponding source concepts. This "concepts-before-language" pattern makes it less likely that evidential concepts depend on language-specific semantic distinctions.

Second, closer inspection of the development of grammatical evidentiality and its conceptual underpinnings reveals homologies between language and source monitoring. These homologies cohere with the position that cognitive development precedes and places boundaries on linguistic development. For instance, tests of children's knowledge of linguistic evidentiality have typically produced an unusual pattern whereby production of evidentials precedes their comprehension (Aksu-Koç, 1988; Ozturk & Papafragou, 2016; Papafragou et al., 2007). This pattern parallels the self–other asymmetry that characterizes children's nonlinguistic source monitoring, whereby children are better at reasoning about their own compared with other people's sources of knowledge (see Papafragou et al., 2007; Ünal, 2016; Ünal & Papafragou, submitted). In the clearest demonstration of this parallel, Ünal and Papafragou (2016b) showed that the production–comprehension asymmetry tracked the self–other asymmetry in Turkish learners between the ages of three and six tested in otherwise-identical tasks. The conclusion was that the linguistic asymmetry reflects the conceptual presuppositions of two linguistic processes: production requires assessing one's own information sources, while comprehension requires reasoning about information sources in others. The fact that the course of acquisition of different evidential morphemes is closely linked to children's ability to identify the corresponding sources of information in nonlinguistic tasks is consistent with a "concepts-before-language" picture (for evidence of an asymmetry between direct and indirect information sources that also characterizes both linguistic and nonlinguistic development, see Ozturk & Papafragou, 2016).

## Adult studies

Could long-term experience with the evidential categories of one's native language influence adults' sensitivity to distinctions among knowledge sources? The developmental evidence we have summarized so far does not preclude the possibility that language may exert strong influences on source-monitoring processes in mature speakers. For instance, over time, selective encoding of evidential distinctions in language may direct speakers' attention to the features that distinguish different information sources, resulting in more accurate source-monitoring decisions. Interestingly, experimental studies (conducted primarily with English speakers) have shown that source-monitoring decisions are prone to errors, and adults often mistakenly report having seen things that they have only learned indirectly through imagination, visualization, or inference

(Anderson, 1984; Chan & McDermott, 2006; Durso & Johnson, 1980; Fazio & Marsh, 2010; Harris, 1974; Harris & Monaco, 1978; Johnson, Kahan & Raye, 1984). Could speaking a language that marks evidentiality grammatically and obligatorily prevent speakers from making such errors?

A recent cross-linguistic study addressed the potential impact of language on source monitoring, but from a somewhat different perspective. Tosun, Vaid, and Geraci (2013) compared Turkish and English speakers on their memories for linguistic assertions marked with the direct or indirect evidential in Turkish and with evidential adverbs in English ( *allegedly, reportedly*, etc.). The source of information in the linguistic assertions did not affect memory accuracy in English speakers, but Turkish speakers had lower memory accuracy for sentences marked with the indirect evidential compared to the sentences marked with the direct evidential. The authors attributed these differences in memory to the cross-linguistic differences in the encoding of evidentiality. However, it is difficult to directly compare the findings by Tosun et al. to the adult source-monitoring literature from English speakers: unlike typical source-monitoring studies in which participants learn about events directly or indirectly, Tosun et al. tested memory for someone else's sources of information as indicated in their linguistic assertions. Furthermore, several aspects of the methodology (e.g., the lack of independent measures of cognitive equivalence among the groups, and the use of different kinds of stimuli across the groups) raise issues about the interpretation of the observed cross-linguistic differences. Thus, it remains an open question whether selective encoding of source distinctions in language would increase the accuracy of source-monitoring decisions even when speakers are not required to process evidentially marked sentences.

This question was directly examined in a set of experiments by Ünal, Pinto, Bunger, and Papafragou (2016). First, Ünal and colleagues confirmed the cross-linguistic differences in how Turkish and English speakers mark information sources using a linguistic task. Participants were presented with photographs of events that they either saw directly (e.g., a man tearing a piece of paper towel) or inferred on the basis of evidence (e.g., a man holding a piece of paper towel that he had torn) and had to describe the events. As the authors expected, English speakers did not mark the sources of these events in language, whereas Turkish speakers had to use evidentiality markers when giving past-tense descriptions of the events. Specifically, they marked the events they had seen with the direct evidential (*-dı*; 73% of the time) and the events they had inferred the indirect evidential (*-mış*; 64% of the time). Moreover, there was some variation in the degree to which inferred events elicited indirect evidential marking. For some inferred events, post-event visual cues were ambiguous and clearly differed from a seen event; for these events, Turkish speakers used the indirect evidential 80% of the time ("high-indirectness" events). For other inferred events, post-event visual cues yielded secure inferences that were similar to seeing the event; for these events, Turkish speakers used the indirect evidential only 48% of the time ("low-indirectness" events). Furthermore, the distinction between high- and low-indirectness events was confirmed by asking a control group of English speakers to report whether they had "seen" or "inferred" the events used in the description task. The judgments from this group closely mapped onto the use of the indirect evidential by the Turkish speakers.

In a subsequent experiment, Ünal and colleagues (2016) used these very same events in a source memory task. In the encoding phase, participants studied the "inferred" events from the description task (half were high-indirectness events, the other half were low-indirectness events), and in the test phase these items were replaced with the "seen" versions of the same events. If language has an effect on source monitoring, then Turkish speakers should make fewer errors than English speakers, especially for the high-indirectness events that elicited indirect evidential marking more consistently. Alternatively, if source monitoring is independent from language, then Turkish and English speakers should commit source-monitoring errors to the same extent. The results supported the second possibility: both language groups made source-monitoring errors to the same extent (about 30% of the time). Moreover, both language groups were more likely to make source-monitoring errors for low-indirectness events that yielded highly secure inferences as opposed to high-indirectness events that yielded less secure inferences. Finally, Turkish and English speakers did not differ on a control task that tested memory for items that did not involve changes to sources of information. Together, these findings suggest that long-term experience with the evidential categories of one's native language does not shape conceptual representations of information sources.

## Encoding mental states in language and cognition

### Developmental evidence

Empirical studies on the development of mental state understanding typically use paradigms that test whether children realize that other people can hold false beliefs about the world. In these studies, children are typically presented with the following scenario (Baron-Cohen et al., 1985). A doll, Sally, hides a marble in a basket and leaves. Then, another doll, Ann, comes in moves the marble to a box. When Sally comes back to play with her marble, children are asked: "Where will Sally look for her marble?" When asked this question, three-year-olds predict that Sally will look for the marble in the box (i.e., where it really is), whereas five-year-olds predict that she will look for it in the basket (i.e., where she thinks it is). This developmental shift in children's ability to represent mental states has been replicated across many studies (for a review, see Wellman, Cross & Watson, 2001). Other studies have shown some understanding of false beliefs before the age of three using simplified versions of this task that rely on looking time (instead of verbal responses) to assess children's expectations (Onishi & Baillargeon, 2005; cf. Buttelmann, Carpenter & Tomasello, 2009; Southgate, Senju & Csibra, 2007; Surian, Caldi & Sperber, 2007). Nevertheless, this basic understanding of false beliefs may be limited (Saxe, 2013).

How does the development of epistemic thinking make contact with language? Recall that, according to one hypothesis (de Villiers, 2007; de Villiers & de Villiers, 2000, 2009), mastery of complementation is a necessary condition for the development of false-belief understanding. The case of deaf children (and adults) who are deprived of linguistic input

(Schick, de Villiers, de Villiers & Hoffmeister, 2007; de Villiers, 2005; Woolfe, Want & Siegal, 2002) provides a strong test of this hypothesis. Peterson and Siegal (1999) report that five-year-old deaf children who are born to nonsigning hearing parents lag behind their hearing peers on false-belief understanding, and in fact perform as poorly as a mental age-matched group of children with autism who have significant impairment in understanding mental states. In the same study, a group of deaf children who grew up with at least one deaf native signer in their homes, and thus were native signers themselves, performed as well as hearing preschoolers on false-belief tasks. A later longitudinal study by Pyers and Senghas (2009) investigated false-belief understanding in relation to the use of mental state terms by a group of deaf adults in Nicaragua. During the first observation, participants watched short video clips of people making mistakes and were asked to describe the mental states of the people in the videos. Participants did not use any signs to refer to the mental states of the people. Moreover, they failed to perform successfully on false-belief tasks. Two years later, their performance on the false-belief tasks improved; around the same time, they also acquired mental state vocabulary. The authors suggest that the absence of mental state language creates delays in epistemic reasoning, despite years of social experience.

At present, the interpretation of these data is debated. Notice that it is difficult to tease apart whether access to mental state vocabulary and sentential complements provides structural support for epistemic reasoning, or whether, alternatively, these resources (and language more generally) support social interaction among people, which then contributes to the development of epistemic thinking (Astington, 1996; Tomasello, 2009). More generally, the hypothesis that linguistic complementation is necessary for epistemic thinking seems unlikely, given that mere infants (e.g., Onishi & Baillargeon, 2005) and even nonhuman primates (Krupenye, Kano, Hirata, Call & Tomasello, 2016) are successful with fundamental aspects of false-belief reasoning. Furthermore, this hypothesis is hard to reconcile with evidence showing that, cross-linguistically, development of mental state representations is independent of language-specific syntactic properties of mental state verbs. A first such piece of evidence comes from the development of belief versus desire concepts: children understand desires (including discrepant desires in different individuals) before they understand beliefs (including discrepant beliefs in different individuals; Astington & Gopnik, 1991; Flavell, 1988; Wellman, 1990). Crucially, this asymmetry seems to emerge regardless of the complement-taking properties of mental verbs in the learners' language. For instance, both English- and Mandarin-speaking children acquire desire terms before belief terms, despite the fact that in English the two types of terms vary in the kinds of complements they take but in Mandarin they do not consistently do so (Tardif & Wellman, 2000; cf. also Bartsch & Wellman, 1995). Similarly, German-speaking children produce and understand sentences about desires earlier than sentences about beliefs, even though, in German, terms expressing desires for others' actions take the same finite complements as belief verbs (Perner, Sprung, Zauner & Haider, 2003). A second piece of evidence comes from the developmental trajectory of false-belief understanding: both traditional verbal-response tasks (Avis & Harris, 1991;

Liu, Wellman, Tardif & Sabbagh, 2008; Tardif, Wellman & Cheung, 2004) and newer looking-time methods (Barrett et al., 2013) have shown that this trajectory is similar across children from different linguistic communities. Together, these results point to the conclusion that mental state representations are not finely attuned to specific properties of linguistic complementation in the input language.

Even if complementation does not create the resources necessary to grasp mental state concepts, it remains possible that language is involved in crucial ways in the ability to handle and store mental state representations in flexible ways. If so, then complementation could provide a uniquely helpful format to represent false beliefs. If this line of reasoning is correct, then training children on sentential complements should lead to changes in their false-belief performance. Several studies have shown that young children who fail false-belief tasks become able to successfully pass such tasks after receiving various types of linguistic and nonlinguistic training (Appleton & Reddy, 1996; Clements, Rustin & McCallum, 2000; Slaughter & Gopnik, 1996). However, these studies did not compare the relative effectiveness of general linguistic feedback that simply explains to children why their answers were right or wrong as opposed to feedback based on more specific linguistic constructions such as sentential complements.

Lohmann and Tomasello (2003) addressed the specific contributions of complementation to children's epistemic reasoning. In that study, groups of three- and four-year-olds received different kinds of feedback about the deceptive properties of objects that looked like one thing but were actually something else (e.g., a pen/writing instrument that looked like a flower). The full training group that was given feedback about the deceptive properties using sentential complement syntax had the biggest improvement in false-belief performance in post-test. False-belief performance also improved in the group that heard only sentential complement syntax without any deceptive scenarios and in the group that heard deceptive properties highlighted using simple language. Finally, the group that heard deceptive properties highlighted nonverbally (e.g., "Look! … But now, look!") did not show any improvement in false-belief performance in post-test. The authors concluded that both experience with the deceptive aspects of the objects and the complement syntax were necessary for facilitating false-belief understanding.

These findings converge with the findings of another training study (Hale & Tager-Flusberg, 2003), in which four-year-olds who failed in false-belief tasks in the pre-test received one of three types of training. One group received false-belief training in which they were given corrective feedback when they gave incorrect responses in the false-belief task. A second group was trained on producing false sentential complements of communication verbs such as *say* or *tell* (e.g., "The boy said, 'I kissed Grover,' but he really kissed Big Bird"). A third group of children were trained on producing relative clause constructions (e.g., "Bert hugged the girl who jumped up and down"). The results revealed that the groups that received the false-belief and false-communication training had significant improvements between the pre-test and the post-test, but the group that received the relative clause training continued to fail in the false-belief tasks.

Together, these findings support the proposal that the development of false-belief understanding is facilitated by language, and, more specifically, the syntactic structures that allow the expression of false ideas embedded in true main clauses. Nevertheless, they also show that complementation is not necessary for representing mental states, since other types of training also help improve false-belief understanding. Thus, language may be one of the many factors that scaffold the representation of mental states.

## Adult studies

How does the relationship between language and epistemic thinking change during development? One possibility is that language may provide representational and/or computational resources that facilitate the development of false-belief understanding in childhood, but is no longer needed in adulthood after both abilities mature. Alternatively, language might still be necessary for reasoning about false beliefs in adulthood. If so, then adults would need to have access to language while performing false-belief tasks; furthermore, disrupting access to language should impair false-belief performance. Dual-task paradigms provide a clear test of these contrasting predictions. The idea behind these paradigms is that, if language is required to perform a cognitive task, then performance should be impaired when people are asked to perform a concurrent task that blocks the ability to engage in verbal encoding; however, performance should be immune to an equally distracting concurrent task that does not involve language (Frank, Fedorenko, Lai, Saxe & Gibson, 2012; Hermer-Vasquez, Spelke & Katsnelson, 1999; Trueswell & Papafragou, 2010; Winawer et al., 2007).

In one dual-task study (Newton & de Villiers, 2007), adults were given two location-change scenarios: one involved reasoning about false beliefs and the other did not (i.e., it was a true-belief scenario). Participants were also asked to perform one of two secondary tasks: a first group performed a verbal interference task (namely, shadowing a text) and a second group performed a nonverbal interference task (namely, tapping a rhythm). Whereas performance in true-belief reasoning was immune to both verbal and nonverbal interference, only the verbal interference impaired performance in the false-belief reasoning. Newton and de Villiers took these findings as support for the possibility that language is the representational format necessary for false-belief understanding in adulthood.

This interpretation was challenged by Dungan and Saxe (2012), who pointed out that the verbal and nonverbal interference tasks in Newton and de Villiers's study were not matched in their level of difficulty. In fact, when Dungan and Saxe tested false-belief understanding using the very same tasks as Newton and de Villiers, but matched the verbal and nonverbal interference tasks in terms of their working memory demands, the two interference tasks affected false-belief performance similarly. This suggests that the difficulty in false-belief understanding under verbal interference reported in the earlier study may not be due to the fact that adults needed to have access to linguistic encoding while representing others' mental states. Instead, this difficulty might be explained by the fact that the verbal interference task was cognitively demanding, and thus participants did not have the cognitive—but not necessarily linguistic—resources needed to perform the false-belief task.

Additional support for this interpretation comes from case studies investigating the epistemic thinking of adult patients with agrammatic aphasia. These are individuals who have severe grammatical impairment due to a stroke or damage to the left hemisphere but had developed typical epistemic thinking prior to the brain damage. The linguistic profiles of these patients are characterized by single-word production and comprehension of mostly nouns, poor understanding of verbs, and failure to perform simple grammatical judgments, including judgments of embedded sentences (Apperly, Samson, Carroll, Hussain & Humphreys, 2006; Siegal, Varley & Want, 2001; Varley & Siegal, 2000, Varley, Siegal & Want, 2001). Nevertheless, these patients have intact epistemic reasoning abilities, as evidenced by near-perfect scores on several false-belief tasks. This indicates that language is not necessary for false-belief understanding in adulthood. Nevertheless, certain linguistic structures, such as complementation, may provide an efficient tool that helps the representation of false beliefs in others' minds.

## Conclusion

In this chapter, we have reviewed empirical evidence addressing the relation between language and theory of mind in both children and adults. Our goal was to assess whether and how cognitive abilities such as source monitoring and epistemic thinking are affected by the way these domains are encoded in language. In this section, we revisit the two broad types of language effects we outlined in the introduction and evaluate these possibilities in relation to the evidence we have summarized.

One potential effect of language on cognition is selectivity. Language selects and encodes certain aspects of the world, and, as a result, might direct speakers' attention to those distinctions that are systematically encoded over others. Cross-linguistic differences in the encoding of evidentiality provide a clear test of this possibility. Speakers of a language that grammatically and obligatorily encodes evidentiality could be more attentive and sensitive to those features of experience that distinguish different information sources. If so, then young learners of such languages might develop source concepts earlier than learners of systems without evidential marking; similarly, adult speakers of languages with grammaticalized and obligatory evidential markers might be less prone to making errors when distinguishing information obtained from different sources compared with populations speaking languages without systematic evidential encoding. However, experimental evidence with children and adults does not lend support to this possibility. Instead, both learners and mature speakers of languages with and without grammaticalized evidentiality perform similarly on nonlinguistic source-monitoring tasks (Papafragou et al., 2007; Ünal & Papafragou, submitted; Ünal et al., 2016). Furthermore, linguistic evidentiality is acquired later than conceptual representations of information sources by young learners (Ozturk & Papafragou, 2016; Papafragou et al., 2007), and both linguistic and conceptual development in this domain seem to follow similar principles (Ozturk & Papafragou, 2016; Papafragou et al., 2007; Ünal & Papafragou, 2016b). Finally, there is independent evidence that some aspects of human source-monitoring abilities may be shared with nonhuman primates (Hare, Call & Tomasello, 2001), suggesting that the ability to reason about sources of information develops independently of language. In sum, these findings point to the conclusion that evidential categories in language do not shape but build on conceptual representations of sources of knowledge.

A second potential source of linguistic effect is the fact that language provides an additional medium of representation that might augment human representational or computational resources that might otherwise be fragile. Empirical findings in the domain of false-belief understanding provide a useful test of whether having language as a representational system is beneficial or even necessary for false-belief understanding. The evidence suggests that mental state terms such as *think* or *believe* and their complements provide an efficient tool to encode false ideas in someone else's mind. When deaf individuals learn the signs that refer to mental states (Pyers & Senghas, 2009) or children are trained on sentential complementation (Hale & Tager-Flusberg, 2003; Lohmann & Tomasello, 2003), their false-belief performance improves. Similarly, adults perform better in false-belief tasks when they are able to use linguistic encoding (Dungan & Saxe, 2012; Newton & de Villiers, 2007). However, this additional tool does not seem to truly create mental state representations, since other forms of training also improve false-belief performance (Hale & Tager-Flusberg, 2003; Appleton & Reddy, 1996; Clements, Rustin & McCallum, 2000; Slaughter & Gopnik, 1996). Furthermore, children learning different languages follow the same patterns when developing false-belief understanding, despite the variation in the syntactic features of individual mental state terms (Bartsch & Wellman, 1995; Perner et al., 2003; Tardif & Wellman, 2000). Perhaps most strikingly, some evidence of false-belief reasoning is present in prelinguistic infants (e.g., Onishi & Baillargeon, 2005) and primates (Krupenye et al., 2016). Taken together, the evidence suggests that language is not necessary for false-belief understanding, even though having language as a tool may facilitate the representation or processing of mental states. A number of possibilities remain open as to how language can scaffold the representation of mental states. For instance, language might act as a source of information about mental states—especially the contrast between people's beliefs about a situation and the truth of the situation—during children's conversations with others (Harris, 1996, 1999; Tomasello, 2009). Alternatively or additionally, language might act as a flexible, online tool that highlights those aspects of the world that are relevant for solving false-belief tasks and helps speakers track and reason about mental states.

Viewed within the broader debate about the role of language in cognition, the present conclusions are consistent with work on further domains such as motion (Gennari, Sloman, Malt & Fitch, 2002; Papafragou, Hulbert & Trueswell, 2008; Trueswell & Papafragou, 2010), spatial frames of reference (Li & Gleitman, 2002; Li, Abarbanell, Gleitman & Papafragou, 2011), and the object–substance distinction (Li, Dunham & Carey, 2009). Across domains, empirical findings point to some behavioral differences among speakers of different languages that can be tied to cross-linguistic differences in how the world is encoded. Nevertheless, these differences often diminish or disappear when speakers are prevented from linguistic encoding while performing a cognitive task, a fact suggesting that these language-driven effects are temporary and task-dependent. Thus, available findings in the domain of evidentiality, false-belief understanding, and other domains point to a nuanced view of the language–cognition interface, according to which language scaffolds cognitive processes without modifying the underlying conceptual representations.

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