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Relations Between Language and Cognition: Evidentiality and Sources of Knowledge

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Abstract

Understanding and acquiring language involve mapping language onto conceptual representations. Nevertheless, several issues remain unresolved with respect to (a) how such mappings are performed, and (b) whether conceptual representations are susceptible to cross-linguistic influences. In this article, we discuss these issues focusing on the domain of evidentiality and sources of knowledge. Empirical evidence in this domain yields growing support for the proposal that linguistic categories of evidentiality are tightly linked to, build on, and reflect conceptual representations of sources of knowledge that are shared across speakers of different languages.

Keywords: Theory of Mind; Language acquisition; Evidentiality; Source monitoring; Language–cognition interface; Concepts

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1. Relations between language and cognition

According to psycholinguistic theories, the way we talk about the world is constrained by how we conceptualize space, objects, and events. Classic models of language acquisition generally assume that learners are equipped with a set of basic, probably universal, concepts for representing the world (even though the size of that set is under dispute), such that acquiring language includes mapping incoming speech stimuli onto this set of concepts (Gleitman, 1990; Jackendoff, 1996; Miller & Johnson-Laird, 1976; Pinker, 1989). On this view, the development of the ability to produce and understand language presupposes the learner's ability to entertain thoughts about the objects, relations, and events that language encodes. For both mature (adult) and novice (child) speakers, the ability to map language to conceptual representations is the hallmark of language production and comprehension (Levelt, 1989).

This view of how mental representations make contact with language faces two issues. First, theories of the language–cognition interface require detailed representations of both linguistic-semantic meaning and underlying non-linguistic concepts, together with precise linking hypotheses about how semantics and cognition are to be connected. However, until recently, the nature and acquisition of linguistic meaning and cognitive representations have typically been studied independently, by different communities of scholars and through different methodologies. As a result, evidence for the claim that language builds on cognition has often remained indirect. For instance, one of the strongest arguments for the link between linguistic and cognitive universals comes from studies that have identified similarities in the acquisition of lexical semantics cross-linguistically and have attributed these similarities to universal patterns in children's cognitive growth (e.g., Johnston & Slobin, 1979; on spatial vocabulary; see Bowerman, 1996; for discussion). Nevertheless, the literature has typically not pursued a direct test of this hypothesized link between linguistic and cognitive development by comparing these processes in the same group of learners through matched tasks. In the absence of such tasks, the role of cognitive growth cannot be disentangled from other powerful factors that shape lexical acquisition cross-linguistically, such as the learning processes that drive the way incoming linguistic stimuli are mapped onto already available concepts (Gleitman, 1990).

A second issue for theories attempting to account for how cognition interfaces with language is that natural languages vary in their lexical-structural resources. For instance, languages have different means for encoding space, motion, number, and objects (see Bowerman & Levison, 2001; Gentner & Goldin-Meadow, 2003; Gleitman & Papafragou, 2016; Ünal & Papafragou, 2016a, for reviews). These cross-linguistic differences raise the question whether the underlying conceptual representations might also vary in the minds of speakers of different languages. This possibility has been famously raised in the past by Benjamin Lee Whorf (Whorf, 1956) and has been revived in the last two decades within cognitive science by various theorists (e.g., Boroditsky, 2001; Levinson, 2003). Proponents of this possibility argue that "experience with language can influence perceptual systems such that they become more or less attuned to particular features in the environment" (Majid, Bowerman, Kita, Haun, & Levinson, 2004, p. 113), perhaps through the selective direction of attention (Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002). If language can reorganize conceptual representations, then different languages can themselves have stable and permanent restructuring effects on the concepts held by their speakers (Levinson, 1996, 2003) and learners can acquire different concepts (or the same concepts but in different ways or at different rates) depending on encoding patterns in the linguistic input.

In this paper, we address these issues focusing on the domain of the sources of knowledge. We begin by summarizing the way in which sources of knowledge are represented in cognition and encoded in language. In the main sections of the paper, we probe specific ways of uncovering the relation between thinking and talking about sources of knowledge in young learners and across members of different language communities. Throughout we combine cognitive, developmental, and cross-linguistic methods to address the nature and development of the complex interactions between language and cognition.

2. Sources of knowledge in cognition

Humans gain knowledge about the world through various experiences. For example, one might directly see an event happen, hear about it from someone else, or make an inference on the basis of available evidence. The ability to reason about the sources of knowledge is a fundamental aspect of human cognition, since it is crucial for forming and updating beliefs about the world. Some understanding of the sources of knowledge in others' minds is present even in non-human primates (Hare, Call, & Tomasello, 2001; Krupenye, Kano, Hirata, Call, & Tomasello, 2016). Furthermore, neuroscientific evidence shows that concepts related to sources of knowledge, such as seeing or hearing, are represented similarly across sighted and blind individuals (Bedny & Saxe, 2012; Koster Hale, Bedny, & Saxe, 2014). However, understanding that perception leads to knowledge is impaired in individuals with autism disorders who have difficulty representing mental states and their properties (Hogrefe, Wimmer, & Perner, 1986; Leslie & Frith, 1988; Perner, Frith, Leslie, & Leekham, 1989).

Humans do not canonically tag their beliefs with information about how these beliefs were acquired but reconstruct this information as needed via a process known as *source monitoring* (Johnson, 1988; Johnson, Hashtroudi, & Lindsay, 1993). Both the accuracy of these belief attributions and the chances of attributing certain types of beliefs to particular sources depends on several qualities of beliefs, such as the amount of visual, spatial, and temporal details (Johnson, Raye, Foley, & Kim, 1982; Johnson et al., 1993), the similarity between the belief origins that need to be differentiated (Johnson, Bransford, & Solomon, 1973; Lindsay, Johnson, & Kwon, 1991; Mather, Johnson, & De Leonardis, 1999), and one's awareness of the mental steps that produced a belief (Durso & Johnson, 1980; Intraub & Hoffman, 1992; Johnson & Raye, 1981). For example, when someone's memory of an event is highly rich in visual details, this memory is likely to be attributed to visual perception (Johnson & Raye, 1981). By contrast, when memories about the formation of a belief include many mental steps involved in producing that belief, this memory is likely to be attributed to self-generated representations, such as inference or imagination (ibid). Since people do not automatically tag their beliefs with source information, their source attributions are not always accurate—for instance, people tend to report having seen things that they have only imagined, visualized, or inferred from reading a piece of text (e.g., Durso & Johnson, 1980; Fazio & Marsh, 2010; Intraub & Hoffman, 1992; among others).

3. Sources of knowledge in language

In language, a set of devices known as *evidentiality markers* are dedicated for encoding the source from which a piece of information is acquired (see Aikhenvald, 2004, 2014; Faller, 2001, 2002; De Haan, 2001; Izvorski, 1998; Johanson & Utas, 2000; Matthewson, 2012; Mayer, 1990; McCready, 2008, 2014; Speas, 2004; Willett, 1988, for different perspectives). In English, speakers do not need to encode their information sources, even though they have the option to do so by using lexical or syntactic devices. For example, in (1a) and (1b), the speaker uses a verb to convey their informational access, which is direct/visual perception in (1a) and verbal communication in (1b). In (1c), the speaker uses an adverb to convey that they made an inference on the basis of available evidence.

(1) a. I saw Ali play soccer.
b. I heard from John that Ali played soccer.
c. Ali, apparently, played soccer.

About a quarter of the world's languages encode evidentiality through grammaticalized means such as verbal affixes, particles, or other devices. For example, in Turkish, for all past events encoded in a main clause, there is an obligatory choice between two verb suffixes, *-DI* and *–mIş*, (realized as *-dı*, *-di*, *-du*, *-dü*, *-ti*, *-tı*, *-tu*, *-tü* and *-mış*, *-miş*, *-muş*, *-müş*, respectively, depending on phonological factors) that denote the direct versus indirect past. Thus, (2a) encodes a direct source, typically visual perception, and (2b) encodes an indirect source, specifically either hearsay or inference from visual clues.

(2) a. Ali futbol oyna-dı. "Ali played soccer (I saw)"
b. Ali futbol oyna-mış. "Ali played soccer (I heard/inferred)"

Other languages have even more elaborate systems. As seen in the following example from Tuyuka, spoken in parts of Colombia and Brazil, speakers can use five different evidential morphemes (Barnes, 1984).

(3) a. dı′iga ape′-wi "He played soccer (I saw him)"
b. dı′iga ape′-ti "He played soccer (I heard the game and him but didn't see it or him)"
c. dı′iga ape′-yi "He played soccer (I have seen evidence that he played but did not see him play)"
d. dı′iga ape′-yigi "He played soccer (I obtained the information from someone else)"
e. dı′iga ape′-hı˜yi "He played soccer (It is reasonable to assume that he did)"

Evidentiality systems carry pragmatic implications. This is because the sources of information encoded by evidentiality makers vary in terms of their reliability, with direct sources generally being ranked more highly than indirect sources (Coady, 1992; Dancy, 1985; Fricker, 2006; Hume, 2007; Locke, 1964).

Evidentiality offers a good testing ground for investigating the relationship between language and conceptual systems. Evidential meanings refer to abstract and unobservable source-of-knowledge concepts and involve subtle reasoning about the reliability of different sources of information that may be challenging from a learning perspective. Furthermore, abstract, higher-level cognitive domains (of which evidentiality is an example) have been hypothesized to be particularly susceptible to linguistic effects (Spelke & Tsivkin, 2001). Whorf himself posited that a speaker of a language with grammatical markers of sources of knowledge—unlike an English speaker—"discriminates these relationships with effortless ease, for the forms of his speech have accustomed him to do" (Whorf, 1956, p. 85). Thus, evidentiality raises two key types of questions. First, how do children acquire linguistic evidentials across languages? What is the nature of the link between young children's mastery of the lexical-grammatical representation of evidence in their language and their ability to reason about information sources? Second, do cross-linguistic differences in evidential encoding affect source monitoring? In particular, do speakers of different languages process information sources in distinct ways? In the following sections, we take up these questions.

4. The acquisition of evidentiality and source monitoring

Several acquisition studies suggest that full semantic and pragmatic understanding of evidentiality develops over a lengthy timetable (for recent reviews, see Fitneva, 2018 and Matsui, 2014). In an early study, Aksu-Koç (1988) showed that even 6-year-old Turkish learners did not have adult-like command of the evidential system of their language, especially of the indirect (inferential/hearsay) evidential. Similar findings emerged in later studies on Turkish (Aksu-Koç, Ögel-Balaban, & Alp, 2009; Aksu-Koc & Alici, 2000; Ozturk & Papafragou, 2016; Uzundag, Taşçı, Küntay, & Aksu-Koç, 2018; Ünal & Papafragou, 2013). Delays in the acquisition of evidentiality have also been reported in other languages, including Cantonese (Lee & Law, 2000), Korean (Papafragou, Li, Choi, and Han, 2007; but see Choi, 1995), Tibetan (de Villiers, Garfield, Gernet-Girard, Roeper, & Speas, 2009), Japanese (Matsui, Yamamoto, and McCagg, 2006), Bulgarian (Fitneva, 2008), and English (Winans, Hyams, Rett, & Kalin, 2014).

How should children's difficulty in acquiring evidential terms be explained? A possible hypothesis is that children's acquisition of evidentiality needs to await mature understanding of information sources. This hypothesis appears plausible given findings suggesting that the ability to engage in source monitoring undergoes considerable development. For instance, by age 3 children can acquire simple knowledge from a variety of sources and accurately report that knowledge (e.g., they can say what is in a tunnel after looking inside, being verbally informed, feeling inside, or figuring out the contents from a clue; Gopnik & Graf, 1988); however, children of this age, unlike older children, have difficulty reporting how they acquired such knowledge, especially for indirect sources such as inference (ibid; cf. O'Neill & Gopnik, 1991; Pillow, 1989; Pillow, Hill, Boyce, & Stein, 2000; Wimmer, Hogrefe, & Perner, 1988; Woolley & Bruell, 1996). Furthermore, in simple tasks, young children grasp the connection between seeing and knowing in others (Pillow, 1989; Pratt & Bryant, 1990; see also Povinelli & deBlois, 1992; Ruffman & Olson, 1989; Wimmer et al., 1988). Nevertheless, young children fail to understand the subtleties of verbal testimony (Jaswal, 2010; Jaswal, Croft, Setia, & Cole, 2010; Koenig & Harris, 2005; Mascaro & Sperber, 2009) and do not fully realize that inference can be a source of knowledge for others until the age of 6 or later (Sodian & Wimmer, 1987; cf. Keenan, Ruffman, & Olson, 1994; Pillow, 1999; Pillow et al., 2000; Sodian, Zaitchik, & Carey, 1991; Taylor, 1988).

Even though this evidence from cognitive development is suggestive, the first studies to bring non-linguistic development to bear on the acquisition of linguistic evidentials within a single population of learners showed that, in fact, some aspects of source monitoring are in place before the acquisition of evidentiality. In one study, 3- and 4-year-old Korean learners failed a comprehension task in which they had to attribute a sentence marked with the Korean hearsay evidential to either a speaker who looked inside a box or another speaker that was told about what was inside the box (Papafragou, Li, et al., 2007). In the same study, the children were more successful in attributing knowledge to a character who was verbally informed about the box's contents compared to another character who did an irrelevant action (e.g., lifted the box) and thus did not know what was inside. Another study conducted direct comparisons between production and comprehension of evidential morphology and non-linguistic source monitoring in Turkish learners between the ages of 5 and 7 (Ozturk & Papafragou, 2016). Results revealed that children's performance in linguistic tasks lagged behind their performance in the non-linguistic tasks (ibid). In a particularly striking demonstration, children failed to recognize that a speaker who used the direct evidential should be trusted over another speaker who conveyed different information using the indirect evidential, even though the same children understood that someone with direct (perceptual) access knew better compared to someone else with indirect (hearsay or inferential) access (ibid; see also Matsui, Miura, & McCagg, 2006 for similar results on Japanese). These findings are consistent with the position that the development of evidential language follows (and presumably builds on) the development of the corresponding source concepts. However, they show that delays in the acquisition of evidentiality do not transparently reflect cognitive immaturity: Even when source concepts are available, discovering the correspondence between these concepts and linguistic input is far from trivial, a point that we return to below.

A more recent study with Turkish learners has further probed the connection between source monitoring and the acquisition of evidentiality (Ünal & Papafragou, 2016b). That study tested the production and comprehension of evidentials in children between the ages of 3 and 6 using a simple, naturalistic setting that highlighted different types of access to information. In a production task, children were asked to describe a series of events acted out in a puppet theater. Half of the events unfolded in full view of the child so that they could be directly *seen* by the child (e.g., a puppet dropped three small objects into a jar). For the other half of the events, only the beginning and the end state of the event were visible; the main event unfolded when the curtains were closed, such that the child could *infer* what had happened on the basis of visual evidence (e.g., a puppet held a deflated balloon in the beginning of the event, then the curtains dropped down, and when they were raised again an inflated balloon was shown). Unlike previous studies, in this simple paradigm, even the youngest group of 3-year-olds successfully modified the evidential marking in their descriptions depending on whether they saw or inferred the events; that is, they used the direct evidence marker (*-dI*) for seen events and the indirect evidence marker (*-mIş*) for inferred events.

Nevertheless, other evidence from the same series of experiments showed that the acquisition of evidentials was not complete in young Turkish learners (Ünal & Papafragou, 2016b). In a comprehension task, children between the ages of 3 and 6 and adults watched videos of seen and inferred versions of the same event presented side-by-side. The experimenter offered a verbal description of the event with either the direct evidence (*–dI*) or the indirect evidence (*–mIş*) marker, and the participants had to pick the video that the experimenter described. Across age groups, children were equally likely to pick the seen or the inferred version of the event regardless of the type of description, whereas adults selected the seen version when they heard the description with the direct evidence marker and the inferred version when they heard the description with the indirect evidence marker. These findings show that children's comprehension of the evidentiality markers was not adult-like. Furthermore, the difficulty persisted across a variety of further experiments targeting evidential comprehension and was, thus, unlikely to have been due to methodological artifacts (Ünal & Papafragou, 2016b; for similar comprehension difficulties across languages, see Aksu-Koç, 1988; Ozturk & Papafragou, 2016; Papafragou, Li, et al., 2007; Rett & Hyams, 2014; Winans et al., 2014).

In the same study, two additional tasks were used to measure Turkish-speaking children's ability to reason about visual perception and inference as information sources. Importantly, these tasks did not require processing of evidentially marked utterances. Instead, children were shown pairs of an accessible (either seen or inferred) event alongside a mystery (inaccessible) event. Then children were given a verb in the infinitival form that either matched or did not match the accessible (seen or inferred) event. In the Self task, children had to identify the video that depicted the verb and thus had to respond on the basis of their own knowledge of the events (in case the verb mismatched the event that they could see or infer, children were expected to choose the mystery event). In the Others task, children had to identify which one of two puppets was more knowledgeable about the event depicted by the verb. One of the puppets had access to the seen or the inferred event and the other puppet had access to the mystery event (that remained inaccessible for the child). Thus, in the Others task, the children had to respond based on their understanding of someone else's (i.e., the puppet's) knowledge of the event. The results revealed an asymmetry between the Self and Others tasks, such that children's use of perception and inference to assess event knowledge in others lagged behind their ability to use the same types of evidence to gain knowledge themselves. This asymmetry shows that the difficulty with evidential comprehension extends to cases when children have to reason about someone else's information sources even if they do not have to unpack evidential meanings.

We conclude that the production–comprehension asymmetry in Ünal and Papafragou (2016b) and much prior work stems from the development of perspective-taking abilities needed to compute others' informational sources and resulting mental states: producing evidentially marked utterances involves accessing and reporting one's own information sources, whereas understanding evidentially marked utterances involves reasoning about someone else's (i.e., the speaker's) information sources. This conclusion is consistent with prior research on source monitoring that has also pointed out an asymmetry in how children reason about the sources of knowledge in themselves versus others (Hogrefe et al., 1986; Sodian, 1988; Sodian & Wimmer, 1987a; Wimmer et al., 1988). Thus, even though young Turkish learners can produce evidential morphology themselves in simple situations where access to information is clear and salient, they may not be able to unpack evidential morphemes into their full meanings when these morphemes are used by others in more opaque contexts.

Taken together, these findings reveal a tight relation between language and cognition in the domain of evidentiality, such that the conceptual representations of information sources and linguistic evidentiality develop hand in hand. These findings also suggest, however, that conceptual factors may not be sufficient in explaining the delay in the acquisition of mental terms. The data we have reviewed show that children may be delayed in discovering the correct meaning or pragmatic interpretation for evidentials *even if they have the underlying concepts*—presumably because discovering the correspondence between evidential language and sources-of-knowledge concepts is complex (see Gleitman, 1990; Gleitman, Cassidy, Nappa, Papafragou, & Trueswell, 2005; Papafragou, Cassidy & Gleitman, 2007, for similar arguments about mental verbs). There are several factors that may contribute to the complexities of mapping origins-of-knowledge concepts to language. Most obviously, perhaps, such concepts do not correspond to observable referents in the world. Even though at least some evidentials connect to actions and behaviors in the world (e.g., seeing an event or hearing about an event in a conversation), the notion of sources of knowledge is only indirectly related to such actions and behaviors. Furthermore, most of the evidentiality devices in language do not map straightforwardly onto individual sources of knowledge (perception, communication, or inference) but rather they encode more abstract categories such as indirect evidence that need to be defined in language-specific ways (as with the Turkish indirect evidential). Other factors may also complicate the mapping process (e.g., the fact that evidentials, as in the case of the Turkish system, sometimes encode multiple meanings). In sum, both conceptual and mapping factors contribute to learners' successes and failures in acquiring evidentials across languages. How the relative contributions of such factors change over time remains to be determined by further work.

5. Cross-linguistic diversity and source monitoring

The empirical evidence reviewed so far suggests a homology between language and cognition, such that evidential distinctions in language build on and reflect antecedently available conceptual representations of information sources. This broad perspective expects the development of source reasoning to follow a broadly similar timetable across learners of different languages (see Chomsky, 2000; Gleitman, 1990; Pinker, 1984; for this general position). According to an alternative view, the salience or availability of conceptual representations of information sources might be affected by the way evidentiality is encoded in language (cf. Bowerman & Choi, 2001; Bowerman & Levison, 2001, for similar arguments). If so, learners of languages that mark a particular evidential distinction in a salient or obligatory way might develop the corresponding concepts earlier than learners of languages that do not make that distinction.

Until recently, these competing predictions could not be tested directly, since most of the empirical evidence on the development of source monitoring came from speakers of English. Recently, however, a number of studies have tested the source monitoring abilities of young learners of Turkish and reported better performance compared to what is known about English learners (Aksu-Koç et al., 2009; Lucas, Lewis, Pala, Wong, & Berridge, 2013). In one study reported by Aksu-Koç et al. (2009), Turkish-speaking children's production of hearsay morphology correlated with their performance in a task adapted from Drummey and Newcombe (2002) in which they had to identify which of two speakers had uttered a statement (additionally, these children appeared to perform better than the English-speaking 4-year-olds in the original sample). In another study, Turkish-speaking 4-year-olds performed better than English and Chinese speakers of the same age in a flexible trust task, which required keeping track of two speakers' accuracy in naming objects in order to be able to identify the speaker to be trusted when learning the name of a novel object (Lucas et al., 2013). Although one might be tempted to claim that these early successes in source monitoring could be driven by learning a language that encodes evidentiality obligatorily, these studies were subject to several limitations that challenge the validity of such claims (see Ünal, Pinto, Bunger, & Papafragou, 2016; Ünal & Papafragou, 2018a for detailed discussion). Most importantly for present purposes, these studies either did not directly compare source monitoring in learners of English and Turkish (Aksu-Koç et al., 2009), or they did so in the absence of independent linguistic measures to confirm the role of evidential language—as opposed to other factors—in Turkish learners' cognitive performance (Lucas et al., 2013).

A recent study comparing English- and Turkish-speaking children directly found similarities in children's understanding of the link between different types of evidence and knowledge in themselves and others (Ünal & Papafragou, 2015). One experiment (Self task) assessed whether children themselves could reconstruct events based on the available evidence. In this task, 4-year-old English and Turkish learners were presented with two photographs. The first, face-up photograph gave either perceptual access to an event (e.g., the photograph would show someone perform an action) or inferential access to an event (e.g., the photograph would show clues about a prior action, such as footsteps on snow). The second, face-down photograph depicted a mystery event (see also the earlier description of a similar task in Ünal & Papafragou, 2016b). Children were given a verb that either matched or did not match the face-up photograph (e.g., either *walking* or *stacking* for the footsteps picture) and were asked to find the picture of the verb. Of interest was whether children would be able to pick the face-up picture for matching verbs (linking the evidence shown to the event described) and the face-down picture for mismatching verbs. A further experiment (Others task) assessed children's ability to attribute knowledge to others who were presented with different types of evidence. In this task, the same paradigm was used but the child's access to an action was replaced by someone else's (a puppet's) access. Four-year-olds from both language groups performed above chance for both the perceptual and inferential access trials (even though they were more accurate in the Self than in the Others task); crucially, there was no difference between English and Turkish learners.

Another study by Papafragou, Cassidy, et al. (2007) and Papafragou, Li, et al. (2007) compared the source monitoring abilities of 3- and 4-year-old speakers of English and Korean (Korean also grammatically encodes the distinction between visual perception and hearsay). Children completed tasks that tested their reasoning about their own and others' knowledge sources. In the basic paradigm, a toy was hidden at different locations within a doll house. In the Self task, children discovered the location of the hidden toy either by seeing it or by being told by the experimenter; later, children had to report where the toy was and how they knew. In the Others task, a puppet either saw where the toy was hidden or was told about the toy's location. Another puppet performed an irrelevant action (e.g., kicked the doll house) and thus did not gain knowledge about the toy's location. Children had to pick the knowledgeable puppet. Children successfully reported how they knew the location of the hidden toy in the Self task, but they had difficulty identifying the knowledgeable puppet in the Others task. Importantly, English-speaking children were no less accurate than Korean-speaking children in either tasks. Furthermore, in the same study, Korean children also completed an evidential production task, which showed that they were in the process of acquiring the evidential system of their language. Together with the previous study, these findings suggest that, despite cross-linguistic differences in the encoding of evidentiality, the development of source monitoring proceeds similarly across learners of different languages.

The lack of cross-linguistic differences in the time course of the development of source monitoring leaves open the possibility that adults—who have mature linguistic abilities and long-term experience with the evidential distinctions in their native language—might diverge in their source monitoring abilities. In fact, several commentators have proposed that language-specific encoding patterns bias speakers' attention to different aspects of the world, and that these biases over time result in different cognitive profiles among speakers of different languages, even when speakers are not using language (Levinson, 2003; Majid et al., 2004; cf. Whorf, 1956). An alternative possibility is that evidential language may be recruited online to support cognitive computations without modifying the underlying structure of source monitoring. On this view, conceptual representations of information sources are shared among speakers of different languages and any language-driven effects on cognition should be malleable and ephemeral in nature (cf. Gleitman & Papafragou, 2016; Landau, Dessalegn, & Goldberg, 2010; Ünal & Papafragou, 2016a).

A number of studies have tested these competing possibilities in the domain of evidentiality. In one study, adult Turkish speakers were found to be less accurate in recognizing the information reported in non-first-hand form (as indicated by indirect evidential marking, *-mIş*) compared to information reported in first-hand form (as indicated by direct evidential marking, *-dI*; Tosun, Vaid, & Geraci, 2013). In another study, Turkish-speaking adults were less prone to suggestibility to misinformation when the original information was marked by the direct evidential and the misleading information was marked by the indirect evidential compared to the opposite situation (i.e., when the original information was marked by the indirect evidential and the misleading information was marked by the direct evidential; Aydın & Ceci, 2013). These results suggest that explicit choices about the evidential forms included in linguistic messages have further cognitive implications about how information is remembered.

A stronger test of the effects of evidential encoding on cognition is to see whether these language-driven effects generalize to cases where speakers are not required to process and remember evidentially marked linguistic messages. Recall that prior research on source monitoring (conducted with English speakers) has shown that people often commit errors when reconstructing the origins of their knowledge—typically, reporting having seen things that they have only imagined, visualized, or inferred from written text (e.g., Durso & Johnson, 1980; Fazio & Marsh, 2010; Intraub & Hoffman, 1992). Could speaking a language that obligatorily makes a distinction between direct and indirect sources of information, such as Turkish, prevent speakers from making such errors?

Ünal et al. (2016) addressed this question by comparing adult speakers of English and Turkish on a source memory paradigm. In a preliminary experiment, English- and Turkish-speaking adults were presented with photographs that either directly showed an event (e.g., a woman wrapping a present, a woman blowing bubbles) or gave visual evidence that allowed the viewer to infer the event (e.g., a woman sitting next to a present, a woman standing next to bubbles traveling through the air) and were asked to describe the events. Turkish speakers used evidential morphemes to describe the events, with the seen events being described predominantly by the direct marker and inferred events predominantly by the indirect marker. By contrast, English speakers never used evidential language. For the main experiment within this study, during the encoding phase, new groups of English- or Turkish-speaking participants studied the inferred events from the same set of photographs together with some filler events. During the memory phase, the inferred photographs were replaced with photographs depicting the point at which the unfolding event could be directly seen. The filler events either stayed the same or were replaced with completely new events. Participants performed either a simple recognition memory test (reporting whether they had "seen" or "not seen" the events before) or more detailed source judgments (reporting whether they had "seen," "inferred" or "neither seen nor inferred" the events previously). Both language groups committed source monitoring errors (typically, by reporting having seen events that they had only inferred). Importantly, English and

Turkish speakers were similar in terms of the extent and types of errors they made, and the time it took to make their source monitoring decisions. These findings converge with the cross-linguistic data on the development of source monitoring: Just as the development of source monitoring follows a similar timetable across learners of different languages, source monitoring decisions are executed similarly across adult speakers of different languages.

6. Summary and prospectus

Classic theories of language and cognition assume that language builds on the conceptual repertoire available to humans, and that the acquisition of linguistic meaning is constrained by underlying mental representations of human experience (see Gleitman, 1990; for a particularly influential statement). However, explicit evidence for how linguistic meaning and conceptual representations are related in both mature (adult) and novice (child) thinkers can be limited. Furthermore, some commentators have suggested that the interaction between language and cognition might be even more complex than the classical view suggests, to the extent that the concepts themselves might vary depending on the linguistic community that one belongs to (e.g., Boroditsky, 2001; Levinson, 2003). Here, we sought to contribute to these broad topics by exploring specific links between the foundational ability to think about the origins of our knowledge and the way origins-of-knowledge are encoded in language through evidential distinctions.

From a learning perspective, there is massive support for the conclusion that evidentiality presents a hard puzzle for children (Fitneva, 2018; Matsui, 2014). Learners acquire the linguistic encoding of information source over a protracted timetable (e.g., Aksu-Koç, 1988; Ozturk & Papafragou, 2016; Papafragou, Cassidy, et al., 2007; Papafragou, Li, et al. 2007), partly because thinking about the sources of knowledge also develops in the preschool years (e.g., Sodian & Wimmer, 1987; Wimmer et al., 1988). Careful comparisons of linguistic and non-linguistic tasks suggest that full comprehension of evidential devices requires the listener to unpack them into the corresponding sources and is therefore subject to limitations in the ability to adopt someone else's perspective on informational access (Ünal & Papafragou, 2016b). Nevertheless, difficulties with evidentials persist well after children have arrived at the appropriate concepts, presumably because children have not yet fully discovered how these concepts map onto semantic and pragmatic aspects of evidential language. This picture supports the presence of strong links between linguistic and conceptual development but points also to contributions of language-internal factors to the way evidential meanings are acquired and used (Gleitman et al., 2005).

Are non-linguistic source concepts susceptible to the influence of linguistic evidentials? In other words, do cross-linguistic differences in the encoding of evidentiality influence performance even when speakers are not required to process evidential language while performing a task? Both adult and developmental studies have shown that linguistic categories of evidentiality have cognitive consequences, but that these linguistic influences are strictly limited to cases where language was explicitly involved in a cognitive task (e.g., contexts in which people had to process sentences with evidential markers; Aydın

& Ceci, 2013; Tosun et al., 2013). When speakers were tested with cognitive tasks that did not require processing linguistic stimuli, no cross-linguistic differences emerged (Papafragou, Cassidy, et al., 2007; Papafragou, Li, et al., 2007; Ünal et al., 2016). This picture is not compatible with the broad position that language has lasting effects on cognition, since that position would predict different cognitive profiles among speakers of different languages, both on tasks that involve processing linguistic stimuli as well as purely non-linguistic tasks. On the other hand, these findings cohere with a broader position about the role of language in cognition, according to which the effects of language are computed online, in the moment of performing cognitive computations and do not alter conceptual structure (cf. also Gleitman & Papafragou, 2005, 2016; Ünal & Papafragou, 2016a, for evidence from other domains).

Convergent evidence for this conclusion comes from studies on the development of mental state understanding in deaf individuals. Deaf children who are born to hearing parents and lack access to sign language lag behind their hearing peers on false-belief tasks (Peterson & Siegal, 1999; cf. de Villiers, 2005). These delays in false-belief understanding persist in adults who were exposed to sign language later in life but have not yet acquired mental state vocabulary (Pyers & Senghas, 2009), suggesting a relation between language and reasoning about mental states. Even though the precise contribution of language on the development of epistemic reasoning is debated, it seems unlikely that the syntactic features of the terms that express mental states in language provide the resources *necessary* for representing mental states; instead, language is a tool that can facilitate the processing and tracking of mental states in both children and adults (for fuller discussion, see Ünal & Papafragou, 2018b).

This picture of how linguistic evidentiality interacts with our understanding of sources of knowledge has both theoretical and methodological implications for the interface between language and cognition. On the theoretical level, our perspective offers support to the classic position that language builds on prelinguistic concepts that are widely shared by members of different linguistic communities and form the basis of language learning in young children. Nevertheless, it suggests that the acquisition of linguistic meaning is determined not only by the concepts that children can and cannot entertain but also by the mechanisms responsible for linking linguistic stimuli to conceptual representations (cf. Gleitman, 1990).

On the methodological level, the present approach highlights the usefulness of non-linguistic, cognitive tasks as an independent way of testing hypotheses about the cognitive basis of language and language acquisition within and across linguistic communities. Future studies should extend the present approach of using carefully matched linguistic and non-linguistic tasks to create simplified versions of these tasks that rely on implicit measures of performance instead of explicit verbal responses. For instance, studies using implicit measures to assess the development of Theory of Mind have revealed that at least some basic understanding of mental states is present in children younger than 2 (Baillargeon, Scott, & He, 2010; Onishi & Baillargeon, 2005). How this implicit understanding of mental states is linked to explicit understanding of mental states, sources of knowledge, and the acquisition of linguistic evidentiality remains an open issue.

The picture of evidentiality we have sketched here faces certain limitations. A first limitation is that we currently lack information about how evidential systems are actually used during conversation to mark different types of information access. This information is critical for developing a better understanding of how language marks sources of knowledge, as well as for charting more precisely what the input to acquisition looks like (see Uzundag et al., 2018). Inspection of available production data reveals subtle regularities underlying adults' use of evidential language. Recall that, in one of their experiments, Ünal et al. (2016) presented Turkish- and English-speaking adults with photographs that either directly showed an event or gave visual evidence that allowed the viewer to infer the event and asked them to describe the events. As mentioned already, Turkish speakers preferred the direct evidential for seen events and the indirect evidential for inferred events (and English speakers used no evidential marking at all). A closer look at the data shows that the Turkish speakers' use of the indirect evidential to describe inferred events was sensitive to the strength of the visual cues given in the photograph. When visual cues were weak and did not lead to a secure inference (e.g., a woman sitting next to a present, where it was likely but not certain that she had wrapped it), Turkish speakers overwhelmingly used the indirect morpheme ("high-indirectness" events). But when visual cues yielded secure inferences that were closer to direct perception (e.g., a woman next to bubbles traveling in the air, where it was obvious that she had previously blown the bubbles), Turkish speakers were equally likely to use either the direct or the indirect morpheme ("low-indirectness" events).

In a further experiment, these fine-grained distinctions between direct versus indirect evidence that underlie the use of evidential morphology in Turkish were reflected in implicit assumptions about evidence types held by English speakers (whose language lacks grammatical evidential distinctions). When a separate group of English speakers were asked to judge whether they had "seen" or "inferred" the events in the same photographs, they responded "seen" for the seen events (that were also overwhelmingly marked with the direct marker in Turkish), "inferred" for the high-indirectness events (that consistently elicited indirect morphology in Turkish), and both "seen" and "inferred" options equally for the low-indirectness events (that elicited indirect morphology in Turkish only about half of the time). When separate groups of English- and Turkish-speaking adults were tested and found equivalent in their source memory for the same photographs (as described in the previous section), closer analyses revealed that both groups were more likely to confuse inference with visual perception for low-indirectness events that were somewhat similar to direct visual evidence. In sum, these patterns show that the highly abstract boundary between visual perception and visual inference seems to be drawn in similar ways across language communities and to underlie several potentially distinct cognitive phenomena, such as the conditions of use of grammatical evidential distinctions in language, subtle intuitions about what counts as a "seen" versus "inferred" event, and memories of the way events were experienced. It remains to be seen whether the perception–inference boundary is drawn similarly in other languages and whether this boundary bears on how direct and indirect evidentials are acquired cross-linguistically.

A second limitation of the current research is that most of the psycholinguistic work on evidentials has focused on a small number of languages with grammatical evidentiality. There is variation within the class of grammatical evidential systems, with some languages having several dedicated evidential morphemes within the classes of direct and especially indirect access (see Aikhenvald, 2004, 2014). It is an open possibility that richer evidential systems place different pressures on the source monitoring processes of their speakers and the way linguistic evidentials are acquired by children (see Ünal & Papafragou, 2018a).

Notice, however, that despite their surface variability, grammatical evidential paradigms cross-linguistically appear to be subject to several constraints (Faller, 2001; Willett, 1988). For instance, the meanings typically encoded by evidentials are uniformly abstract and do not capture the multiplicity of specific sources of information found in human experience (e.g., children learn important pieces of information from their parents; thus, parents are important sources of information for humans, but this fact is not reflected in the grammars of natural languages; Speas, 2004). Overall, evidential systems draw a broad distinction between direct (mostly visual) and indirect (mostly inferential and hearsay) access cross-linguistically; even though finer subdivisions within these broad types are possible, four- and five-way evidential systems are quite rare (Aikhenvald, 2014). Furthermore, indirectness is a marked category compared to directness of evidence: typically, languages either mark both direct and indirect sources of knowledge or only indirect origins—but never direct origins alone (De Haan, 2005). These observations need to be pursued by detailed formal analyses of evidential semantics across languages that are only beginning to develop (see Davis, Potts, & Speas, 2007; Faller, 2001, 2002, 2012, 2014; Garrett, 2000; Izvorski, 1998; Matthewson, 2012; McCready, 2008, 2014; McCready & Ogata, 2007; Murray, 2017). At the moment, the fact that evidential systems cross-linguistically seem to converge on a narrow set of distinctions points to the conceptual basicness of these distinctions prior to the emergence of language. After all, the view that languages build on non-linguistic primitives is plausible only if one does not have to posit a new set of non-linguistic basic concepts for every language one looks at (Bloom, 2000). It seems likely that these basic distinctions are shared cross-linguistically and form the basis for conjecturing evidential meanings during language learning.

If the hypothesis space for evidential meanings reflects the naturalness or basicness of origins-of-knowledge concepts, it follows that the kinds of evidential distinctions that are most prevalent in languages should also be the easiest to learn. This prediction is currently being tested in a series of artificial language learning experiments with adult speakers exposed to novel evidential systems. Preliminary results confirm the expectation that broad cross-linguistic regularities affect the learnability of evidential systems, even though not in a completely predictable way (Bartell & Papafragou, 2015). This line of research can inform further stages of psycholinguistic research on evidentiality by revealing core concepts about sources of knowledge that themselves potentially structure the nature and acquisition of evidential language.

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