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Young children's conceptions of knowledge

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Abstract

How should knowledge be analyzed? Compositionally, as having constituents like belief and justification, or as an atomic concept? In making arguments for or against these perspectives, epistemologists have begun to use experimental evidence from developmental psychology and developmental linguistics. If we were to conclude that knowledge were developmentally prior to belief, then we might have a good basis to claim that belief is not a constituent of knowledge. In this review, I present a broad range of developmental evidence from the past decade and discuss some of the implications it has for the proper analysis of knowledge. The orthodox perspective from the developmental literature was one where children fail to understand belief and knowledge concepts until later in childhood (around 4–5 years of age), with typical asymmetries in belief attribution and knowledge attribution. But what emerges from both a discussion of newer findings and a contextualization of older findings is a picture of development whereby core competence with belief and knowledge concepts emerges much earlier than previously thought (in the first or second year of life) that apparent failures in later childhood may be explained by other aspects of development than conceptual development and that there is no clear evidence that knowledge attributions emerge earlier than belief attributions.

1 | INTRODUCTION

How should knowledge be analyzed? This is a central question in epistemology. When we think of conditions that might be relevant to knowledge, we tend to think of belief, truth, and justification. To know something, we must believe it, it must be true, and we should be justified in having such a belief. But as Gettier (1963) famously notes, more is needed to capture our attributions of knowledge, given that his cases of justified true beliefs (JTBs) fail to be cases of knowledge (Machery et al., 2015; Machery et al., 2017). Since Gettier, many attempts have been made to rescue JTB, by making the conditions more stringent or adding further conditions (e.g., sensitivity and safety).

But it is not clear that these attempts have been completely successful (see Ichikawa & Steup, 2017, inter alia for discussion).

An alternative to rescuing JTB would be to reject the claim that knowledge is decomposable, and to argue instead that knowledge is basic in some sense and not derived from belief (Williamson, 2000). In recent years, experimental evidence seems to have played a central role in this debate, supporting such "Knowledge First" accounts with arguments that knowledge attributions are earlier, easier, or more immediate—for human adults and infants as well as primates—than belief attributions (Mar, Tackett, & Moore, 2010; Martin & Santos, 2014, 2016; Melis, Call, & Tomasello, 2006; Phillips, Knobe, & Cushman, 2015; Santos, Nissen, & Ferrugia, 2006; Shatz, Wellman, & Silber, 1983; Tahiroglu et al., 2014; Wellman & Liu, 2004). Developmental evidence in particular seems to have played a role, especially in motivating the priority of knowledge over belief, because certain findings seem to suggest that children reach conceptual and linguistic milestones related to knowledge before equivalent ones related to belief (Nagel, 2013; Stich, 2013). But this parse of the developmental literature has also been challenged, with the argument that a more nuanced look at the studies reveals no developmental priority of knowledge (Butterfill, 2013; Rose, 2015).

As a developmentalist myself, I do not wish here to wade into debates about how to analyze knowledge, but I do wish to contribute to the discussion about whether there is a basis for claims about the developmental priority of knowledge. From a bird's-eye view, we can acknowledge that the literatures from developmental psychology and developmental linguistics do suggest that knowledge attributions emerge prior to belief attributions. But I echo others who have previously argued that a more nuanced presentation of developmental data does not necessarily support claims that knowledge is developmentally prior to belief, and present further sets of findings to support such a view. While I will not make any claims about what knowledge is, I will address some issues in how children's understanding of knowledge develops, and how developmental research bears on this debate in epistemology. I will present major findings from a few developmental bodies of literature along with some new ways of thinking about how and why children might fail and succeed where they do. In what follows, I will focus on research relevant to propositional knowledge and set other types aside (e.g., practical knowledge and acquaintance knowledge). I will also focus mainly on evidence from the first 5 years of life, since there is almost universal agreement that the relevant concepts are in place by age 5 (although some notable exceptions, see Rakoczy, 2017, for discussion). I will also focus mainly on studies from the past decade or so, with some discussion of historical context that motivated them. And without accepting JTB as the appropriate analysis of knowledge, I will use notions of belief, truth, and justification to guide the discussion; even if they are not the basis for analysis, they do represent some necessary conditions of knowledge, and we might ask if young children share these conditions with us.

We will see that although philosophers and developmentalists use the same vocabulary to discuss conceptual issues, it is often hard to use any one developmental study or even collections of such studies to adjudicate philosophical debates. The practical goals in the fields tend to differ, and developmental studies do not always lend themselves to the fine-grained distinctions that are relevant in epistemology. Along the way, I hope to suggest that there is no clear evidence for the priority of knowledge attributions over belief attributions or for knowledge vocabulary over belief vocabulary, and thus no clear support for the developmental priority of knowledge over belief concepts. I also hope to suggest that both kinds of concepts are acquired very early in development, if acquired at all, given the kinds of early competencies that children show and the nature of their childhood experiences. This is consistent with the perspective that apparent asymmetries and early failures in development might be best explained by the development of other aspects of cognition (e.g., socio-pragmatic, linguistic, and executive function) and not conceptual development.

2 | UNDERSTANDING OF BELIEFS AND KNOWLEDGE

Let us first examine developmental evidence for young children's conception of belief. This has been explored extensively for the past three or four decades in the literature on children's developing Theory of Mind, or mind reading abilities. Having a Theory of Mind requires being able to represent the mental states of others, as well as being able to use

those representations in reasoning about behavior (Premack & Woodruff, 1978, and associated commentary, Wimmer & Perner, 1983; Baron-Cohen, Leslie, & Frith, 1985). For several decades, this literature was focused around so-called *explicit* or elicited-response tasks that test children's ability to make explicit judgments—through verbal and behavioral responses—about another agent's beliefs (which might differ both from reality and from the child's own beliefs).

One such task is the change of location task, where it is established that an agent has a particular justified belief about an object (e.g., that it is in location A because they placed it there) and then, while the agent is absent, their object is moved to a new location (e.g., location B), making their belief inconsistent with the current state of reality. To test their understanding of the agent's belief, children are asked questions about what the agent would think, say, or know about the location of the object and where they might look for the object. This "false belief" (FB) condition is often contrasted with a "true belief" (TB) condition where the agent is aware of the location change and therefore maintains a belief about the object's location that matches the child's belief.[1] The typical, well-replicated result here is that no children struggle to respond appropriately in the TB condition,[2] but there are age differences in children's responses to FB conditions (Wellman, Cross, & Watson, 2001). Children who are at least 4 years of age are able to acknowledge that the agent has the FB that their object is in location A, even while children themselves believe that the object is in location B. In contrast, 3-year-olds incorrectly insist that the agent believes the object to be in location B.

Furthermore, in a wider variety of tasks used to assess different aspects of Theory of Mind, children start to succeed at different tasks in a predictable order (see Wellman & Liu, 2004, and references therein). First, they pass tasks measuring their comprehension of the conflicting nature of desires and beliefs: first that desires can conflict (so-called *diverse desires* tasks), then that beliefs can conflict (so-called *diverse beliefs* tasks). Afterwards, they pass so-called *knowledge-ignorance* or *knowledge access* (KA) tasks, which, for example, ask whether agents need perceptual access to form beliefs about the contents of a container. And finally, they start to pass the FB tasks. These results contributed to the orthodox view that children lack a full Theory of Mind before 4 years of age (Perner, Leekam, & Wimmer, 1987), and the fact that success on KA tasks precedes FB tasks has been used to argue for the developmental priority of knowledge (see Nagel, 2013, and discussion in Rose, 2015).

But the orthodox view has been challenged by those who argued that these results in the traditional elicited-response FB tasks (such as the change of location task) were performance errors (Leslie, 1994; Leslie, Friedman, & German, 2004; Scholl & Leslie, 2001; Surian & Leslie, 1999; Yazdi, German, Defeyter, & Siegal, 2006), potentially due to immature executive functioning (Carlson, Claxton, & Moses, 2015; Carlson & Moses, 2001; Hansen, 2010; Leslie & Polizzi, 1998) or immature pragmatic understanding (Helming, Strickland, & Jacob, 2014, 2016; Lewis, Hacquard, & Lidz, 2017; Pham, Bonawitz, & Gopnik, 2012; Rubio-Fernández & Geurts, 2012; Rubio-Fernández & Geurts, 2016; Siegal & Beattie, 1991; Sullivan & Winner, 1993; Westra, 2016). Such explanations, these challengers argue, are consistent with performance errors that adults have been shown to make (Apperly, Samson, & Humphreys, 2005; Gillette, Gleitman, Gleitman, & Lederer, 1999; Papafragou, Li, Choi, & Han, 2007).

One pragmatic explanation of the FB task failure, for example, highlights the complexity of the pragmatic inference children would need to make in the experimental conditions. Children might well have the relevant conceptual understanding of belief but instead fail to appropriately recognize the intentions of the experimenter in asking test questions, and they thus respond in a predictable way to a question adjacent to, and pragmatically inferred from, the one that was asked (e.g., "Where will she look for the ball?" interpreted along the lines of "Where should she look for the ball?", see Westra, 2016). And, in particular, test sentences involving the verb *think*, such as "the agent thinks that the object is in location A" may be difficult because they do not match children's typical experiences with the verb (Diessel & Tomasello, 2001; Lewis et al., 2017); children may entertain these as profferings (e.g., "the object is in location A, because the agent thinks so") due to the "assertive" nature of *think* in everyday conversations that they are exposed to (Dudley, 2017; Simons, 2007; Urmson, 1952). Thus, late success on FB tasks would be predicted under these pragmatic[3] explanations, and similar pragmatic explanations may be applied to other studies in the Theory of Mind battery to explain when they are passed. For example, just as the test sentences in FB tasks are unintentionally hard for children given their prior experiences, the *know* test sentences (e.g., "Will the agent know what is in this box?") in KA tasks may be unintentionally easy. Children often get experience with such *know-wh* sentences used

in indirect speech acts to request information (Searle, 1975; Dudley, 2017; Dudley, Rowe, Hacquard, & Lidz, in preparation). If they understand the experimenter to be asking something like "will this agent be a good source of information about the box's contents?", they could provide the expected answer, but for an unexpected reason.[4] Defenders of the pragmatic view also appeal to the finding that the relevant order of successes is not constant across all cultures. In Iran and China, children tend to pass KA tasks before diverse belief tasks (Duh et al., 2016; Shahaeian, Peterson, Slaughter, & Wellman, 2011; Wellman, Fang, Liu, Zhu, & Liu, 2006). Proponents of pragmatic interpretations contend that we should not admit cultural differences in conceptual development, but alternatively, these children from more "collectivist" cultures could find KA tasks easier because they are more used to discussion of knowledge shared by a community than beliefs which may differ from individual to individual (Westra & Carruthers, 2017).

In the past few decades, these pragmatic challenges to the orthodoxy have also been supported by a rising tide of experimental evidence that children can attribute FBs and predict behaviors on the basis of them, well before their fourth birthday—when assessed via an appropriate paradigm (see Baillargeon, Scott, & Bian, 2016, for a recent review). This evidence comes from multiple paradigms considered to be "implicit" measures of children's Theory of Mind because they do not require children to make explicit judgments about what other individuals believe. Instead childrens' sensitivity to the beliefs of others is measured via other behaviors, including violation of expectation or looking time studies (Kovács, Téglás, & Endress, 2010; Onishi & Baillargeon, 2005; Poulin-Dubois & Chow, 2009; Scott & Baillargeon, 2009; Scott, Baillargeon, Song, & Leslie, 2010; Scott, Richman, & Baillargeon, 2015; Song & Baillargeon, 2008; Surian, Caldi, & Sperber, 2007; Träuble, Marinović, & Pauen, 2010; Yott & Poulin-Dubois, 2012) where children's interest in novel or unexpected stimuli are gauged; anticipatory looking measures (Clements & Perner, 1994; Garnham & Ruffman, 2001; Senju, Southgate, Snape, Leonard, & Csibra, 2011; Southgate, Senju, & Csibra, 2007) which ask what children will spontaneously predict given some stimuli; helping paradigms (Buttelmann, Carpenter, & Tomasello, 2009; Buttelmann, Over, Carpenter, & Tomasello, 2014; Buttelmann, Suhrke, & Buttelmann, 2015; Knudsen & Liszkowski, 2012) where children assist other individuals; as well as affective measures (Moll, Kane, & McGowan, 2016; Moll, Khalulyan, & Moffett, 2017); neural measures (Kampis, Parise, Csibra, & Kovács, 2015; Southgate & Vernetti, 2014); and cross-cultural comparisons thereof (Barrett et al., 2013).

Given this new accumulation of findings from "implicit" tasks, it is clear that we need to attribute some representational Theory of Mind capacity to children as young as 6 months.[5] But how should that capacity be characterized: as representation of beliefs qua beliefs, or some more minimal characterization? One set of authors endorse rich interpretations of the findings, namely, that very young children do have a Theory of Mind and a conceptual repertoire of belief concepts (Song & Baillargeon, 2008; Luo & Baillargeon, 2010; Carruthers, 2013; Scott, 2014; Scott & Baillargeon, 2014; Michael & Christensen, 2016). Another set of authors endorse leaner, more minimal interpretations of children's performance in these tasks (Butterfill & Apperly, 2013; Gallagher & Povinelli, 2012; Heyes, 2014; Low, 2010; Perner, 2010; Perner & Ruffman, 2005; Ruffman, 2014). Doubts about rich interpretations are motivated, among other reasons, by the following concerns: that these new implicit studies have demonstrated some sensitivity to beliefs while failing to show that young children have meta-awareness or conscious access to the belief representations; that young children fail to grasp the intensionality of beliefs; that the representations employed by young children do not have the same content as belief representations; or that the representations do not interface with other aspects of cognition, such as action prediction. For example, evidence from violation of expectation paradigms and neural measures in infancy suggest very young children seem to spontaneously track the FBs of others, but many studies have failed to find adult-like competence with verbal attributions of FBs until 2–3 years later. How should this apparent inconsistency be explained? Some have taken this to suggest that the spontaneous representation in infancy are unconscious or unavailable for reasoning, and thus different from the representations in later childhood and adulthood. Others have suggested that performance factors explain the later errors and that the representations at play are similar across development. For extensive discussion of the different interpretations and implications of the experimental findings, see Hutto, Herschbach, and Southgate (2011); Rakoczy (2012); and Carruthers (2013).

Most recently, infant researchers, who tend to advocate rich interpretations, have started to respond to these criticisms of minimalist interpretations with a new wave of findings. With respect to metacognition, while even

school-aged children can sometimes fail to recognize their own ignorance (van Loon, de Bruin, Leppink, & Roebers, 2017), Goupil and colleagues have suggested that infants are sensitive to the accuracy of their own mental states (Goupil & Kouider, 2016) and seek help when they are uncertain (Goupil, Romand-Monnier, & Kouider, 2016). But see Gliga and Southgate (2016) for a concise summary of the tentative nature of these infant metacognition findings. Additionally, while it has been suggested that even older children fail to recognize the aspectuality or intensionality of beliefs (Apperly & Robinson, 1998; Perner et al., 2015; Rakoczy et al., 2015; Sprung, Perner, & Mitchell, 2007), infants do seem to understand that other individuals can have FBs about an object's identity (Scott & Baillargeon, 2009) and that such beliefs are based on the aspect under which the object is viewed (Scott et al., 2015). Furthermore, work with adults has shown that the neural regions recruited for "explicit" mental state reasoning are also recruited in some instances of "implicit" or spontaneous belief tracking (Kovács, Kühn, Gergely, Csibra, & Brass, 2014), suggesting that the mechanisms or representations involved in the two cases are similar. And these representations do interact with action performance (Buttelmann et al., 2009) and action prediction (Southgate & Vernetti, 2014). So when do children attribute propositional attitudes? While there is still work to be done and the debates are still raging, new evidence suggests that infants in the first year of life are able to represent the beliefs or knowledge of others and use them in predicting behavior.

3 | JUSTIFICATION AND TRUTH AS A BASIS FOR KNOWLEDGE

Past studies on the behavior of children as young as 2 or 3 years suggest that they understand the role of sensory experiences in acquiring knowledge. They use perceptual access to acquire information (Call & Carpenter, 2001; Gopnik & Graf, 1988). In interacting with others, children are sensitive to what they themselves have seen (O'Neill, 1996) and they ascribe knowledge to others who have had visual access (Pillow, 1989). But, similar to the case of FBs, early findings in this literature suggested that the child's understanding is quite fragile. These studies found that 3-year-olds, even while acquiring new knowledge through perceptual access, failed to correctly report this as their source for information (Gopnik & Graf, 1988; O'Neill & Gopnik, 1991). Furthermore, children did not always correctly distinguish between the kinds of knowledge that different sensory modalities can provide (O'Neill, Astington, & Flavell, 1992; O'Neill & Chong, 2001) or even correctly distinguish between beliefs from justified or imagined sources in some cases (Woolley & Bruell, 1996). Children also claimed that they knew some piece of information if they merely guessed correctly (Johnson & Wellman, 1980). Furthermore, children as young as 4 years of age acquire knowledge through inferential reasoning and can make the judgment that inference counts as a source of knowledge, particularly when there is some pragmatic support for it (Keenan, Ruffman, & Olson, 1994; Ruffman, 1996; Sodian & Wimmer, 1987). But they struggle to fully understand the role that inference plays well into the school years (Miller, Hardin, & Montgomery, 2003; Pillow, 1999, 2002; Pillow, Hill, Boyce, & Stein, 2000). This body of literature might suggest that children have a flawed understanding of how knowledge is formed.

More recently, evidence from behavioral studies and analyses of children's speech has started to challenge this picture. In verbally reporting information to others, 3-year-olds are sensitive to their own (lack of) knowledge (Kim, Paulus, Sodian, & Proust, 2016). Two-year-olds are also sensitive to their own ignorance and can explicitly admit that they lack knowledge when asked (see discussion of studies in Harris, Ronfard, & Bartz, 2017). Moreover, studies with children between 12 and 24 months of age suggest that they understand that an individual's beliefs can be formed on the basis of what they can see (Flavell, Everett, Croft, & Flavell, 1981; Luo & Baillargeon, 2007; Luo & Beck, 2010; Scott et al., 2015; Song & Baillargeon, 2008; Southgate, Chevallier, & Csibra, 2009). Given these findings, it is clear that even very young children have some level of competence with what qualifies as a source of knowledge.

What do we know about children's facility with truth and falsity? Very early discussions of children's lying behaviors involved anecdotal and observational evidence (Darwin, 1877; Piaget, 1932). More recently, research in this area has focused on children's performance within manipulations of the "temptation resistance paradigm" (from Lewis, Stanger, & Sullivan, 1989). In this paradigm, children are instructed that they should not play with a particularly

tempting toy while the experimenter is away. In these situations, children tend to transgress and play with the toy, providing a good opportunity to examine children's deceptive behaviors (or lack thereof) when questioned by the experimenter upon their return. Work with this paradigm led to the proposal that there are several stages of development in children's verbal deception behaviors (Talwar & Lee, 2008), with some cross-cultural validation (Evans, Xu, & Lee, 2011). At 2–3 years of age, children start to produce false statements to deny that they played with the toy, but no attempt is made to justify these false statements. By 4 years of age, children start to provide justifications, but they commit "semantic leakage" errors that make maintaining the deception difficult. Later in the school years, children start to provide better justifications for their lies and prosocial lying behaviors emerge (Talwar, Murphy, & Lee, 2007; Xu, Bao, Fu, Talwar, & Lee, 2010). Deceptive behaviors have also been found to be related to "explicit" Theory of Mind performance and executive functioning: Children who perform well in these tasks also lie earlier and more convincingly (Chandler, Fritz, & Hala, 1989; Leduc, Williams, Gomez-Garibello, & Talwar, 2016; Ma, Evans, Liu, Luo, & Xu, 2015; Polak & Harris, 1999; Talwar & Lee, 2008; Williams, Moore, Crossman, & Talwar, 2016), but there is also some suggestion that deceptive behaviors can be found in children who do not demonstrate fully orthodox Theory of Mind competence (Newton, Reddy, & Bull, 2000; Sodian, 1994).

While children are starting to use false statements, they sometimes fail to recognize when others make false statements, notably even when they should otherwise know better. One study found that 2.5-year-old children trust false testimony from others about the location of a hidden object even when they themselves have seen the hiding event (Jaswal, 2010), and studies have found similar results in other contexts (for reviews, see Mascaro & Morin, 2014; Jaswal & Kondrad, 2016). One interpretation of this kind of result would be that children are unable to represent false propositions (just as some interpret the findings in the Theory of Mind literature to suggest that children are unable to represent FBs). However, a set of studies by Mascaro and Morin (2015) and Mascaro, Morin, and Sperber (2016) demonstrate that children are able to understand false statements and FBs, even while they trust the deceptive testimony of others. These authors propose that errors are merely due to children's trusting nature. Children trust the deceptive statements of others because they perceive them as assertions and assume that asserted content will be true; the apparently immature errors that children make are instead due to their understanding of communication.

This interpretation is supported by evidence that children are sensitive to verbal and nonverbal signals of communicative cues and use them in learning or reasoning about the world (e.g., when making generalizations about category membership), as young as 10 months and through preschool (Butler & Markman, 2014; Egyed, Király, & Gergely, 2013; Király, Csibra, & Gergely, 2013; Kovács, Téglás, Gergely, & Csibra, 2016; Topál, Gergely, Miklósi, Erdőhegyi, & Csibra, 2008). Within the literature on children's trust in testimony, studies have shown that children can reject deceptive testimony when it is not associated with communicative or intentional cues (Heyman, Sritanyaratana, & Vanderbilt, 2013; Jaswal, Croft, Setia, & Cole, 2010). And recent work by Mascaro and Kovács (in prep, discussed in Mascaro & Sperber, 2016) suggests that this trusting tendency in the presence of communicative cues strengthens between 15 and 24 months of age, which is consistent with children developing expectations about assertions and what they commit the speaker to. So there is some reason to think that children understand false statements, with pragmatic explanations of cases where they seem to be overly trusting. What about other kinds of false representations?

Young children, from 8 months of age, are sensitive to an informant's history of accuracy (Tummeltshammer, Wu, Sobel, & Kirkham, 2014). When choosing individuals to model after or informants from whom to learn novel actions, object functions or object labels, children prefer reliable—or previously accurate—informants (Begus & Southgate, 2012; Chow, Poulin-Dubois, & Lewis, 2008; Poulin-Dubois, Brooker, & Polonia, 2011; Zmyj, Buttelmann, Carpenter, & Daum, 2010). They do not ignore information from unreliable informants; this information is encoded, but their representations of it are weaker than their representations of information gleaned from reliable sources (Koenig & Woodward, 2010; Sabbagh & Shafman, 2009) and may be dependent on comparisons of relative reliability (Vanderbilt, Heyman, & Liu, 2014). In older children, these representations are more nuanced and robust: reliability is described epistemically (Koenig & Harris, 2005), represented probabilistically (Pasquini, Corriveau, Koenig, & Harris, 2007), remembered after delays (Corriveau & Harris, 2009a), and used in further reasoning, such as inference via elimination

of alternatives (Birch, Vauthier, & Bloom, 2008). Preschooler's understanding of an informant's reliability is also tied to their expertise with a particular topic (Sobel & Corriveau, 2010), which does not necessarily generalize to another topic (Koenig & Jaswal, 2011; Kushnir, Vredenburgh, & Schneider, 2013; Stephens & Koenig, 2015), and they will seek out contextually expert informants who they may not value in other contexts (Lutz & Keil, 2002; VanderBorght & Jaswal, 2009). While these seem like epistemic considerations, there are also many other traits that children value in informants, which we might consider less closely related to epistemic justification.

Children sometimes prefer informants that are older (Jaswal & Neely, 2006; Shutts, Banaji, & Spelke, 2010; Zmyj, Daum, Prinz, Nielsen, & Aschersleben, 2012); more similar to them, for example, in the languages they speech (Begus, Gliga, & Southgate, 2016; Buttelmann, Zmyj, Daum, & Carpenter, 2013; Corriveau, Kinzler, & Harris, 2013; Kinzler, Corriveau, & Harris, 2011; Marno et al., 2016), or in their gender (Ma & Woolley, 2013; Shutts et al., 2010), but not always their race (Krieger, Möller, Zmyj, & Aschersleben, 2016; Shutts et al., 2010); more familiar to them (Corriveau & Harris, 2009b; Reyes-Jaquez & Echols, 2013); nicer (Clément, Bernard, Grandjean, & Sander, 2013; Hamlin & Wynn, 2012; Landrum, Mills, & Johnston, 2013; Lane, Wellman, & Gelman, 2013; Mascaro & Sperber, 2009); more attractive (Bascandziev & Harris, 2016; McDonald & Ma, 2015); stronger (Bernard et al., 2016; Fusaro, Corriveau, & Harris, 2011); or more confident (Birch, Akmal, & Frampton, 2010; Jaswal & Malone, 2007) than other informants. And children sometimes value these traits above and beyond an informant's previous accuracy (Corriveau & Harris, 2009b; Landrum et al., 2013).[6] So what do the findings from this literature really tell us? If children value direct perceptual access in information sources, that could reflect their understanding of different sources of justification for knowledge. But what about all the other factors that seem to matter for children? There are different functions of the learning and modeling that young children do: one being cognitive and the other being normative or affiliative (Harris & Corriveau, 2011; Heyes, 2016; Nielsen & Blank, 2011; Over & Carpenter, 2013; Uzgiris, 1981). It is possible that understanding of knowledge is in place, but is not clearly demonstrated by children's behaviors because social motivations for trust are more relevant in early childhood than epistemic ones. The nonepistemic characteristics that children value in informants and models might be valuable in finding others to affiliate with and from whom to learn the norms or conventions of a community (Barth, Bhandari, Garcia, MacDonald, & Chase, 2014; Corriveau, Pickard, & Harris, 2011; Fusaro & Harris, 2008; Gergely, Bekkering, & Király, 2002; Rakoczy, Warneken, & Tomasello, 2009; Stephens & Koenig, 2015), even in infancy (Begus et al., 2016; Buttelmann et al., 2013; Hamlin & Wynn, 2012; Marno et al., 2016; Scott & Henderson, 2013), but strengthening throughout development before dropping off again in the school years (Brosseau-Liard & Birch, 2010; Elashi & Mills, 2014; Zmyj, Daum, & Aschersleben, 2009).

4 | EPISTEMIC VOCABULARY

A more indirect measure of children's conceptual understanding of knowledge is their use of epistemic vocabulary, including propositional attitude verbs (e.g., *know*), epistemic modals (e.g., *must*), and adverbs (e.g., *certainly*), as well as evidential markers and perception verbs (e.g., *see*). Children may have the appropriate concepts in place long before they start to use epistemic words (Hespos & Spelke, 2004), but their use of these words can still be informative about their understanding of knowledge and its (purported) constituents.

Propositional attitude verbs describe mental states, such as belief and knowledge. Research on children's use of propositional attitude verbs shows that they start to use these words after their second birthday and that their uses increase in complexity across the preschool years. Early studies of children's production found that children use the attitude verb *know* earlier and more often than *think* (Shatz et al., 1983; see Nagel, 2013, for discussion). Furthermore, many studies looking at children's comprehension of attitude verbs suggest that they do not start to develop an adult-like understanding of these verbs until around 4–5 years, or even older (Abbeduto & Rosenberg, 1985; Bassano, 1985; Falmagne, Gonsalves, & Bennett-Lau, 1994; Harris, 1975; Hopmann & Maratsos, 1978; Johnson & Maratsos, 1977; Léger, 2008; Macnamara, Baker, & Olson, 1976; Moore, Bryant, & Furrow, 1989; Moore & Davidge, 1989; Scoville & Gordon, 1980).

But more recent findings suggest that children's performance in these tasks is due to pragmatic or input-related factors and that their understanding of the words is more sophisticated than once thought. With respect to production of *know*, children use it in many of the same ways that adults do: to respond to questions, provide declarations of ignorance, and indicate levels of certainty about a proposition, even at 2 years (Dudley, 2017; Dudley et al., forthcoming; Harris, Yang, & Cui, 2017). It is true that many of these early utterances are *I don't know*, but they use this to express ignorance, and as children, they are often more ignorant than their conversational partners (Harris et al., 2017; see Rose, 2015, for discussion). Around 3 years, children use the verbs in unambiguous mental state attribution and around 4 years, they use *know* to describe necessarily TBs, while *think* is used to describe FBs (Schulz, 2003). With respect to comprehension of the verbs, children as young as 3 can differentiate *know* from *think* on the basis of their (non-)factivity[7] (Dudley, Orita, Hacquard, & Lidz, 2015; Lewis et al., 2017), but some children do not do so until they are over 4.5 years old (Hacquard, Dudley, Baron, & Lidz, 2016), and individual variation may be related to ways which the adults around them use the verbs (Dudley, 2017; Nichols & Pinillos, forthcoming).

Epistemic modals and adverbs can be used to express epistemic meanings (e.g., "He must/certainly think(s) it's raining because he's carrying an umbrella"). The literature on children's understanding of modals has described an "epistemic gap" in their use of modal terms. Children start to use words like *must* as early as 2 years of age, but first with nonepistemic meanings, such as permission or obligation (e.g., "You must carry an umbrella to avoid getting wet"), and only later with epistemic meanings (de Villiers, 2007; Heizmann, 2006; Papafragou, 1998; Shatz & Wilcox, 1991; Stephany, 1979). Recently, Cournane (2015) has argued that this is due to children's developing linguistic abilities and not their conceptual understanding of knowledge, given that they use epistemic adjectives and adverbs around their second birthday (O'Neill & Atance, 2000).

In some languages, such as Turkish, there are lexical markers of sources of evidence called *evidentials*. These evidentials linguistically indicate the justifications that speakers have for the assertions that they make, and cross-linguistically, there is a limited set of sources that evidentials mark: including direct perceptual evidence (sometimes distinguishing between modalities of perception), secondhand information reported by others, and information arrived at via inference from circumstantial evidence (Aikhenvald, 2004). Other languages, such as English, can mark sources of information through other means, such as using perception verbs (e.g., *see*, *hear*, *sounds*, and *looks*). With respect to children's understanding of evidentials, there is an apparent comprehension/production asymmetry whereby children start to use evidential terms much earlier than they demonstrate adult-like competence with them (Matsui, 2014; Ozturk & Papafragou, 2016; Papafragou et al., 2007). For example, although there are a lot of variations in when children start to produce evidential markers, the average age for Japanese children is around 2 years (Shirai, Shirai, & Furuta, 2000) and complex uses of evidentials occur even at 2 years (Matsui & Yamamoto, 2013), yet they fail to pass comprehension tasks with evidentials until 6 years of age (Matsui, Yamamoto, & McCagg, 2006). But there may be a linguistic—not conceptual—explanation, given that children use perception verbs to distinguish between different sources of information around 2 years of age (Rett & Hyams, 2014).

5 | DISCUSSION

A current debate in epistemology revolves around how to analyze knowledge. Is it decomposable into constituents such as belief or not? Recently, some have highlighted the relevance of developmental evidence rehearsed above in adjudicating this debate (Nagel, 2013; Rose, 2015). The orthodox view from development was that attributions of FBs are hard (Perner et al., 1987), that attributions of knowledge may emerge earlier (Hogrefe, Wimmer, & Perner, 1986; Wellman & Liu, 2004) and that *know* is used earlier and more often than *think* (Shatz et al., 1983). This orthodox view from development was taken as support for the new and unorthodox analysis of knowledge (Nagel, 2013; Williamson, 2000). But as argued previously by Butterfill (2013) and Rose (2015), and expanded upon here, a newer and broader perspective on the developmental literature does not necessarily support such a theory.

What does this broad look at the developmental literature tell us about the epistemological debate? The importance of developmental evidence in adjudicating the debate hinges on asymmetries in the conceptual developmental of knowledge versus belief, with the assumption that asymmetries in task successes reflect underlying conceptual asymmetries. If knowledge tasks are passed before belief tasks, then we have some support for theories where belief is not a constituent of knowledge. But this broader look at the developmental literature presents three challenges. First, asymmetries in development do not clearly favor the priority of knowledge. Second, nonconceptual explanations of task success or failure are gaining ground among some developmentalists, in that other known immaturities in other aspects of cognition (social understanding and linguistic understanding) contribute to explaining errors in childhood. Third, there is growing body of evidence which supports remarkably early competence with concepts like belief and knowledge, suggesting that concepts are in place as early as the first or second year of life (by the earliest measures, 6 months), which gives little time for conceptual development to occur. Thus, the burden is shifted to those who want to explain children's performance in terms of conceptual development: What kinds of experiences help to scaffold such development? How is belief understanding or knowledge understanding built? And how would we build one from the other? Once we have clear proposals about the kind of experiences needed to motivate such development, experimentalists can tell us whether children have the relevant experiences in such a short window of time.

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ENDNOTES

[1] Notice the juxtaposition of TB conditions (sometimes referred to as cases where the agent "knows" the object's location) and FB conditions. I do not believe that this should be taken to imply anything about developmentalists' conceptualizations of knowledge. Instead, this seems to be an artifact of the intertangling of several research questions within the developmental literature: First, do children possess metarepresentational abilities? Second, can they deal with representations that conflict? And third, can those representations take beliefs and/or knowledge as their content? As noted by Nagel (2013), other terms that are used to name such critical conditions are "reality-congruent" and "reality-incongruent."

[2] With the exception that much, much older children (even at 8 years) can fail to answer TB questions appropriately (see Oktay-Gür & Rakoczy, 2017; Fabricius, Boyer, Weimer, & Carroll, 2010).

[3] Either linguistic pragmatic, or more generally socio-pragmatic.

[4] Similar pragmatic conditions can make these *know* questions just as challenging for children as the *think* questions in FB tasks. This occurs in typical second-order Theory of Mind tasks, and children tend to pass these tasks much later in development (Perner, Huemer, & Leahy, 2015; Rakoczy, Fizke, Bergfeld, & Schwarz, 2015).

[5] Of course, there is the possibility that this wave of findings is actually due to a host of false positives which came about because of sociological factors in developmental fields. See Oakes, 2017, for discussion of the factors that could contribute.

[6] However, the significance of these other group- or individual-level traits can be overcome by epistemic considerations, such as knowledge about an informant's perceptual access (Terrier, Bernard, Mercier, & Clément, 2016), previous accuracy (Corriveau et al., 2013; Hermes, Behne, & Rakoczy, 2015; Jaswal & Neely, 2006; Taylor, 2013), described competence (Johnston et al., 2015) or relative success (Scofield, Gilpin, Pierucci, & Morgan, 2013; Wilks, Collier-Baker, & Nielsen, 2015). And it is possible that some of findings tied to these nonepistemic characteristics are better explained under more epistemic accounts (see, for example, Zmyj & Seehagen, 2013).

[7] Here, I am appealing to linguists' use of the term *factivity* where factive verbs are those which not only entail but also presuppose the truth of their complement (Egré, 2008; Kiparsky & Kiparsky, 1970).

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