2021

With Language in Mind

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1.0 Outline of the paper

The relationship between language and theory of mind is a perplexing one that raises questions about how *any* concept is connected to language. This paper considers the question of how mental language and the understanding of propositional attitudes, or *intentionality*, relate. In the first section, belief reports are considered, and the conditions on when we invoke them. But beliefs are not the only mental states that theory of mind encompasses. The next section addresses which *other* linguistic phenomena also have point of view, perhaps entailing concepts that fall short of false belief understanding. The reasonable assumption is that there is conceptual development that is necessary before its manifestation in language , but in the special case of reasoning about false beliefs, the usual order seems to be reversed. How can this be? Recognizing that belief reports entail different points of view on truth assertions, the possible role that syntactic development seems to play in false belief reasoning is reviewed, with an assessment of the conflicting evidence. Returning to the language of propositional attitudes like *belief*, the learning problem for the different complements of mental verbs is addressed. Crucially, to achieve the correct truth evaluation requires that the complement be embedded as an argument under a matrix verb. Children may not immediately or infallibly take that step, and different opinions are reviewed about the cause and nature of the mistakes made. In a final section, new puzzles are laid out about other linguistic phenomena such as epistemic modals and predicates of personal taste where syntax seems to delimit possible meanings.

At issue here is the claim that linguistic phenomena rest on achievements that are manifest first in non-linguistic domains. Could human language make possible some ideas – surely not all - that exist, first and foremost, within linguistic phenomena themselves? That is,

when we consider the "interface" between language and cognitive achievements, we usually think of cognition providing input to language. But what if grammar feeds cognition? Or, even more precisely, what if human grammar *is* structured human thought? The inspiration for this theoretical perspective comes from the writings of Wolfram Hinzen (2009, 2014, 2017; Hinzen & Sheehan, 2014), and empirical puzzles from research have made me receptive to it (de Villiers, 2014; 2017).

2.0 Intentionality

First, consider intentionality itself. Under what kind of conditions do we attribute beliefs to an individual? In ordinary life, we rarely bother to describe beliefs driving actions. The notion of a belief state is just too rich and redundant, which is why Behaviorism resisted invoking any inner states as explanatory devices (Skinner, 1953). Suppose Lizzie is getting ready for work in the morning. She puts bread in the toaster, gets the tub of butter out of the fridge, and gets a knife from the drawer. It would be unusual to describe this as driven by a series of beliefs, though they are implicit in her actions, e.g. that the knives are kept in such-and-such a place, that she will require butter and a knife to spread it etc. If we interfere with the sequence in some way, we will see appropriate secondary procedures take over to achieve the goal, for example, if the knives are all gone from the drawer she will reach into the dishwasher for one. If there are none in the dishwasher either, we might see a change come over Lizzie, as she moves from habit into conscious reasoning about where the knives could possibly have gone. Even more strikingly, what if the toast pops and we see Lizzie insert the knife into an open jar of hand cream and spread the substance on the toast? Now we are entering the territory of the "false belief". We

would explain her action by saying, “Lizzie thought that was the butter!” Notice that Lizzie probably had no more conscious thought about the matter than if it had proceeded normally, but we as witnesses leap into interpretive mode: that is precisely when we invoke talk about beliefs driving actions.

It was with films of such disparate actions that our own investigations twenty years ago explored when and how children understand and attribute beliefs to others. Three year olds laughed at the mistakes, but could not offer sensible descriptions of why people did what they did. They gave explanations such as, “She likes that”. In contrast, four and five year olds often laughed in anticipation of the mistakes that were to be made, and offered explanations that referred quite often to belief states, such as “She thought it was the butter!” (de Villiers & de Villiers, 2000). Language-delayed deaf children shown the same silent videos divided along the same lines, as a function of their language skill, often two or three years later than hearing counterparts (Schick, de Villiers, de Villiers & Hoffmeister, 2007).

Complement structures such as:

1. She thought it was the butter.

have properties that set them apart from other kinds of sentences, semantically and syntactically, making them perfectly suited to capture truths in other possible worlds: worlds in the heads of other persons. The truth of the embedded proposition “it was the butter”, is relative to the subject of the sentence, and false to the speaker. Using indices to mark whose world the truth belongs to, each clause, each proposition, might have an index (PoV for Point of View) reflecting that world (de Villiers, 2001; 2005):

2. $_{PoV1}$[she thought $_{PoV2}$[it was the butter]]

The matter is not so simple however, because noun phrases also have a point of view on them: in the above proposition, "the butter" is subsumed under Lizzie's point of view, and that is not the label the observer would place on it (hand cream). In more nuanced circumstances, the label is not a false one, but is nevertheless not one known both by the subject and the speaker. Imagine that the bread being used in the scenario above, unbeknownst to Lizzie, is one that Lizzie's roommate Esmé has been using to grow mold for her biochemistry project. Esmé might truthfully say to her professor,

3. My roommate ate the bread.

or more informatively,

4. My roommate ate my biochemistry project.

But she could not report,

5. My roommate thought she ate my biochemistry project.

Substitution of co-referential terms is everywhere else a possibility, but it is blocked under opaque contexts, which is what the sentential complements under verbs constitute. In opaque contexts, close attention must be paid to the particular knowledge of the subject of the sentence if one is to preserve truth in labeling. This too, children must learn, and they are rather too accepting of sentences like (5) until relatively late in acquisition (Russell, 1987; Apperly & Robinson, 1998; Kamawar & Olson, 1999). The problem is a deep one, and existing treatments in developmental psychology often scratch the surface of the phenomena of referential opacity (Apperly & Robinson, 2003; Racoczy, 2015). In a new paper, Gut, Haman, Gorbaniuk and Chylinskia (2020) make progress in distinguishing the demands of opacity from the demands of false belief tasks, arguing that perspective taking requires the additional competence of distinguishing the intensions under which the object is known, not just knowing if the person registered the object or not (see also de Villiers, 2001;2005). The child has to think in a subtler way, considering the "intension under which a given belief is presented", not only its truth value. However, there is more to be said even still, as children do better in production of the correct designations than they do in comprehension (Merchant & de Villiers, 2007). The linguistic side of referential opacity is still neglected.

3.0 Point of View elsewhere

Surely many aspects of human language also have a point of view. Clauses and noun phrases do not exhaust the contribution of speaker perspectives. Much literature in linguistics has discussed point of view as part of the meaning of a wide variety of expressions. De Villiers (2018) considers such forms as personal (I/you) and spatial (here/there) deixis, of time perspectives in tense (had been) and adverbs (tomorrow), of personal taste in adjectives (tasty) and adverbs (fortunately), even prepositions (in front, behind). In addition, in as many as a quarter of the world's languages, evidential morphemes must be used as grammatical markers of how a speaker knows what they are talking about: is it via private experience, via the senses, or it is by hearsay, or inference? These markers are as obligatory as tense is for an English speaker (Aikhenwald, 2004). Even the use of determiners in English, the choice between *a* cat versus *the* cat, requires, among other factors, consideration of whether the entity in question is new to the listener or not (Schaffer & de Villiers, 2000; Van Hout, Harrigan & de Villiers, 2010). Point of view is ubiquitous in linguistic expressions, so does that mean that all such uses require theory of mind understanding? How else could a child adjust their speech to another's perspective?

Understanding another's false beliefs is not the sum of theory of mind development, though it is a significant one. In the earliest days of inventive experimentation, the first tasks were being developed to test whether young children could understand that other people had minds. The psychologists (e.g. Wimmer & Perner, 1983) based their reasoning on that of Premack & Woodruff (1978) , investigating apes, and Dennett (1978), arguing in philosophy, that the only secure way to know was to see if someone could reason about another person's *false* beliefs. We normally reason premised on our own beliefs being true, but the real test of

awareness of other minds is if we can reason from a premise that we know to be false. Truth is at the heart of this. Of course, there are earlier tasks at which children can succeed, the difference being these earlier tasks, and the abilities they reflect, do not entail truth contrasts. A rough timetable of the achievements on which most researchers agree is provided in Table 1 (more details can be found in e.g. Wellman & Liu, 2001; de Villiers, 2007). What remains in dispute is whether the classic tasks developed for testing false belief reasoning, held to be a crowning achievement of theory of mind, in fact distort what children know from a much earlier age.

Table 1 here

The linguistic markings that seem to entail another's point of view generally appear earlier in child language, on the whole, than the corresponding conceptual understanding, like spatial perspective taking, or understanding that seeing leads to knowing. This could be given any of *at least* three interpretations:

a) A popular view is that assessing theory of mind, especially false belief reasoning, via the usual explicit cognitive tasks is confounded by other skills, such as inhibitory control, that mask what a child really knows about others' perspectives. The linguistic phenomena expose the classic tasks as faulty indices of what children understand about point of view (e.g. Baillargeon, Scott & He, 2010; Wang & Leslie, 2016). If infants have sophisticated core knowledge about theory of mind, including beliefs, then there is no contradiction, and concepts precede the language, maintaining the traditional view.

b) Alternatively, one could take the position that the kind of perspective-taking required to use deixis or evidential marking correctly is less than it seems. In that case, the linguistic forms do

not require sophisticated reasoning and it is not a problem that full theory of mind development is later in childhood.

c) It is possible that the child succeeds at using the linguistic forms via some knowledge inherent to the linguistic system that is not broadcast to the larger interface of cognition and language, that is, the skills might be considered modularized, in some sense, to the language faculty (e.g. Recanati, 2002). This view contains two radically different sub-positions. One is that the grammar has evolved to encode certain properties essential for human thinking (Hinzen, 2014). The second[1] is that language is the first domain in childhood in which these inherent (or very early developed) conceptual skills are demanded, so they show up there first.

3.1 Deixis

It is not clear how to arbitrate empirically among these alternatives given the current state of our knowledge. Let us take examples of each in turn by way of illustration. Consider personal pronouns first. Personal pronouns in the first person refer to the speaker, and the second person to the listener, and hence switch reference. Very young children make the mistake of thinking the forms are names, as do children with autism for a longer time, and hence can reverse them (Loveland, 1984; Fay, 1979; Dale & Crain-Thoreson, 1993; Girouard, Ricard & Decarie, 1997). Given that they are very difficult for a caregiver to correct, this can be a challenge. One child persisted in calling his own soup, "your soup", to which his caregiver would respond, uselessly, "that's not my soup, it's your soup!" After a few weeks of this, the child seemed driven to invent

[1] I am grateful to an anonymous reviewer for pointing out this alternative.

a neutral pronoun, “own”, in which each person had “own” soup! But usually by shortly after age two, the personal pronouns are remarkably error-free, as long as they are in simple sentences. However, once they are embedded in complex forms, children can have considerable difficulty keeping track of them (de Villiers, Nordmeyer & Roeper, 2018; Tanz, 1980). Other pronouns can shift too, if more than two people are in conversation, for example in following directions like:

6. Ask him what color my eyes are “what color are her eyes?”

The spatial deixis forms, like here/there, this/that, also can switch meaning according to the speaker, but not necessarily. In some circumstances, we share a perspective: *here* is *here* and *there* is *there* for both of us. The usage depends on the domain of contrast, and how big an area is concerned, and how close we are within it (Fillmore, 1975). In some languages there are more than two distinctions, as in Latin hic / iste / ille (near speaker / near hearer / away from both). As with the somewhat archaic English (*yonder*), the choice of expression requires attention not just to one's own perspective but whether the listener shares it. "Yonder" means away from *both* of us, even if we are apart. Children’s use of spatial deixis is harder to gauge, given that it is contextually variable. In the case where a barrier makes the division of space more precise, preschoolers are able to work out the meaning of expressions such as, “it's over there”, or “it’s in this cup”, though they are not perfect (de Villiers & de Villiers, 1974; Clark & Sengul, 1978).

Thus, there is a puzzle. The simple switching of perspective required by personal pronouns and spatial deixis is acquired in a period before children can do explicit theory of mind tasks, even those involving say, seeing and knowing, i.e. earlier than false beliefs (Wellman & Liu, 2004). How do we interpret this? Taking position a) one could assert that nonverbal experimental tasks are often flawed, and that only tasks that consider eye-gaze reveal the true

state of children's knowledge. In other words, one could grant perspectival knowledge to the children at this age, and argue that whatever they have in the way of *implicit* theory of mind is recruited to help language contrasts. There is work suggesting that infants younger than two years can recognize false beliefs in another person, because they react accordingly by looking longer (Baillargeon, Scott & He, 2010), or looking in anticipation (Southgate & Vernetti, 2014). Why then is the passing of classic false belief tasks so late, at 4 to 5 years? Some theorists believe that infants understand others' beliefs, but to activate a *decision*, they need to add executive function skills. That is, they have implicit false beliefs, but not explicit false beliefs: something else is needed to use that incipient understanding in reasoning. But if implicit false belief is not supposed to drive *decisions*, is linguistic usage not a decision? The implicit theory of mind has also been described as unconscious, perhaps in the sense that it is not broadcast to other parts of the mind (Baars, 2002). But language *is* a different faculty of the mind.

Taking position b) in contrast, one could claim that children are succeeding in the single usage by some simpler means, and are therefore fooling us that they have mastered perspective. Could they have learned some kind of "switching" rule, for example, to get the pronouns right? Perhaps this is how they are handling some spatial deictics, i.e. using them right only in a case where the boundaries are clear.

Position c) asks, what if the language faculty itself has built into it a capacity to encode point of view, just as grammar represents the timeline of events, or the event structure of actions? Controversially, Chomsky (2007), as well as Hinzen (2006) argued that the source of semantics, apart from lexical semantics, is grammar. In such a case there is no "interface" with general cognition in which concept arise first: instead, the grammar constitutes the contrasts. When the

sentences become more complex, as with pronouns inside complements, or when the spatial deixis is made contextually richer, children stumble. But why propose that is a cognitive failure, reflected in the language? There is nothing in non-verbal cognition that comes close to matching the complexity that is achieved in such a conversation. Suppose instead one argues that mastering the linguistic forms in all their subtlety is all there is. Then grammar itself makes possible and represents the highly elaborate edifice of points of view and their connections.

The alternative mentioned is that language is the first modality in which real demands are made on these concepts, and that is why language leads. This is an attractive idea, but it is difficult to reconcile with the long delay in reasoning found in language delayed children (see Section 4.0). When the normal timetable of language is blocked, why do these children not manifest the core ability in nonverbal tasks?

3.2 Evidentiality

Take the tricky case of evidentiality as a second illustration. Evidentials create a serious puzzle for the standard view of Theory of Mind. The evidential markers –usually verb inflections or as in Tibetan, varieties of the copula - reflect a person's own perspective on how they know something. In Tibetan, for example, there are markers for ego-knowledge (e.g. a taste), for a witnessed event (e.g. what the speaker saw), for inference (from a clue, rather than the event itself), and from more general inference (e.g. from a calendar, or a schedule) (Kalsang, Speas, Garfield & de Villiers, 2013). In other languages, a hearsay evidential morpheme is prominent (e.g. Korean, see Papafragou, Li, Choi & Han, 2007). However, the range of possibilities in the world's languages does not extend much beyond this handful of alternatives (Speas, 2004),

suggesting that language sets constraints on the kinds of meanings that can appear. In using each one, a speaker selects the appropriate morpheme that indicates how they came to know the truth of the proposition. These are not hedges on truth, though a listener could weigh the likelihood of the veracity of each mode of knowing (de Villiers, Garfield, Gernet-Girard, Roeper & Speas, 2009). Evidentials seem on first glance not to involve perspective taking at all, since the morphemes are *self*-referent. Yet how could a child possibly learn to use them, without first being able to interpret what *another* speaker means when they use one?

Several researchers have claimed that children adopt the use of evidential morphemes early and errorlessly (Choi, 1991). This raises questions about whether some sophisticated conceptual perspective taking is allowing these meanings. Again, the choices seem threefold: First, perhaps children could utilize their implicit theory of mind skills to establish the meaning of the evidentials, thus maintaining the traditional view that nonverbal concepts underlie linguistic use. Second, perhaps children are succeeding by some lesser method, for example, in spontaneous situations, which are not controlled, a young child could sound persuasively adult by restricting use to the simpler morphemes and by mimicking what others say. Use of the more complex morphemes such as inferentials in Tibetan is quite late in development (de Villiers & Garfield, 2017), and errors of commission are made there. Thirdly, and more radically, perhaps the language faculty allows the encoding of distinctions that lie well beyond what a child can achieve non-linguistically at that same age. As the language develops further, to contrast e.g. epistemics versus evidentials, or complement-taking verbs versus evidentials (de Villiers & Garfield, 2009; 2017), the internal grammar elaborates appropriately for a given language type. We should keep open the possibility that instead of concepts developing first and feeding the

grammar, the grammatical distinctions, internal to the language faculty, might feed conceptual distinctions that are outside of language.

One might then expect an odd and variable relationship between language and non-language conceptual tasks, which is exactly what is observed in empirical work on evidentiality, where paradoxically, production is often seen ahead of comprehension (Kyuchukov & de Villiers, 2009; de Villiers et al, 2009; Aksu-Koç, Avci, Aydin, Sefer & Yasa, 2005; Papafragou, et al 2007, Aksu-Koç, Ögel-Balaban, & Alp, 2009; Uzundağ, Taşcı, Küntay, Aksu-Koç, 2018; Ozturk & Papafragou, 2016; Ünal & Papafragou, 2016, Ünal & Papafragou, 2018). The contrasts in evidential morphemes in comprehension develop later, and perhaps do depend on the development of both a more sophisticated theory of mind and inference skills, especially in judging how to ask the right question contingent on what the interlocutor knows (de Villiers & Garfield, 2017).

It is clear that there is much more still to be investigated about the relationship between various linguistic phenomena that take point of view - short of complementation – and their possible nonverbal equivalents. For example, there is virtually no comprehensive research on the impact of language delay that might allow us to ask if there are concomitant delays in nonverbal perspective taking in those areas of theory of mind that are earlier on the scale than false belief reasoning, and that do not entail truth contrasts.

4.0 Language for the Propositional Attitudes

De Villiers (2005; 2010) has argued that in the case of reasoning about the propositional attitudes, namely false belief, we have to perform computations across representations that are at least as complex

as those of natural language. The point has been made theoretically also by Segal (1998) and Collins (2000). The prediction is that children's mastery of complement forms as in 1. (repeated here)

1. She thought it was the butter.

should be one of the best predictors of their ability to pass classic theory of mind tasks, in which they must deliberate about another's false belief understanding. What is the status of the evidence?

The so-called "memory for complements" task has been widely adopted as the index of complement mastery following the results of de Villiers & Pyers (2002). A sample scenario goes as follows (see Figure 1):

7. The woman said the girl had a bug in her hair, but it was just a leaf.

   What did the woman say the girl had in her hair?

   Correct answer: Bug.

   "Reality answer": Leaf.

In the longitudinal study across a year of preschool by de Villiers & Pyers, young typically-developing children were tested three times on a batch of explicit false belief tasks (such as Unseen displacement and expected contents) and a set of 12 wh-questions like 7), half of them using communication verbs. The natural expectation was these questions would depend on cognitive success first. However the reverse was found: children passed the wh-question task in advance of passing the false belief tasks. There have been numerous subsequent studies, with some confirmations of the same result (Lowe, 2010; San Juan & Astington, 2012; Perner, Sprung, Zauner & Haider, 2003; Brandt, Buttleman, Lieven & Tomasello, 2016). Others have found different complex linguistic forms are predictive as well (Smith, Apperly &White, 2003; Durrleman, Hinzen, & Franck, 2018), and yet others found that complements have no special advantage over general syntactic competence (Cheung, Husan-Chih, Creed, Ng, Wang,

& Mo 2004; Slade & Ruffman, 2005), or even over executive function, specifically inhibitory control (Hughes & Ensor, 2007). With relatively small samples, and many converging skills at the same age with little variance in age of acquisition (Wellman & Liu, 2001), some noise is to be expected empirically. Three sets of results suggest that the theory can be supported despite variability in the findings.

The first set comes from cases in which the acquisition path of language is spread out over time because of delays or insufficiencies of input. Much research has now been conducted with children with various developmental delays in language to see how their theory of mind skills are impacted. An early study suggested that there was no delay in false belief reasoning in children with specific language impairment (Van der Lely, Hennessey & Battell, 2001), a result interpreted as meaning that the conceptual understanding was not affected by language delay. Several papers (de Villiers, Burns, & Pearson, B., 2003; Andrés-Roqueta, Adrian, Clemente, & Katsos, 2013; Farrar, Johnson, Tompkins, Easters, Zilisi-Medus, & Benigno, 2009; Durrleman, Burnel, Thommen, Foudon, Sonié, Reboul, & Fourneret, 2016) and two recent meta-analyses (Nilsson & López, 2016; Farrar, Benigno, Tompkins, & Gage, 2017) show the opposite to be true. There is a pervasive delay in ToM reasoning contingent on the language delay of the children, even when low-verbal tasks are used. In fact, the meta-analysis of Farrar et al (2017) strongly suggests that the development of complementation plays a major role for children whose language is delayed. Their interpretation is that children with various language disabilities might need language as a bootstrap in a way that children with typical language do not. It is also possible that the greater variance in abilities and timing makes the result clearer in the atypical population.

Reflecting a similar phenomenon, children with profound hearing impairment who are developing language more slowly, either because their parents have adopted an oral approach, or because they are only later exposed to Sign language, can be seriously delayed in False belief reasoning (Peterson & Siegal, 2005; Schick et al 2007). Furthermore, their performance on even the tasks adapted to be less verbal is predictable from their command of complement syntax and vocabulary (Schick et al, 2007). Deaf children born to Deaf parents and using Sign from birth, are unaffected in their development of false belief reasoning. It could be argued that language is only a tool that assists in theory of mind reasoning, and that with enough life experience, perhaps behavioral observations alone will help such children arrive at a working theory of other minds. In many areas, learning via human language has been hailed as a shortcut for the slower learning that occurs through direct experience. But the adults who learned a simpler version of Nicaraguan Sign Language did not benefit from their years of social engagement and observation, as they continued to fail false belief tasks into their twenties (Pyers & Senghas, 2009). Only when they developed linguistic devices to encode mental state descriptions did they begin reasoning like other adults. This finding casts doubt on the interpretation that language is merely the domain which the conceptual demands normally arise first.

Finally, children with autism (Tager-Flusberg & Joseph; 2005; Durrleman et al, 2016) reveal the same pattern, namely, children with associated language impairment can't pass the standard tasks until they have language of a sufficient complexity. Complementation is shown to be a major predictor of their success on false belief tests.

A second set of results comes from deeper mining of data on typically developing children. A large-scale study of children growing up in poverty, studied as part of a curriculum intervention study in

preschools and daycare center in Florida and Texas (de Villiers et al, 2013; in preparation).[2] The large N (325), longitudinal design and extensive testing battery allowed the researchers to explore the relations and predictors using Structural Equation Modeling (SEM), which can look at the coherence of constructs, and offers a greater chance of unpacking directionality and mediating effects. The children were assessed towards the beginning of their final preschool year (Time 1, average age 4.51 years, range 3.03 to 5.52 years) and again towards the end of the school year (Time 3, average age 5.04 years, range 3.58 to 6.07 years). In the middle of the year (Time 2), non-verbal IQ and verbal memory span (word span) were assessed. Table 2 shows the measures taken.

Table 2 here

Preliminary results reveal one of the fundamental difficulties in running purely correlational studies with typically developing children, as all variables of interest with the exception of nonverbal IQ are correlated with the composite false belief score at the last time point. However, a hierarchical regression looking at the longitudinal data reveals that both language measures and inhibitory control at Time 1 have significant predictive effects on false belief reasoning at Time 2. An initial Structural Equation Model on the longitudinal data confirms a significant contribution of complementation to the change in Theory of Mind scores, over and above the variance explained by general vocabulary and executive function (de Villiers, de Villiers, Lindley, Chen et al. (2013). Therefore, different aspects of language have separate effects on explicit FB understanding in development, both concurrently and longitudinally. Inhibitory Control also has separate direct concurrent and longitudinal effects on FB reasoning. The SEM supports theories of general language effects (Astington & Jenkins, 1999) as well

[2] All were part of the School Readiness Research Consortium curriculum intervention project, funded by NICHD (P01 HD048497)

as specific effects of complement syntax on the development of explicit FB reasoning (de Villiers & Pyers, 2002).

Finally, a third set of developmental findings comes from training studies, in which children who lack both false belief reasoning and complementation are trained specifically on complements. The training has usually employed verbs of communication like *say* or *tell* that also can take false propositions in their complements. In this way, any subsequent improvement on false belief cannot be attributed to teaching about mental states themselves[3]. Children trained to understand false complements should improve on false belief reasoning tasks by virtue of acquiring the appropriate representational structures. This was found in English by Hale & Tager-Flusberg (2003), then also in German (Lohmann & Tomasello, 2003), and French (Durrleman, et al, 2020). In Mandarin, Shuliang, Yanjie & Sabbagh (2014), explicitly avoided any mental state content in their communication verb-complement training and still found pay off in false belief understanding. However, complexities arise because success is sometimes reported after training in false beliefs directly (Hale & Tager-Flusberg, 2003; Lohmann & Tomasello), using teaching that offers perspective contrasts that were not encoded in complement structures. Shuliang et al. (2014) report for Mandarin that although the findings showed that facility with sentential complement grammatical structures could promote false belief reasoning, sometimes false belief understanding emerged even when children did not show improvement on sentential complement constructions. That would suggest it is not strictly necessary to have comprehension of sentential complements.

All things considered, the strong suggestion is that language training can at least *facilitate* false

[3] There is continued controversy over whether using verbs of communication simply presupposes mental states. However not all false complements under communication verbs entail false beliefs: they can also be used for deception e.g. "The mother said she bought paper towels" (because she was concealing the birthday cake). In addition, the children in these studies were chosen for training precisely because they *failed* to understand false beliefs and false complements.

belief reasoning, and the children who stand to benefit most from this are children with clinical issues, such as children with autism. In a new study, Durrleman et al (2020) studied a group of French children with autism. These children initially failed both complementation and false belief tasks, then were trained on complements with verbs of communication in a software program that they interacted with for only a few hours a week for several weeks. At the end, they showed significant improvement in false belief reasoning over a control group trained with software on vocabulary for the same duration.

Nevertheless, there are plenty of doubts about the conclusion that the language of complements is *prerequisite* for false belief reasoning. The obvious starting point is the numerous studies of infant theory of mind, in which many researchers believe they have found evidence for sophisticated reasoning long before children are verbal, never mind syntactically competent (see Baillargeon, Buttleman & Southgate, 2018: Kulke, Von Duhn, Schneider, & Rakoczy, 2018). The debate rests on a succession of four points: whether the findings are reliable, and if they are, whether eye gaze is a sufficient index of understanding (see also Rubio-Fernandez, 2018), and if so, whether infants' sensitivity is to others' belief or something lesser (Perner & Ruffman, 2005) and if indeed it is beliefs, whether early understanding might have some signature limitation (Apperly & Butterfill, 2009; Low & Watts, 2013). An important new summary (Newen & Wolf, 2020) attempts a reconciliation of the infant and preschool findings, suggesting a three-stage model couched in terms of mental files (Perner Huemer & Lahey, 2015). However, the role that language might play in the change is not yet accommodated.

As described, developmental studies that pit complementation against other language measures sometimes find that complements are less significant than broader measures of syntax, in typically developing children. Interestingly, most of the failures to find a unique role for complements over other language (Farrar et al, 2017) come from studies with Chinese-speaking children (Mandarin and

Cantonese), in which the syntactic marking is very lean. Furthermore, though the training studies find that training on complements works, and persist (Durrleman et al, 2020), they leave open the possibility that there could be other, though perhaps less efficient routes, such as training directly on false belief tasks without using complex language. It remains to be discovered if these are also lasting or broad changes.

5.0 Do any concepts in adults require the use of language?

Adult Theory of Mind is usually taken for granted, unless the adult in question has some atypicality, for example Asperger's' syndrome (Senju, Southgate, White and Frith, 2009) or sociopathy (see Paal & Bereczkei, (2007). But in fact, it is important to study adults to differentiate theories about Theory of Mind. For example, a strong and sensible rival to the idea that children use language to represent false beliefs is that children learn from language about theory of mind. There is an abundance of good data showing that families that engage in more discourse about mental states have children who grasp false beliefs earlier (Dunn & Brophy, 2005; Meins, Fernyhough, Arnott, Leekam, & Rosnay, 2013). Many have argued that discourse is part of the evidence, perhaps the major evidence, from which children develop the particular *cultural* theory about other minds (Berio, 2020). Of course, in that case, adults wouldn't need language to reason about false beliefs, because the theory has been fully developed.

For example, what would happen to adults if they had their language "tied up" in echoing speech (shadowing)? Would they fail to understand a false belief scenario? The inspiration for this question was the work by Hermer-Vasquez, Spelke and Katznelson (1999) on language and spatial reasoning. They showed that adults shadowing a story, but not those shadowing rhythmic

patterns, could not find an object hidden in a location that required a description such as “to the left of the red wall”. (Neither can rats, children below age four, or Nicaraguans deaf adults without a fully developed Sign (Pyers & Senghas, 2009). The conclusion was that shadowing language interfered with reasoning ability that rested on language for its success (See also Carruthers, 2002). In Newton and de Villiers (2007), the adult participants’ task was to choose the right ending of a video: for example, in an unseen displacement task, where will the mouse look for his cheese? The finding in Newton and de Villiers was that adults who were engaged in verbal shadowing could not predict the ending of a False belief video, though an attentionally-matched rhythmic shadowing did not affect judgement, and True Belief videos were easy under both types of shadowing. Newton and de Villiers argued that it was not because of simple attentional difficulty, as shown by control of rhythmic shadowing matched for its attentional demands. Neither was it because of a competing narrative, as shown by another control in which English-speaking adults shadowed Swahili, and showed the same disruption despite the absence of meaning (Newton, 2005). However simpler forms of shadowing such as saying “bababa” (Newton, 2005) or repeating digits (Samuel, Durdevic, Legg, Lurz, & Clayton, 2019) does not disrupt reasoning. Nor, tantalizingly, does verbal interference affect it if it is not simultaneous, but appears only after the video has finished, namely, the participant is not under dual-task interference while watching the video (Samuel et al, 2019). The language faculty has to be engaged, simultaneously, by something beyond repetitive speech. Though the study followed the logic of the study by Hermer-Vasquez, et al (1999) on spatial reasoning, the control of rhythmic shadowing was called into question in later follow-ups (Dungan & Sachs, 2012). Suggestions are made that the verbal shadowing disrupts something more like executive function

skills than conceptual understanding. On that argument, even rhythmic shadowing could be made difficult enough to disrupt false belief reasoning (see de Villiers, in press, for more discussion). The dual task studies with adults have variable results, in that one can find a rhythmic tapping task that interferes as much as language shadowing when carefully titrated for the particular subjects (Dungan & Saxe, 2012), who nevertheless conclude:

> "Consistent with Newton and de Villiers (2007), we found that verbal shadowing led to a striking impairment in adults' false-belief performance. Although we found that this effect was not specific to verbal shadowing, linguistic resources may nevertheless contribute to false-belief reasoning when working memory is not impaired." (p.1155)

The field of cognitive science is far from understanding what various kinds of language shadowing actually disturb (Margulis, 2014; Samuel et al, 2019), or what they might disturb about broader event understanding (Forgeot-Arc & Ramus, 2011; see also Floyd, 2014, on event telicity). Finally, the shadowing results are at odds with case studies of adult aphasic patients who can succeed on false belief tasks in the apparent absence of syntactic competence (Varley, Siegal & Want, 2001; Apperly, Samson, Carroll, Hussain, & Humphreys, 2006), though these have been questioned too (Baldo, Dronkers, Wilkins, Ludy, Raskin & Kim, 2005). It may still be true that language is needed for the development of false belief, but then becomes an optional tool to facilitate reasoning in adults. Dungan and Saxe (2012) suggest it might be the default form of reasoning unless there are impediments.

The debate has spurred a different line of work that has tried instead to identify the category of events that are disrupted by verbal shadowing (Jung & Hummel, 2013) . Using an eye tracker and anticipatory eye-gaze minimizes task demands and makes it possible to test

infants as well using the same procedures. Adults engaged in shadowing linguistic material have difficulty seeing the resemblance across event types or stimulus types that are tied together propositionally. For instance, events having the common property of negation (Nordmeyer, 2011) or telicity (Floyd, 2015), or stimuli that require a propositional description (like Hermer-Vasquez et al. (1999) on "to the left of the blue wall", Margulis (2014) on "downward descending from the left" (from Gentner & Kurtz, 2005). Concepts untouched by shadowing are complex visual stimuli that seem not to require a propositional description (e.g. prototypes of faces: Margulis, 2015) and artifacts versus natural kinds (Nordmeyer, 2011). At the very limit of this distinction is the case of simple reversible transitive sentences e.g. adult kiss child/child kiss adult (de Villiers, 2014); dog push car versus car push dog (Shukla & de Villiers, submitted), where it appears that adults engaged in complex verbal shadowing fail to construct a representation that distinguishes them, as do young toddlers shown the same stimuli. Yet shadowing adults and toddlers can see the resemblance across simpler intransitive events such as dog rolling versus dog jumping, despite close matches in scene complexity (Shukla & de Villiers, submitted).

These kinds of findings suggest that the specialized language faculty of the human mind is requisite for seeing the similarity across event or stimulus types that lie beyond the very basic sortals that we share with other creatures. On this radical view, ongoing access to our faculty of grammar is needed for semantic distinctions.

6.0 Why are complements unique in syntax?

The paper began with a radical proposal, that some concepts are a product of the language faculty itself. Complements have the property that they describe a world in the speaker's or thinker's

mind. This is what gives them the right property for being the representational medium for false belief reasoning. But complements don't all describe something false, therefore the proposal needs refinement. De Villiers (2005) made the proposal that the complements in question had to be realis, rather than irrealis, namely the proposition had to be truth-evaluable with respect to the speaker's or the shared world. Notice the contrast in complement type:

8. What did Dad think Sally bought?

9. What did Dad want to buy?

The infinitival complement in 9) is irrealis, lacking a separate truth in the absence of tense: there is nothing that can be evaluated about the truth of "to buy", or even "*pro* to buy". The nature of the attitude verb and its complement is the focus of several research studies. It has long been established that children understand, and use, complements with *want* before complements with *think*. Perner, Sprung, Zauner & Haider, (2003) found that German-speaking children answered wh-questions with *want* complements correctly before wh questions with *think* complements, in a contrast like this:

10. Mutter will dass Andreas ins Bett geht.

Mother wants that Andy in bed goes.

11. Mutter glaupt dass Andreas ins Bett geht.

Mother thinks that Andreas in bed goes.

As a result of the identity of the complements in German, Perner et al argued that the difference in children's performance had to be conceptual: desires are understood before beliefs.

In an attempt at a rebuttal, de Villiers (2005) showed two things: first, that it was the complement that mattered, not the verb. Invoking the distinction between realis and irrealis clauses, de Villiers (2005) reported a study in which the children do better with the irrealis modal form under think:

12. Does Mom think that Bella should wash the dog?

than the realis tensed form:

13. Does Mom think Bella washed the dog?

In the same study, children were tested on two forms of *want* with complements:

14. Does Mom want Bella to play on the piano?

15. Does Mom want Bella playing on the piano?

Children treated 14) and 15) exactly the same: as irrealis, and correctly answered them. Notice that this result reveals that the verb alone is not the significant contributor in English: it is the clause with the verb that counts. A similar point was made by contrasting two forms of the verb *say* in another study (de Villiers, Harrington, Gadilauskas & Roeper, 2012), namely:

16. What did Dad say he bought?

17. What did Dad say to buy?

Children were much more likely to answer the infinitive case in 17) correctly. The result is massively confirmed in the data from 674 children tested using QUILS, an early screener that included complements of both types under *say* (see Figure 2).

Figure 2 here

But across languages, infinitives are not always the grammatical marker used in contrast with tensed clauses. In both French and Spanish, irrealis clauses are manifest as subjunctives instead of infinitives. For example, take the following pair of contrasts:

18. Dónde le dijo Sofîa a Mauricio que estaba Javier?

Where said Sofia to Mauricio that was Javier?

'Where did Sofia tell Mauricio that Javier went?'

19. A dónde le dijo la abuelita a Javier que fuera?

To where said the Grandma to Javier that he <would go>?

'Where did the Grandma tell Javier to go?'

In the first, the form is indicative, much as in an English tensed clause. But the equivalent to the English infinitive is the change to subjunctive in Spanish. Linguists have argued that these subjunctive clauses are -TNS (they are restricted by the tense of the *matrix* clause that contains them), though they have subject agreement (Iglesias & de Villiers, 2019). In the second case Javier is not a subject, but a dative argument in the matrix clause that has obligatory control over embedded subject *pro*. Children learning Spanish treat realis and irrealis complements differently, making more errors with the realis clauses with indicative mood, and finding the subjunctive easier. Again, it is the tensed embedded clause that causes difficulties for young children, in each of their languages. Figure 3 shows data from a large sample of bilingual Spanish-English children (N=357) on both the English and Spanish parts of the bilingual QUILS: ES (Iglesias, de Villiers, Golinkoff, Hirsh-Pasek & Wilson, 2019; Iglesias, Golinkoff, de Villiers, Hirsh-Pasek & Wilson, in press).

Figure 3 here

This brings us back to German. Perner et al (2003) had argued that the clauses under *think* and *want* were exactly the same in German, so how could children make a syntactic distinction for which complement was realis? De Villiers (2005) claimed that the two structures still differed underlyingly in German, not on the surface with a single pair, but when one considers the range of other forms into which they can morph, namely what other syntactic or morphological properties they allow. A single instance will not fix the difference, but the array of data available in the input will teach the child that they are only superficially the same.

In a more recent paper Hacquard and Lidz (2018) make progress on the difference in types of complements under attitude verbs and they invoke a set of ingredients – semantic, pragmatic and syntactic- to help children achieve the distinction. They also mention the variation in other languages like French and Spanish, where the difference in the complements of desire and belief is carried by mood: subjunctive to represent the intensional/irrealis case, and indicative for the realis case. Hacquard and Lidz then demonstrate that in English as well as these Romance languages, the embedded complement under a belief verb takes the same syntax as the matrix clause. They confirm that the same argument can be made for German: the embedded clause under a cognitive verb can take on characteristics of the matrix clause in terms of verb placement and complementizer use (Brandt, Lieven & Tomasello (2010). In German the usual placement of a verb in an embedded structure is at the end,

20. Maria {denkt/will}, dass Peter heute kommt.

    Maria {thinks/wants} that Peter today comes.

In matrix clauses the verb is moved to C (so-called "second position"). However, in realis clauses under think (denkt), but not irrealis, the verb can also be in C ("second position"), and that is the most frequent in child-directed speech:

21. Maria {denkt/*will}, Peter kommt heute.

    Maria {thinks/wants} Peter comes today.

    'Mary thinks that Peter is coming today'.

Hacquard and Lidz's cross-linguistic solution for classifying complements is termed the Declarative Main Clause Syntax Hypothesis:

> "..learners exploit speech act similarities between belief verbs and declarative main clauses to make the right semantic inferences. If so, he/she might infer that the verb think

> has a meaning that is compatible within direct assertions, i.e. think expresses a judgment of truth (belief)." (Huang et al, 2018)…..This proposal resolves the cross-linguistic challenge to syntactic bootstrapping: the learner only needs to track syntactic hallmarks of declarative clauses, whatever these turn out to be in a specific language (such as finiteness in English)". Hacquard and Lidz (2018, p5)

By this means, then, children can use the language around them to differentiate the two types of verbs. Using correlated syntactic patterns is only part of what Hacquard and Lidz (2018) propose, as they also invoke the notion that young children can *pragmatically* identify the speech acts being engaged in by those around them to differentiate desire from belief. Following Lewis, Hacquard & Lidz (2013;2017), the mistakes children make are seen as pragmatic ones, occurring in cases where the experimental scenario does not present a compelling occasion to use their existing concept of belief.

> "… we will argue that children's difficulty with think is not due to its syntax or semantics , but to the kinds of pragmatic enrichments that verbs that express truth judgments trigger. We will present evidence that when we control for pragmatic enrichments, 3-year olds display an adult-like understanding of think sentences, even in false belief contexts" (Lewis, Hacquard & Lidz, 2017)

This is indeed the heart of the matter. The issue is not just differentiating between ordinary verbs, desire and belief verbs, and working out which syntax is associated with each type. The real question is, how do children come to realize that the complements under belief verbs, even having all the properties of matrix clauses, are fundamentally different in that they refer, not to the actual world, but to possible worlds? The clause level is not sufficient. Hacquard and Lidz

take this to involve an integration with both existing conceptual understanding and with the pragmatics of test scenarios. But is that necessary?

Consider instead a syntactic proposal, namely, that the clauses following certain verbs, namely belief verbs, do not just follow but are *embedded* as arguments. The missing ingredient is: how does a clause become interpreted as an argument? Hinzen, Sheehan & Reichard (2014) contend that intensionality is an "architectural consequence" of the human grammar. They make the point that matrix clauses and embedded intentional complements differ in a critical way: it is nothing about their internal form, but rather the grammatical fact that one is an argument of the verb. With the sentences:

22. Joanne cooked.

23. Alice thought that Joanne cooked

24. Joanne cooked and Alice believes this.

Hinzen et al take it as clear that 33) is not taken to assert that Joanne cooked: the truth value is indeterminate. The fact that the clause is an argument of the verb in 33) makes all the difference. The ellipsis in the coordination in 34) does not suffice. They contend that the truth of a sentence is only applied at its root, because of a more general principle they refer to as the nonrecursivity of reference (Arsenijevic & Hinzen, 2012): a syntactic phrase of category X recursively embedded in a phrase of the same type lacks referential force. Hence, referentiality is a grammatical notion.

How does truth come into the matter at all? Hinzen (2009; Hinzen et al 2014) argues that truth is a property that emerges internally, from the syntax of natural language. In particular, he argues that anything less than a clause cannot have a truth, that is cannot be evaluated as true or

false: Noun phrases, Small Clauses, Infinitive Complements, all lack the necessary structure. Truth comes about by way of tense in a clause, but it alone is insufficient: a full CP phrase with Force is what is needed.

> "An object described through a particular nominal predicate will be located in space (NP); an event described through a particular verbal predicate is located in time (vP); and a proposition described through a tensed proposition is located in discourse (CP)" (Hinzen, 2009).

The fully constructed clause is thus the skeleton on which truth depends. There must be a full Thematic structure, and all of the arguments of the event-head have been appropriately filled. Take the case of PUSH (Agent, Patient). If this becomes a noun (the dog's pushing of the car), then it will never be evaluated for truth. But with a tensed verb: "The dog pushed the car", and merged with C, the structure becomes something that can be asserted in discourse and evaluated for truth value. The preconditions for this evaluation lie in the grammar.

7.0 More syntax makes questions easier to interpret

If the acquisition of embedded complement structures facilitates false belief understanding, does that continue to higher levels of complexity? For example, does mastery of second order complements predict second order false beliefs? The results of several attempts so far have been mixed ( ).

However, using recursive complements seems to avoid the possibility that concerned Lewis et al (2013), namely that children might give reality answers because they interpret 1) as a parenthetical like 25) in which the lower clause is the main clause, and therefore true:

25. Mary, the man said, is in Boston.

In recursive sentences, parenthetical interpretations are not so easily obtained: 26 should be ruled out:

26. *Mary, the man said his wife thought, is in Boston.

de Villiers, Roeper and Kotfila (2019) asked children questions using three clauses, with recursive complements, as in 27.:

27. When did Mom think that Dad said the boy got his train?

Note that the resolution of the question involves integrating two different points of view, Mom's and Dad's, to arrive at the answer. Furthermore, a three clause structure is definitively recursive, whereas a two clause structure could be idiomatic. In the literature on recursion across structures in different languages, Hollebrandse and Roeper (2014) argue that some seemingly forms can appear as idioms, but the process is not productive. The double recursion in 35) involves real cyclic movement of the wh, with no ambiguity of structure, attaching the lower clause trace to the top wh.

Surprisingly, de Villiers et al found that recursive cases like this make four year olds resist the reality answers that they give to the single embedding. In their study 28 children aged 3;5 to 5;7 and 16 monolingual English adults were tested on 6 stories followed by a three clause wh question like 35). The wh-questions were adjunct questions that could originate in any of the clauses: The stories were designed to contain six potential, salient answers, of course not all grammatically warranted. These potential answers were varied as much as possible in their position or recency in the story relative to the final question, and post-hoc analyses suggest the position in the story is not a factor in the answer given.

The answer about when Mom spoke, and the fully integrated answer from the top CP, were the only legitimate answers for most adults for sentences like (35). Unexpectedly, answering the wh with respect to the integrated last clause with full scope is the preferred answer at every age, as for adults. The "reality" answer in which only the last verb is linked to the question but not integrated with the others was of most interest. There was a massive reduction in "reality" answers (<20%) by children

compared to their answers on the two clause case, in which they are very common (>40%) ($F(1,77)= 28$, $p<.001$). Cyclic systematic operations like wh-movement appeared to trigger the correct grammatical analysis of recursive complements, and reduced reality answers.

Single embeddings under belief verbs remain ambiguous for children for longer. We argue that cyclic movement across recursive structures is a purely syntactic operation that ignores lexical and idiosyncratic information. The syntactic operation of cyclic movement, necessary for more than two clauses, seems to circumscribe the semantic and pragmatic interpretation of wh-questions. Typically developing children show early awareness of this constraint.

What we do not yet know is whether this aptitude more exactly captures what children know when they can do false belief reasoning. Perhaps single complements do not always reflect the knowledge of point of view that recursive grammar fixes. There are two ways that the understanding of the complement under mental verb can be enhanced. One is contextual: emphasize the contrasting epistemic stance of two characters. That manipulation alone will not get you all the way to the right semantics of *think* if you don't know it already. The second is syntactic: prove that the structure is syntactically recursive, with embedded arguments. When it is clear that the complement is an argument of the verb, the right truth value can be assessed with respect to the root only. This discovery cannot be immediate, because syntactic development must proceed in respect to the properties of each language. There is much empirical work to be done to move the debate forward, but the question is exciting.

8.0 Beyond simple attitudes

Before concluding, consider some further cases ripe for more experimentation. Modals are also

irrealis: at least one cannot judge the truth of "Bella should wash the dog" using the same procedures as we judge "Bella washed the dog". In a *deontic* modal complement, Tense is irrelevant to whether or not the action has been or is being completed at the time of utterance:

28. Bella should wash the dog.

is only deniable based on Bella's obligation to wash the dog, not whether or not she is washing the dog/ has washed the dog at the time of the utterance. Surprisingly, this makes correct long distance answers easier for the child (de Villiers, 2005). Again, Tense seems to be tied up in this determination of truth value.

Are all modals irrealis? Modals come in two flavors for lexical items such as *must*. The epistemic modals involve knowledge or inference, as in

29. When did Mom say Bill must be sleeping? (epistemic)

but the deontic modals involve obligation:

30. When did Mom say Bill must sleep? (deontic, root)

It has been argued (e.g. Hacquard, 2007; Cournane, 2015), that epistemic modals involve *more embedding* than the deontic kind, of at least a tense node:

31. a. Bella must be washing the dog.

b. Bella must have washed the dog.

Handily, in German they appear in different structural positions in the tree, one above Tense and one below. 2 a. and b. are deniable based on the evidence that Bella is washing/has washed the dog at the time of the utterance. Tense is thus relevant to the truth. Theoretically, then, complements with epistemic modals might pattern with tensed complements in children's judgements. But the evidence for the distinction is much less available in the syntax for English-speaking children.

Kotfila & de Villiers (2019) compared 4-6 year olds' performance on wh-questions with complements with the two modal flavors, and compared the responses to how children respond when there is no modal involved:

32. Why did Dad tell Grandma Mom must make soup? (deontic)

33. Why did Dad tell Grandma Mom must be making soup? (epistemic)

34. Why did Dad tell Grandma Mom was making soup? (tensed)

Interestingly, the children (aged 4 to 6) successfully resisted "reality" (i.e. only lower clause) answers more for *all* modals, regardless of semantic type, compared to tensed clauses. However, it remains possible that the children treated the epistemic modals as if they were deontics, as there was no independent evidence that they knew the distinction at this age (see also Cournane, 2015). We need to discover if the syntax of modals is established together with their semantics, so there is much still to be learned.

In addition, much discussion about the semantics of epistemic modals as in

35. Bella must be washing the dog.

has been devoted to the question of whose knowledge state is being expressed: the speaker's, or a shared Point of View? Stephenson (2007) points out that one can refer to the set of worlds "compatible with what is known," but the question is, known by who? If "what is known" is taken to mean "what is known by the speaker," the resulting meaning is too weak. On the other hand, if "what is known" is taken to mean "what is known by anyone at all" or "what is known by people in general" the meaning becomes too strong. It turns out to be difficult to establish whose knowledge is relevant for the interpretation of epistemic modals. Yet Stephenson shows that there is a class of examples where this uncertainty is less, namely those such as (44)-(45) where an epistemic modal is embedded under *think*.

36. Sam thinks it might be raining.

37. Sam thinks it must be raining.

The knowledge state involved is decided: it is Sam's.

Epistemic modals and predicates of personal taste (tasty, fun, yucky) have parallel behavior in attitude reports. The meaning of a sentence like:

38. Licorice is tasty.

according to Pearson (2013), is that licorice is tasty to the speaker and any relevant individual in the context with whom the speaker identifies. Lasersohn (2005) discusses a similar puzzle that arises with these "predicates of personal taste" like (46) to raise the puzzle, parallel to that of epistemic modals, that if *tasty* in sentences like (2) is taken to mean "tasty for the speaker" or "tasty for someone," the meaning is too weak, but if it is taken to mean "tasty for everyone" or "tasty for people in general" it becomes too strong. Yet the uncertainty is less under a mental state verb:

39) The girl thinks licorice is tasty.

Stephenson (2007) makes clear that the puzzles of epistemic modals and predicates of personal taste are related, and there is still much to be done on these issues in acquisition. The questions revolve around the Point of View (knowledge, or taste) of the experiencer, and how that gets fixed in the case of matrix verbs versus complements. This is parallel to the puzzle above about truth. Aravind and de Villiers (unpublished) made an initial attempt to explore predicates of personal taste, using a strategy much like that of Lewis et al (2013), namely, we introduced two characters with different opinions (see Figure 4).

Figure 4 here

Semanticists have called these kind of circumstances "faultless disagreements", because how do we know how to judge the truth of the matter if Jim thinks something is fun, and Jane thinks it's boring? We

thought children might do better on such questions than on regular complements, given there is no truth of the matter. In fact, with our 14 children aged 3 to 6 years, they did find these judgements remarkably easy, with even the 3 year olds (N=4) getting 77% correct (See Figure 5).

Figure 5 here

We also tried questions like this:

40. Did the raccoon think the yucky fishbones were yummy?

Unlike matrix clauses, complements allow these weird inversions in which Point of View switches can occur, and the children were not thrown off by such questions: they did equivalently well on cases where we used the two contrasting adjectives in the same sentence.

We also asked them matrix questions like:

41. Are the fishbones yummy?

Adults balk on such a question, saying, "well, it depends!" This can be taken as a further demonstration of the general claim: there is no constraint on the PoV of the adjective in a simple sentence, and context must be used. We thought the children would take a standard point of view on these, or at least the point of view expressed by the character most like them (say, the child instead of the parent, the child instead of the raccoon), but they did not, at least at 3 and 4, answering randomly. At 5, they were more likely to adopt their own view. But in the complement case, the PoV was constrained, even for young children.

Studies of the acquisition of a range of phenomena inside complements is very incomplete to date, even in English, not to mention accommodating them within the range of possible grammars in the world's languages. The new interest in pragmatics, in questions-under-discussion, in focus and force, must also be addressed and connected. But linguistic researchers are already imagining ways to assimilate these considerations into tree structures instead of treating them as competing alternatives to

syntax (Rizzi & Cinque, 2016; Woods, 2016). Regardless of the linguistic solution, it becomes evident that the kind of thinking involved here is linguistic. There is nothing, it seems, that could be a nonverbal counterpart. Human language supplies the concepts itself.

9.0 Conclusion

The paper began by raising the possibility that human language has concepts that are embedded in the language itself. This was set in opposition to the pervasive idea that fully-developed concepts always exist first in a non-verbal realm and are then labeled by language. Imagine three levels at which this might be true.

At the first level are the concepts for things, actions, and properties. There is certainly abundant evidence that other nonverbal creatures, animals and infants, can react to these stimulus classes, to discriminate and classify. Nevertheless, words themselves, lexical classes, go beyond names for classes of stimuli. What they correspond to is something more like the philosophical object of a sortal: a way to tell when object begins and another ends, a procedure for counting, a procedure for telling when a change is fatal to class membership or not (a pulverized chair versus a pulverized potato) (Xu, 2007). Perhaps language provides us with sortals.

At the second level, there are combinatorial concepts, ranging from relations in space (To the left of the red wall) to the intricacies of deictic indices (Tell her what color your eyes are). What if no nonverbal equivalent exists? The language can be analyzed as containing these intricate relationships, but it doesn't just scaffold them: they are brought into being by language. Consider the class of events that can be described as "mother kiss child" rather than "child kiss mother". Bear in mind also the sortals of *child* and *mother* and *kiss*, not just poor perceptual substitutes for them like large two-legged

and small two-legged, or "put face on other face" (see e.g. Vonk's (2002) work on primates). But even beyond the sortals, the grammar allows the appropriate structuring of the events as a class into ones with the same type of agent and affected patient, not just any unordered trio of *child, mother, kiss*. The question is: Can the event classes exist, cognitively, without language?

Finally, there is the case of embedded propositions, and opacity of truth. The language faculty appears to play a role in offering the representational structure for such possible worlds in other people's minds, perhaps especially with regard to the intentional contents of a belief. Not only are different structures used for different propositional attitudes, but even phenomena that seem purely semantic, like the difference between deontic and epistemic modals (Hacquard, 2006), or the different interpretations of an evidential (Bhadra, 2018) could be represented in the syntax. Here, point of view is maximally complex, and the idea of a counterpart in nonverbal cognition starts to dissolve. We use language to imagine contexts in which contrasts of knowledge, inference and perception would occur. These contexts become impossibly far removed from two different visual perspectives on a scene.

I lay out these radical possibilities because there is a host of empirical studies needed to advance the debate. There are many perplexing results based on the assumption that the linguistic form must require its constitutive concept(s) be visible in a nonverbal realm first. My work has led me to question that assumption.

References

Aikhenvald, A.Y. (2004). Evidentiality. New York: Oxford University Press.

Aksu-Koç, & Alici, D. M. (2000). Understanding sources of beliefs and marking of uncertainty: Child's theory of evidentiality. In E. V. Clark (Ed.), Proceedings of the 30th Annual Child Language Conference (pp. 123-130). Stanford: Stanford University.

Aksu-Koç, A., Avci, G., Aydin, C., Sefer, N., Yasa, Y., July 2005. The relation between mental verbs and ToM performance: evidence from Turkish children. Paper presented at IASCL, Berlin.

Aksu‐Koç, A., Ögel‐Balaban, H., & Alp, I. E. (2009). Evidentials and source knowledge in Turkish. New Directions for Child and Adolescent Development, 2009(125), 13-28.

Andrés‐Roqueta, C., Adrian, J., Clemente, R., & Katsos, N. (2013). Which are the best predictors of theory of mind delay in children with specific language impairment? International Journal of Language & Communication Disorders, 48(6), 726-737.

Apperly, I. & Butterfill, S. (2009). Do humans have two systems to track beliefs and belief-like states? Psychological Review, 20, 521-536.

Apperly, I., & Robinson, E.J. (1998). Children's mental representation of referential relations. Cognition, 67, 287-309.

Apperly, I.A., Samson, D., Carroll, N., Hussain, S., & Humphreys, G.W. (2006). Intact 1st and 2nd order false belief reasoning in a patient with severely impaired grammar. Social Neuroscience, Special issue on theory of mind, 1(3-4), 334-348.

Arsenijevic, B. & Hinzen, W. (2012) On the absence of X-within-X recursion in human grammar. Linguistic Inquiry, 43 (3) 423-440.

Astington, J.A. & Jenkins, J.M. (1999). A longitudinal study of the relation between language and theory of mind development. Developmental Psychology, 35, 1311-1320.

Avrutin, S & Wexler, K (2000) Children's knowledge of subjunctive clauses; obviation, binding and reference. Language Acquisition, 1(8) 67-100

Baars, Bernard J. (2002) The conscious access hypothesis: Origins and recent evidence. Trends in Cognitive Sciences, 6 (1), 47-52.

Baillargeon, R., Scott, R., & He, Z. (2010). False-belief understanding in infants. Trends in Cognitive Science, 14, 110-118.

Baillargeon, Buttelmann, & Southgate. (2018). Invited Commentary: Interpreting failed replications of early false-belief findings: Methodological and theoretical considerations. Cognitive Development, 46, 112-124.

Baldo, J. V., Dronkers, N. F., Wilkins, D., Ludy, C., Raskin, P., & Kim, J. (2005). Is problem solving dependent on language?. Brain and language, 92(3), 240-250.

Bartsch, K. & Wellman, H.M. (1995). Children talk about the mind. New York:Oxford University Press.

Berio, L. (2020). Culturally embedded schemata for false belief reasoning. Synthese, 1-30.

Bhadra, Diti. 2018. Evidentials are syntax-sensitive: The view from Bangla. Glossa: a journal of general linguistics 3(1): 106. 1–39, DOI: https://doi.org/10.5334/gjgl.449

Brandt, S., Buttelmann, D., Lieven, E., & Tomasello, M. (2016). Children's understanding of first and third person perspectives in complement clauses and false belief tasks. Journal of Experimental Child Psychology, 151, 131-143.

Brandt, S., Lieven, E., & Tomasello, M. (2010). Development of word order in German complement-clause constructions: Effects of input frequencies, lexical items, and discourse function. Language, 86, 583-610.

Carruthers, P. (2002). The cognitive functions of language. Behavioral and Brain Sciences, 25(6), 657-674.

Cheung, H., Chen, H., & Yeung, W. (2009). Relations between mental verb and false belief understanding in Cantonese-speaking children. Journal of Experimental Child Psychology, 104, 141–155. http://dx.doi.org/10.1016/jeco.2009.05.004

Cheung, H., Husan-Chih, C., Creed, N., Ng, L., Wang, S., & Mo, L. (2004). Relative roles of general and complementation language in theory of mind development: Evidence from Cantonese and English. Child Development, 75, 1155–1170. http://dx.doi.org/10.1111/j.1467-8624.2004.00731.x

Choi, S. 1991. Early acquisition of epistemic meanings in Korean: A study of sentence-ending suffixes in the spontaneous speech of three children. First language 11(3): 93-119.

Chomsky, N. (2007). Approaching UG from below. Interfaces+ recursion= language? Chomsky's minimalism and the view from syntax-semantics, 1-30.

Clark, E.V., Sengul, C.J. (1978) Strategies in the acquisition of deixis. Journal of Child Language 5, 457–475.

Collins, J. (2000) Theory of Mind, Logical Form and eliminativism. Philosophical Psychology, 13, 465-490.

Cournane, A. (2015). Revisiting the Epistemic Gap: evidence for a grammatical source. Proceedings of the 39th Boston University Conference on Language Development. Somerville, MA: Cascadilla Press.

Dale, P. & Crain-Thoreson, C. (1993). Pronoun reversals: Who, when, and why? Journal of Child Language, 20(3), 573-58

de Villiers, J.G. (1999) On acquiring the structural representations for false complements. In B. Hollebrandse (ed) New perspectives on language acquisition, UMOP.

de Villiers, J.G. (2001) Extension, intension and other minds. In M. Almgren, A. Barrena, M-J. Ezeizabarrena, I. Idiazabal, & B. MacWhinney (eds) Research in Child Language Acquisition: Proceedings of the 8th Conference of the International Association for the study of child language. Somerville, Ma: Cascadilla press.

de Villiers, J.G. (2004). Meme or module? Invited paper, Web conference on Co-evolution of language and Theory of Mind. http://www.interdisciplines.org/coevolution, May

de Villiers, J.G. (2005). Can language acquisition give children a point of view? In J.W. Astington & J. Baird (Eds.), Why language matters for theory of mind. (pp. 189-219). Oxford, UK: Oxford University Press.

de Villiers, J.G. (2007) The interface of language and theory of mind. Lingua.117, 11, 1858-1878.

de Villiers, J.G. (2010) On building up a sufficient representation for belief: Tense, Point of View and Wh-movement. In Joao Costa, Ana Castro, Maria Lobo & Fernanda Pratas, (eds) Language Acquisition and Development: Proceedings of Gala 2009.121-134. Newcastle: Cambridge Scholars press

de Villiers, J. (2014) What kind of concepts need language? In W. Hinzen (ed), Language Sciences. Special issue.

de Villiers, J.G. (2017) Finding signatures of linguistic reasoning. Commentary on W. Hinzen, Reference across pathologies: A new linguistic lens on disorders of thought. Theoretical Linguistics, 43, 3-4.

de Villiers, J.G. (2018). Perspectives on Truth: the case of language and false belief reasoning. In K. Syrett & Sudha Arunachalam (eds) Semantics in Language Acquisition, for the John Benjamins series Trends in Language Acquisition. 222-245.

de Villiers, J., & de Villiers, P. (2009). Complements enable representation of the contents of false beliefs: The evolution of a theory of mind. In S. Foster(Ed.), Language acquisition (pp. 169–195). New York: Palgrave McMillian.

de Villiers, J. & Garfield, J. (2017) Evidentiality, Questions and the Reflection Principle in Tibetan: What do Children Learn when they Learn About Evidentiality? In F. Nihan Ketrez, Aylin C. Küntay, Şeyda Özçalışkan, Aslı Özyürek (eds) Social cognition and environment in Language development: Studies in honor of Ayhan Aksu-Koç. John Benjamins series: Trends in Language Acquisition. pp 113-130

de Villiers, J. G., Harrington, E., Gadilauskas, E. & Roeper, T. (2012). Tense and Truth in Children's Question Answering. In A. Biller, E. Chung, and A. Kimball (Eds.)

Proceedings of the 36th Annual Boston University Conference on Language Development, Somerville, MA: Cascadilla Press.

de Villiers, J.G. , Garfield, J., Gernet Girard, H., Roeper, T. & Speas, P. (2009) Evidentials in Tibetan: Acquisition, semantics and cognitive development. In Fitneva, S. & Matsui, T. (eds) Evidentiality: a window into language and development. Special Issue: New directions for adolescent and child development 125, 29-48.

de Villiers, J.G. & de Villiers, P.A. (2000) Linguistic determinism and false belief. In P. Mitchell & K. Riggs (eds) Children's Reasoning and the Mind. Hove,U.K.: Psychology Press.

de Villiers, J. (2007) The interface of language and theory of mind. Lingua Volume 117, Issue 11, November 2007, Pages 1858-1878.

de Villiers, J., & Garfield, J. (2009). Evidentiality and narrative. Journal of Consciousness Studies, 16(6-8), 191-217.

de Villiers, J. & Garfield, J. (2017) Evidentiality, Questions and the Reflection Principle in Tibetan: What do Children Learn when they Learn About Evidentiality? In F. Nihan Ketrez, Aylin C. Küntay, Şeyda Özçalışkan, Aslı Özyürek (eds) Social cognition and environment in Language development: Studies in honor of Ayhan Aksu-Koç. John Benjamins series: Trends in Language Acquisition. pp 113-130

de Villiers, J.G. , Garfield, J., Gernet Girard, H., Roeper, T. & Speas, P. (2009) Evidentials in Tibetan: Acquisition, semantics and cognitive development. In Fitneva, S. & Matsui, T. (eds) Evidentiality: a window into language and cognitive development. Special Issue: New directions for adolescent and child development. 125, 29-48.

de Villiers, J.G., Kotfila, J. & Klein, M. (2018) Parsing, Pragmatics, and Representation: Children's comprehension of two-clause questions. In GALANA proceedings.

de Villiers, J.G., Kotfila, J. & Roeper, T. (submitted) When is recursion easier for children? In Proceedings of GALA 17. Dordrecht: Springer.

de Villiers, J.G., Nordmeyer, A. & Roeper, T., (2018) How do children deal with shifted indexicals? In R. Ivan (ed) UMOP 40: The Leader of the Pack: A Festschrift in Honor of Peggy Speas (Volume 40)

de Villiers, & Pyers. (2002). Complements to cognition: A longitudinal study of the relationship between complex syntax and false-belief-understanding. Cognitive Development, 17(1), 1037-1060.

de Villiers, J.G. & Roeper, T. (2016). The acquisition of complements. In W. Snyder, J. Lidz (eds) Oxford Handbook of Developmental Linguistics. Oxford University press.

de Villiers, J.G., Roeper, T. & Vainikka, A. (1990) The acquisition of long distance rules. In L. Frazier and J. G. de Villiers (eds) Language Processing and Acquisition. Dordrecht: Kluwer.

de Villiers, P. A., Burns, F., & Pearson, B. (2003). The role of language in theory of mind development of language-impaired children: Complementing theories. In B. Beachley, A. Brown, & F. Conlin (Eds.), Proceeding of the 27th annual Boston university conference on language development (Vol. 1).Somerville, MA: Cascadilla Press.

de Villiers, P. de Villiers, J., Lindley, E.,]., Chen, M & the School Readiness Research Consortium. (2013) Language, inhibitory control and explicit false belief understanding: A longitudinal structural equation model. Poster presented at SRCD, April.

de Villiers, P.A. & de Villiers, J.G. (1974) On this, that and the other: non-egocentrism in very young children. Journal of Experimental Child Psychology 18, 438-447.

Dennett, D. (1978) Beliefs about beliefs. Behavioral and Brain Sciences, 1, pp. 568-570

Diessel, H. & Tomasello, M. (2001) The acquisition of finite complement clauses in English: a usage based approach to the development of grammatical constructions. Cogn. Linguist. 12, 97–141

Dungan, J., Saxe, R., 2012. Matched false-belief performance during verbal and nonverbal interference. Cogn. Sci. 36, 1148–1156.

Dunn, J., & Brophy, M. (2005). Communication, Relationships, and Individual Differences in Children's Understanding of Mind. In J. W. Astington & J. A. Baird (Eds.), Why language matters for theory of mind (pp. 50-69). New York, NY, US: Oxford University Press.

Durrleman, S., Burnel, M., Thommen, E. Foudon, N., Sonie, S., Reboul, A., Fourneret, P. The language-cognition interface in ASD: Complement sentences and false belief reasoning, Research in Autism Spectrum Disorders, 21, 109-120.

Durrleman, S., Burnel, M., De Villiers, J., Thommen, E., Delage, H. & Yao, R. (2019) The impact of grammar on mentalizing: A training study including children with Autism Spectrum Disorder and Developmental Language Disorder', Frontiers in Psychology.

Durrleman S, Hinzen W, Franck J. (2018) False belief and relative clauses in autism spectrum disorders. J Commun Disord. 74:35-44. DOI: 10.1016/j.jcomdis.2018.04.001.

Farrar, J., Benigno, J., Tompkins, V. & Gage, N. (2017). Are there different pathways to explicit false belief understanding? General language and complementation in typical and atypical children. Cognitive Development, 43(C), 49-66.

Farrar, M. J., Johnson, B., Tompkins, V., Easters, M., Zilisi-Medus, A., & Benigno, J.P. (2009). Language and Theory of Mind in Preschool Children with Specific Language Impairment. Journal of Communication Disorders, 42(6), 428-441.

Fay, W. (1979). Personal pronouns and the autistic child. Journal of Autism and Developmental Disorders, 9 (3), 247-260.

Fenson, L., Dale, P.S., Reznick, J.S., Thal, D., Bates, E., Hartung, J.P., Pethick, S., & Reilly, J.S. (1993). The MacArthur Communicative Development Inventories: User's Guide and Technical Manual. San Diego: Singular Publishing Group.

Fillmore, C. (1975) Santa Cruz lectures on deixis, 1971. Indiana University Linguistics Club. French-speaking and English-speaking children. Journal of Child Language, 24(2), 311-326.

Floyd, S. B., (2014) The role of language in the concept of telicity. Honors thesis, Smith College, Northampton, MA. https://scholarworks.smith.edu/theses/1546

Forgeot D'Arc, B., & Ramus, F. (2011). Belief attribution despite verbal interference. Quarterly Journal of Experimental Psychology, 64(5), 975-990.

Garfield, J. & de Villiers. J.G. (2018) Who knows what and how? New Evidence about the Acquisition of Evidentials in Tibetan. In R. Ivan (ed) UMOP 40: The Leader of the Pack: A Festschrift in Honor of Peggy Speas (Volume 40)

Garrett, E. (2001). Evidentiality and assertion in Tibetan. Unpublished doctoral dissertation, University of California, Los Angeles.

Gentner, D.& Kurtz, K. (2005). Relational Categories. In W.K Ahn, R.L. Goldstone, B.C. Love, A.B. Markman & P.W. Wolff (Eds.), Categorization inside and outside the laboratory. Washington, DC: APA.

Girouard, P., Ricard, M., Decarie, T.G. (1997). The acquisition of personal pronouns in autistic children. Journal of Autism and Developmental Disorders, 19(1), 73-85.

Golinkoff, R.M., de Villiers, J., Hirsh-Pasek, K., Iglesias, A., & Wilson, M.S. (2017). User's manual for the Quick Interactive Language Screener ™ (QUILS™): A measure of vocabulary, syntax, and language acquisition skills in young children. Baltimore: Brookes Publishing Co.

Hacquard, V. (2006). Aspects of modality. PhD Dissertation: Massachusetts Institute of Technology.

Hale, C., & Tager‐Flusberg, H. (2003). The influence of language on theory of mind: A training study. Developmental Science, 6(3), 346-359.

Harrigan, K., Hacquard, V. & Lidz. J. (2016). Syntactic bootstrapping in the acquisition of attitude verbs: think, want and hope. In Proceedings of WCCFL 33, ed. Kyeong-min Kim et al. Cascadilla Proceedings Project.

Hermer-Vasquez, L., Spelke, E. S, & Katsnelson, A.S. (1999). Sources of flexibility in human cognition: Dual-task studies of space and language. Cognitive Psychology 39, 3-36.

Hinzen, W. (2007) Mind Design and Minimal Syntax. Oxford: Oxford University press.

Hinzen, W. (2009). The naturalization of truth. Unpublished manuscript.

Hinzen, W. (2017). Reference across pathologies: a new linguistic lens on disorders of thought. Theoretical Linguistics, 43(3-4), 169-232.

Hinzen, W., Sheehan, M., & Reichard, U. (2014). Intensionality, grammar, and the sententialist hypothesis. In P. Kosta, S. Franks, T. Radeva-Bork, & L. Schürcks (eds) Minimalism and beyond. radicalizing the interfaces, 315-349.

Hollebrandse, B., & Roeper, T. (2014). Empirical results and formal approaches to recursion in acquisition. In T. Roeper & M. Speas (Eds.), Recursion: Complexity in cognition. Dordrecht: Springer.

Hughes, C., & Ensor, R. (2007). Executive function and theory of mind: Predictive relations from ages 2 to 4. Developmental psychology, 43(6), 1447.

Kalsang, Speas, M., Garfield, J & de Villiers, J.G. (2013) Direct Evidentials, Case, Tense and Aspect in Tibetan. Natural Language and Linguistic Theory, Volume 31, Issue 2, Page 517-561

Iglesias, A., de Villiers, J.G., Golinkoff, R., Hirsh-Pasek, K., Wilson, M.S. (2019) Capturing language differences and similarities in Dual Language Learners. Paper presented at SRCD, Baltimore, March.

Iglesias, A., Golinkoff, R., de Villiers, J.G., Hirsh-Pasek, K., Wilson, M.S. (in press) QUILS:ES. Baltimore: Brookes Publishing company.

Jung, W. & Hummel, J. E. (2013). The effects of dual verbal and visual tasks on featural vs. relational category learning. In Proceedings of the 35th Annual Conference of the Cognitive Science Society.

Kamawar, D., & Olson, D. R. (1999). Children's representational theory of

language: The problem of opaque contexts. Cognitive Development, 14, 531-548.

Kotfila, J. & de Villiers, J.G. (2019) When must children acquire long distance wh-questions? In Proceedings of Boston University Conference on Language Development, Cascadilla press.

Kulke, L., Von Duhn, B., Schneider, D., & Rakoczy, H. (2018). Is Implicit Theory of Mind a Real and Robust Phenomenon? Results From a Systematic Replication Study. Psychological Science,29(6), 888-900.

Kyuchukov, H. & de Villiers, J.G. (2009) Theory of mind and evidentiality in Romani-Bulgarian bilingual children. Psychology of Language and Communication, Vol. 13, No. 2

Lasersohn, P. (2005). Context Dependence, Disagreement, and Predicates of Personal Taste. Linguistics and Philosophy 28;6.

Lewis, S., Hacquard, V. & Lidz, J. (2013). The semantics and pragmatics of belief reports in preschoolers. In Proceedings of SALT, volume 22, pages 247–267.

Lewis, S., Hacquard, V. & Lidz, J. (2017). Lewis, S., Hacquard, V., & Lidz, J. (2017). “Think” pragmatically: Children’s interpretation of belief reports. Language Learning and Development, 13(4), 395-417.

Lohmann, H., & Tomasello, M. (2003). The role of language in the development of false belief understanding: A training study. Child development, 74(4), 1130-1144.

Loveland, K.A. (1984). Learning about points of view: Spatial perspective and the acquisition of 'I/you.' Journal of Child Language, 11(3), 535 -556.

Low, J., & Watts, J. (2013). Attributing false beliefs about object identity reveals a signature blind spot in humans' efficient mind-reading system. Psychological Science, 24, 305–311.

Margulis, K.S. (2014). The role of language in understanding second order relations: an eyetracker study. Honors Project, Smith College, Northampton, MA. https://scholarworks.smith.edu/theses/22

Meins, E., Fernyhough, C., Arnott, B., Leekam, S., & Rosnay, M. (2013). Mind‐Mindedness and Theory of Mind: Mediating Roles of Language and Perspectival Symbolic Play. Child Development, 84(5), 1777-1790.

Merchant, G. & de Villiers , J.G. (2007). Children's control of reference in opaque contexts in production. Poster given at Society for Research in Child Development, Boston, April.

Miller, C. A. (2001). False belief understanding in children with specific language impairment. Journal of Communication Disorders, 34, 73–86. http://dx.doi.org/10.1016/S0021-9924(00)00042-3

Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding. Child Development, 78, 622–646.

Newen, A., Wolf, J. (2020) The situational mental file account of the false belief tasks: a new solution of the paradox of false belief understanding. Rev.Phil.Psych.

Nilsson, K., & López, K. (2016). Theory of Mind in Children With Specific Language Impairment: A Systematic Review and Meta‐Analysis. Child Development, 87(1), 143-153.

Nordmeyer, A. (2011). To be or not to be: examining the role of language in a concept of negation. Honors thesis, Smith College, 2011.

Ozturk, O., & Papafragou, A. (2016). The acquisition of evidentiality and source monitoring. Language Learning and Development, 12(2), 199-230.

Paal, T., & Bereczkei, T. (2007). Adult theory of mind, cooperation, Machiavellianism: The effect of mindreading on social relations. Personality and individual differences, 43(3), 541-551.

Papafragou, A., Li, P., Choi, Y., & Han, C. (2007). Evidentiality in language and cognition. Cognition, 103, 253-295.

Pearson, H. (2013) A judge-free semantics for predicates of personal taste, Journal of Semantics, Volume 30, Issue 1, February 2013, Pages 103-154.

Perner, J., & Leahy, B. (2016). Mental files in development: Dual naming, false belief, identity and intensionality. Review of Philosophy and Psychology, 7(2), 491-508.

Perner, J., Ruffman, T., (2005). Infants' insight into the mind: how deep? Science 308, 214–216.

Perner, J., Sprung, M., Zauner, P., & Haider, H. (2003). Want that is understood well before Say that, think that, and false belief: A test of de Villiers's linguistic determinism on German–Speaking children. Child Development, 74(1), 179-188.

Peterson, C. & Siegal, M. (1995). Deafness, conversation and theory of mind. Journal of Child Psychology and Psychiatry, 36, 459–474.

Premack, D. and Woodruff, G. (1978) Does the chimpanzee have a theory of mind? Behav. Brain Sci. 1, 515–526

Pyers, J., 2004. The relationship between language and false-belief understanding: evidence from learners of an emerging sign language in Nicaragua. Ph.D. dissertation. University of California, Berkeley, CA.

Pyers, J., & Senghas, A. (2009). Language Promotes False-Belief Understanding: Evidence From Learners of a New Sign Language. Psychological Science, 20(7), 805-812.

Rakoczy, H. (2017). In defense of a developmental dogma: children acquire propositional attitude folk psychology around age 4. Synthese 194, 689–707. doi: 10.1007/s11229-015-0860-8

Recanati, F. (2002), 'Does Linguistic Communication Rest on Inference?', Mind & Language, 17 (1/2), pp. 105–26.

Rizzi, L. & Cinque, G. (2016). Functional Categories and Syntactic Theory. Annual Review of Linguistics 2(1), 139–163.

Roeper, T & de Villiers, J.G. (2011) The acquisition path for wh-questions. In de Villiers, J.G. & Roeper, T. (eds) Handbook of Generative Approaches to Language Acquisition. Springer.

Rubio-Fernández, P. (2019). Publication standards in infancy research: Three ways to make Violation-of-Expectation studies more reliable. Infant behavior and development, 54, 177-188.

Russell, J. (1987) ''Can we say . . .?'' Children's understanding of intensionality. Cognition 25, 289–308.

Samuel, S. , Durdevic, K. , Legg, E. W., Lurz, R. and Clayton, N. S. (2019). Is language required to represent others' mental states? evidence from beliefs and other representations. Cogn Sci, 43: e12710. doi:10.1111/cogs.12710

San Juan, V., & Astington, J. W. (2012). Bridging the gap between implicit and explicit understanding: How language development promotes the processing and representation of false belief. British Journal of Developmental Psychology, 30, 105–122. http://dx.doi.org/10.1111/j.2044-835X.2011.02051.x

Schick, B., de Villiers, P., de Villiers, J., & Hoffmeister, R. (2007). Language and theory of mind: A study of deaf children. Child Development, 78, 376–396.

Senju, A., Southgate, V., White, S., & Frith, U. (2009). Mindblind eyes: an absence of spontaneous theory of mind in Asperger syndrome. Science, 325(5942), 883-885.

Shukla, M. & de Villiers, J.G. (submitted, 2020) The role of language in building abstract, generalized conceptual representations of two-place predicates: a comparison between adults and infants.

Shuliang, M., Yanjie, S., & Sabbagh, M. A. (2014). Sentential complements and false belief understanding in Chinese Mandarin-speaking preschoolers: A training study. Cognitive Development, 29, 50-61.

Siegal, M. & Varley, R. (2006) Aphasia, language and theory of mind. Social Neuroscience 1:3-4, 167-174

Skinner, B.F. (1953) Science and Human Behavior. The Free Press, Simon and Shuster.

Slade, L., & Ruffman, T. (2005). How language does (and does not) relate to theory of mind: A longitudinal study of syntax, semantics, working memory, and false belief. British Journal of Developmental Psychology, 23, 141.

Smith, M., Apperly, I.A. & White, V. (2003) False belief reasoning and the acquisition of relative clause sentences. Child Development 74(6) 1709-1719.

Southgate, V., & Vernetti, A. (2014). Belief-based action prediction in preverbal infants. Cognition, 130(1), 1-10.

Speas, M. (2004). Evidentiality, logophoricity and the syntactic representation of pragmatic features. Lingua, 114(3), 255–276.

Stephenson, T. (2007) Judge dependence, epistemic modals, and predicates of personal taste Linguistics and Philosophy, Vol. 30, No. 4 (2007), pp. 487-525

Tager-Flusberg, H., & Joseph, R. M. (2005). Theory of mind, language, and executive functions in autism: A longitudinal perspective. In W. Schneider, R. Schumann-Hengsteler, & B. Sodian (Eds.), Young children's cognitive development: Interrelationships among executive functioning, working memory, verbal ability, and theory of mind (pp. 239-257). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Tanz, C. (1980). Studies in the acquisition of deictic terms. Cambridge: Cambridge University Press.

Tardif, T., So, C. W.-C., & Kaciroti, N. (2007). Language and false belief: Evidence for general, not specific, effects in Cantonese-speaking preschoolers. Developmental Psychology, 43, 318–340.

Tardif, T., & Wellman, H.M. (2000). Acquisition of Mental State Language in Mandarin- and Cantonese-Speaking Children. Developmental Psychology, 36(1), 25-43.

Ünal, E., & Papafragou, A. (2016). Production–comprehension asymmetries and the acquisition of evidential morphology. Journal of Memory and Language, 89, 179-199.

Ünal, E., & Papafragou, A. (2018). Relations between language and cognition: evidentiality and sources of knowledge. Topics in cognitive science.

Uzundag, B. A., TAŞÇI, S. S., Küntay, A. C., & Ayhan, A. K. (2018). Functions of Turkish evidentials in early child–caregiver interactions: a growth curve analysis of longitudinal data. Journal of child language, 45(4), 878-899.

Van der Lely, H., Hennessey, S. & Battell, J. (2001) Linguistic determinism and false belief: Insight from children with specific language impairment. Manuscript, University College, London.

Van Hout, A., Harrigan, K. & de Villiers, J.G. (2010) Asymmetries in the Acquisition of Definite and Indefinite Noun Phrases. In Petra Hendriks and Charlotte Koster (eds) Special Issue on Asymmetries in Child Language, Lingua, 120 (8) 1973-1990.

Varley, R., Siegal. M. & Want. S.C. (2001) Severe impairment in grammar does not preclude Theory of Mind. Neurocase, 7:6, 489-493, DOI: 10.1093/neucas/7.6.489

Vonk, J. (2002) Can orangutans and gorillas acquire concepts for social relationships? International Journal of Comparative Psychology, 2002, 15, 257-277.

Vygotsky, L. S. (1962). Thought and language. Cambridge MA: MIT Press.

Wang, Lu & Leslie, A. (2016) Is implicit theory of mind the 'real deal'? the own-belief/true-belief default in adults and young preschoolers. Mind & Language, Vol. 31, No. 2 pp. 147–176.

Wellman, H.M. & Liu, D. (2004). Scaling theory of mind tasks. Child Development, 75, 523-541.

Wimmer, H. & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. Cognition, 13, 103-128

Woods, R. (2016). The syntax of speech acts: embedding illocutionary force. Ph.D. thesis, University of York.

Xu, F. (2007) Sortals, object individuation and language. TRENDS in Cognitive Sciences Vol.11 No.9

Table 1:	Understanding of Theory of Mind of Others
9m to 2.5 years	Shared attention, eye gaze, intent/goal of others.
2.5-3.5 years	Desires, pretence, "scripted" or conventional emotions
3.5-4.5 years	Seeing leads to knowing, emotions based on desires
4.5 -6 years	False beliefs: contents, prediction, explanation, emotions based on them
6 years and up	Second order false beliefs, opacity, spatial perspective taking

Table 2: Measures for SEM

False Belief Understanding

Verbal False Belief Tasks

2 Unexpected Contents containers
(asked about own and others' false beliefs)
2 Unseen Location Change stories
(where will the character first look for the object)

Low-verbal False Belief Tasks

(6 different false belief scenarios, with 3 true belief)
Picture Sequence Version
Thought bubble false belief tasks

Language Measures

Expressive one-word vocabulary (EOWPVT-R)
DELV screener
Memory for False Complements

Conflict Inhibition (EF) Measures

Inhibitory Control
Bear and Dragon Task ("Simon says")
Knock-Tap Test

Figure 1. Item from the memory for complement task (De Villiers & Pyers, 2002).

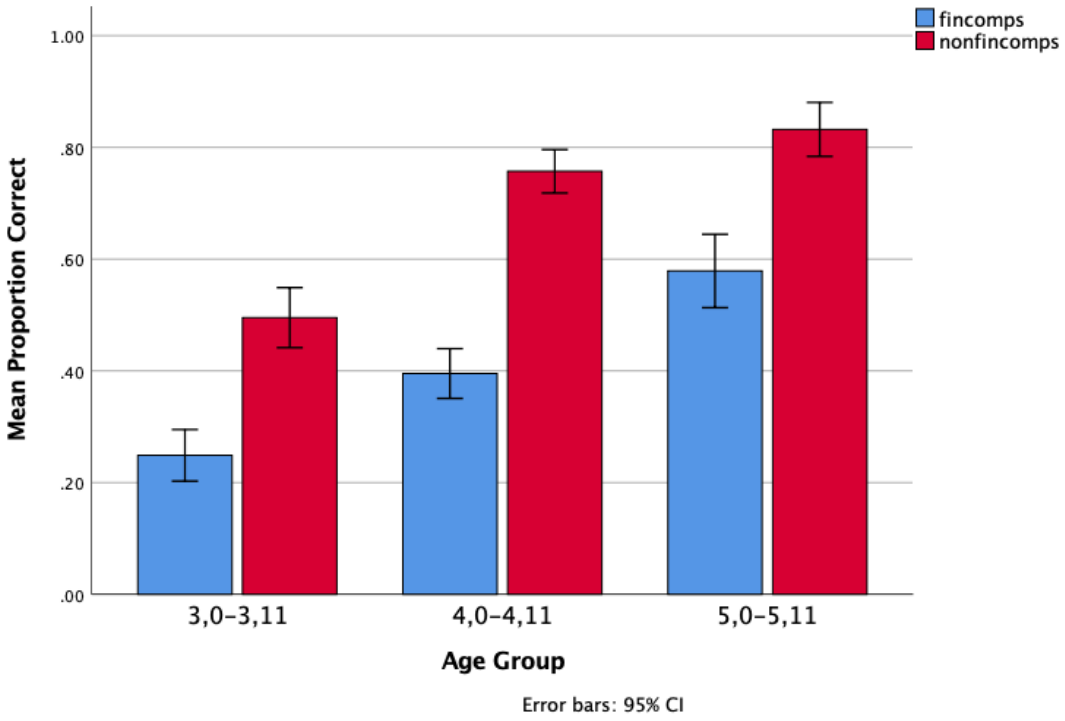

Figure 2: Preschool children tested on QUILS: Comprehension of finite versus nonfinite complement types.

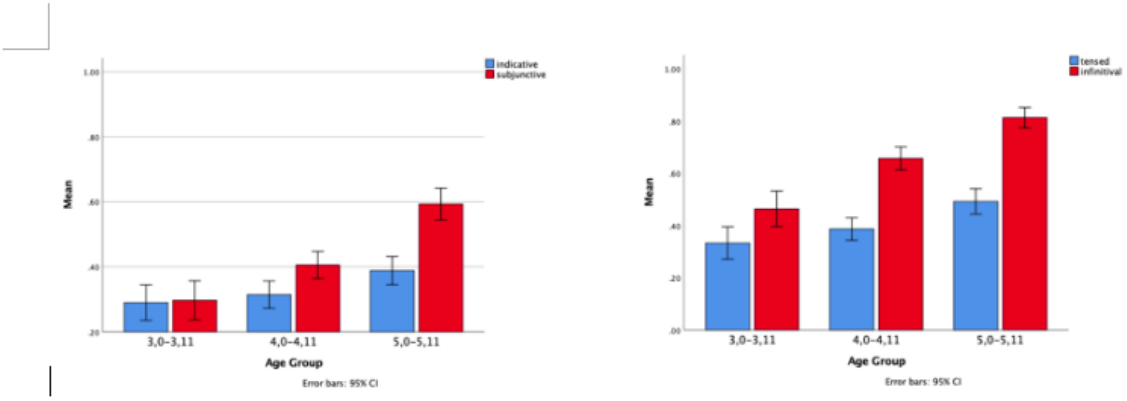

Figure 3: Young dual language learners on Spanish complement types (left) and English complement types (right).

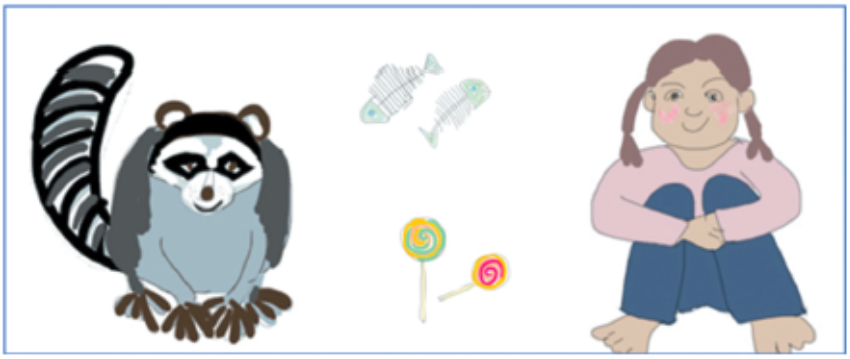

Figure 4. Predicates of personal taste. "This Raccoon likes to eat garbage. Fishbones are his favorite- mm mm, yummy! He doesn't like lollipops- too sweet, ugh! The little girl loves lollipops but really does not like fishbones."Think-type questions:Does the Raccoon think the fishbones are yummy? Does the girl think the lollipops are yucky?Contrasting adjective questions:Does the girl think the yummy lollipops are yucky?

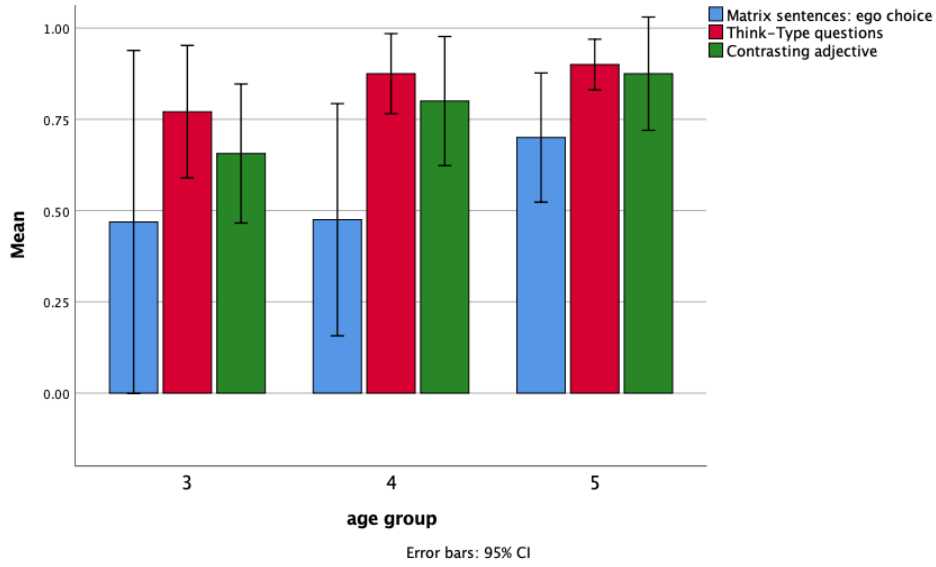

Figure 5 Performance on predicates of personal taste in complements