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The Development of Theory of Mind in Deaf, Hard of Hearing, and Hearing Preschool Children

Christopher Stanzione

ACCEPTANCE

This dissertation, THE DEVELOPMENT OF THEORY OF MIND IN DEAF, HARD OF HEARING, AND HEARING PRESCHOOL CHILDREN, by CHRISTOPHER STANZIONE, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty. The Dean of the College of Education concurs.

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THE DEVELOPMENT OF THEORY OF MIND IN DEAF, HARD OF HEARING, AND HEARING PRESCHOOL CHILDREN

by

CHRISTOPHER STANZIONE

Under the Direction of Amy R. Lederberg

ABSTRACT

Theory-of-mind (ToM) is a conceptual framework used for interpreting human social activity (Astington, 2003). ToM has traditionally been conceptualized as an understanding of false belief, which is the understanding that people have different beliefs about the same object or situation and that those beliefs may not be consistent with reality. Hearing children acquire false belief between 4- and 5-years-of-age. In contrast, many deaf and hard-of-hearing (DHH) children show developmental delays in false belief, sometimes stretching into adolescence (Courtin, 2000; Jackson, 2001; Peterson & Siegel, 1995). Wellman and Liu (2004) have argued that false belief is just one step in a progression of the child's understanding of mental states. They created and validated a five-step ToM scale that assesses a series of related understandings of mental states, beginning with the understanding of desires and ending with false belief.

Peterson and Wellman (2009) found that school-age DHH children showed delays on the ToM scale. In addition, they found that DHH school-age children developed ToM in a different sequential order from hearing preschoolers. The present study examines the development of ToM in DHH and hearing preschoolers—the time period when ToM develops for hearing children. The primary goals of the present study are to compare the developmental sequence of ToM in DHH and hearing children, while also addressing the measurement properties of the scale. One hundred and eighty one children (109 hearing, 72 DHH; *M* age = 50 months) were tested on the 5-item ToM scale. Using confirmatory factor analysis, the results suggest that 1) DHH children are not delayed in their overall ToM compared to hearing children, but there are differences by task, 2) DHH and hearing children follow a similar sequence of ToM, and 3) the five tasks that make up the ToM scale reasonably measure a single construct within both groups.

INDEX WORDS: confirmatory factor analysis, deafness, language, theory of mind

THE DEVELOPMENT OF THEORY OF MIND IN DEAF, HARD OF HEARING, AND HEARING PRESCHOOL CHILDREN

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A Dissertation

Presented in Partial Fulfillment of Requirements for the

Degree of

Doctor of Philosophy

in

Educational Psychology

in

Educational Psychology, Special Education, and Communication Disorders

in

the College of Education
Georgia State University

Atlanta, GA
2014

ACKNOWLEDGMENTS

I owe much of my professional and personal growth to my advisor, Amy Lederberg. Thank you for your time, patience, and dedication in training me to be the best teacher, researcher, and mentor to others. You are a wonderful mentor and friend, and I thank you for helping me advance in my career. I also thank Brenda Schick and Lee Branum-Martin, both who taught me various unique skills related to this project, which now generalizes to future projects. You both saw my potential and pushed me to do my best, and I thank you.

I also thank my co-workers and friends who helped me along the way, specifically Meghan Babcock, Victoria Burke, Hanah Goldberg, Stacey Tucci, and Jessica Trussell. You are wonderful friends and colleagues, and I thank for you for your positive support and energy. Thanks to the graduate research assistants in our research lab, especially Alex Baxter. You were a fantastic help to this project!

Lastly, I thank my amazing family and friends who support me both personally and professionally. I would not be where I am today without your love and support. Thank you for investing in me. In closing, I dedicate this project to the future of deaf and hard-of-hearing children. Education is an investment in our future, and I strive to continue educating those who come into my life.

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ABBREVIATIONS

DHH	Deaf and Hard of Hearing
ToM	Theory of Mind

1 EXPERIENTAL AND ENVIRONMENTAL FACTORS IN THEORY OF MIND DEVELOPMENT

Theory of Mind (ToM), the development of children's understanding of the mind and how it relates to human action and interaction, has long been recognized as part of socio-cognitive development. ToM is a foundational skill with important links to children's socialization process (Carpendale & Lewis, 2004). Typically-developing children acquire a mature ToM between the ages of 4-5, whereas moderate to profound delays have been shown in atypical groups such as children with autism (Baron-Cohen, Leslie, & Frith, 1985), children with specific language impairment (SLI; Bishop, 1997), and children who are deaf or hard-of-hearing (DHH; Peterson & Siegel, 1995).

As a part of a child's socio-cognitive foundation, ToM is also influenced by environmental factors, such as conversational discourse, family size, and socioeconomic status, as well as child factors, such as language and vocabulary skills (Astington & Baird, 2005; de Rosnay & Hughes, 2006; Milligan, Astington, & Dack, 2007). The experiential view of cognitive development assumes that social experience provides a platform for learning new knowledge about the mind through interacting with others in the social and cultural world (Nelson, 1996). These external factors have shown a consistent influence on ToM development (Dunn & Brophy, 2005). Additionally, several training studies provide evidence that learning aspects of ToM can be scaffolded, suggesting the development of social understanding can be constructed through social interactions and explicit teaching (Hale & Tager-Flusberg, 2003).

In this review, I focus on the nature of social interactions that facilitate ToM development in typically-developing children. In addition, I illustrate how language and social interaction function to influence ToM development by focusing on children with SLI and DHH children.

These two atypically-developing groups offer unique perspectives when studying ToM because they both experience delays in this area of social cognition while experiencing different deficits related to language.

Definition and Assessment of ToM

ToM is a conceptual framework used for interpreting human social activity (Astington, 2003). Fundamental to understanding people is understanding that their beliefs and desires govern their action. Classically, much of the study of ToM has been defined as an understanding of false belief; an understanding that people may have different beliefs about a situation and that those beliefs may not be consistent with reality. This requires the child to understand that someone else's belief depends on the history of perceptual access or experience with an object or situation. With that knowledge, children learn that it is possible to predict what a person will do or say, based upon their belief, regardless of whether the belief is true or false. Typically, children younger than age 4 misrepresent the mental states of others, but not their own.

There are several types of false belief tasks and they are very simple to administer. One example is the unexpected displacement task. The classic version of this task involves two dolls (Sally and Anne), a marble, a basket, and a box. Sally is playing with a marble, while Anne is watching. Sally decides to go outside and play and places the marble in the basket. While Sally is gone, sneaky Anne moves the marble from the basket to the box. While the child sees the marble being moved, Sally has not. When Sally returns the child is asked, "Where will Sally look for her marble?" Typically a 3-year-old will answer "the box" and a 5-year-old will answer "the basket."

Another example of a false belief task is the deceptive container task. This experiment includes misleading contents within clearly marked boxes (e.g., a fish inside a M&M box). First, the experimenter will ask the child what he or she thinks is inside the box (candy), then the experimenter reveals the true contents (a fish). Mary, who has not seen the contents of the box, enters the room and the question is asked, “What does Mary think is inside this box?” Children younger than 4 will answer “a fish” and older children will answer “candy.” Passing false belief tasks suggest children know that the world is represented in the mind and that people act on that representation, even when it is incorrect.

Several meta-analyses examining hundreds of classic false belief studies from around the world have been conducted to see when children develop an understanding of false belief (Liu, Wellman, Tardif, & Sabbagh, 2008; Wellman, Cross, & Watson, 2001). For example, Wellman et al. (2001) investigated the effect of different conditions of false belief tasks and how performance changed with age. The meta-analysis included 178 studies including 591 false belief conditions, with a total of over 4,000 children. They found that 30-month-olds were 20% correct, 44-month-olds were 50% correct, and 56-month-olds were 75% correct in passing false belief. Performance began to shift from being statistically below chance to above chance around age 4. This robust finding is consistent across cultures and false belief conditions, showing that understanding false belief develops around 4-5 years of age.

For some time, several researchers have argued that false belief is just one step in a progression of the child’s understanding of the mind (see Gopnik & Wellman, 1992; 1994). Some have argued that the fixation on false belief has prevented us from examining a more expansive view of socio-cognitive development (Carpendale & Lewis, 2004). This broader framework proposes that early beginnings of ToM development emerge from our everyday common sense psychology about the mind. Our everyday interactions with others require us to make predictions based on beliefs, desires, and emotions (Bartsch & Wellman, 1995; Nelson, 1996). Psychologists often characterize our everyday system of reasoning about the mind, world, and behavior as a belief-desire psychology (D'Andrade, 1987; Fodor, 1992; Wellman, 2011). For example, we might wonder why Mary went to open the drawer. She *wanted* cookies and *thought* there would be cookies inside the drawer. Belief-desire reasoning is seen in children as early as age two, well before success on false belief between ages 4 – 5 (Bartsch & Wellman, 1995; Repacholi & Gopnik, 1997). Gopnik and Wellman (1992, 1994) suggest that desires and beliefs help us form a cohesive theory about how we come to understand people, and these experiences are usually embedded within social interactions with others. By adopting a broader definition of ToM as a series of related understandings about how the mind operates on intentions, perceptions, emotions, beliefs, and desires, researchers can comprehensibly capture the development of social cognition prior to false belief.

There is evidence for a sequence of ToM understanding that develops throughout preschool (Wellman & Liu, 2004). First, the results from a meta-analysis on over 45 studies investigating mental state development in preschool-age children suggest that children understand that two people can have different desires about the same object well before understanding that two people can have different beliefs about the same object. Following this development, children gain an understanding that only people given access to privileged information (e.g., seeing the contents of a box) will know the information. Based on these results, Wellman and Liu created a ToM scale composed of a series of tasks that represent a continuum of skills related to ToM. The first task, *diverse desires,* requires the child to recognize that someone else has a different desire about the same object than the child. The second task, *diverse beliefs,* involves the child judging her own belief versus someone else's belief about the same object. In the third task, *knowledge access,* the child sees what is inside an unmarked box while predicting the knowledge of someone else who has not seen the contents. In the fourth task, *contents false belief,* the child is involved in knowing what is inside a distinctive container and someone else having a false belief about the contents. In the fifth task, *explicit false belief,* the child judges how someone will search for an item, provided the false belief situation. In the sixth task, *belief emotion,* the child will judge how someone might feel, when a prediction is incorrect. Lastly, in the seventh task, *real-apparent emotion*, the child judges a situation where a person can feel one emotion but display another emotion. Wellman and Liu used this ToM scale to assess 75 typically-developing hearing preschoolers ranging in age from 3 – 5 years. The results show that these tasks form a highly reliable scale that increases in developmental difficulty with *diverse desires* being the easiest, and *emotion understanding* the most difficult. In summary, ToM development involves a range of developmental steps that begin as early as 3 years of age with the more complex aspects developing at 4 – 5 years of age. Research has demonstrated that the development of false belief understanding is consistent across different tasks, languages, and cultures.

Language & ToM Development

Numerous studies have found significant relationships between language and performance on ToM tasks in typically-developing children (Astington & Jenkins, 1999; Milligan et al., 2007). We also see this same relationship in children with SLI (Farrar et al., 2009) and DHH children (P. de Villiers, 2005; Schick, de Villiers, de Villiers, & Hoffmeister, 2007). Some researchers argue that language plays a causal role in ToM development (de Villiers, 2005), but there is some debate as to which aspect of language is the most important. Bartsch and Wellman (1995) suggest language plays a fundamental role because ToM relies on acquiring the semantics of mental-state vocabulary, such as *think, know,* and *remember* (see also Hughes & Leekam, 2004). Mental-state verbs are unique in that they focus on abstract internal states and psychological processes; concepts that cannot be directly observed. Children begin using these terms around age 2 during their spontaneous conversations with others (Bartsch & Wellman, 1995), however, many are conversational phrases (e.g., "You know what?"). Before age 3, genuine references to mental states appear, along with statements that contrast their own mental states with those of others. With development, children begin using mental-state verbs to refer to others' internal states, suggesting semantics, (i.e., lexical knowledge of mental state words) is important for success on ToM tasks that rely heavily on this knowledge.

Other researchers believe that children must master the use of syntactic complement clauses in order to represent false beliefs, both in language and in cognition (de Villiers & de Villiers, 2000; Schick et al., 2007). Complements are linguistic structures where one sentence is embedded within another (Hauser, Chomsky, & Fitch, 2002). Relevant to ToM development, the set of mental verbs (e.g., *think, believe, know, forget, pretend, see*) and communication verbs (e.g., *say, tell, ask, report, promise*) take either *that*-complements or *wh*-complements (e.g., "I *thought that* cookies were in the jar,"; "I *remember where* my toy is!"). Complex sentence production and complement clause use develops with age (Diessel & Tomasello, 2001; Kidd, Lieven, & Tomasello, 2006). Children do not start using mental state verbs and *that*- or *wh*-complements until around age 4, a time when they are also successful on false belief tasks. de Villiers (2005) argues that this type of syntax acquisition is a necessary precursor for the understanding of false belief.

It may be possible that multiple aspects of language are necessary for the development of a ToM. A meta-analysis by Milligan et al. (2007) investigated the relationship between language and ToM in 104 studies (8,891 children). They included five aspects of language (i.e., general language, semantics, receptive vocabulary, syntax, and memory for syntactic complements) as well as potential moderators. The results show that performance on ToM tasks was related to measures of general language (27% of the variance explained) and receptive vocabulary (12% of the variance explained). No significance difference was found among semantics, syntax, and memory for complements because of the limited number of studies in each category. Additionally, earlier language ability predicted later ToM performance. Milligan concludes there is a causal relationship between language and ToM, although others posit a bidirectional relationship (Slade & Ruffman, 2005).

Researchers like Astington (1996) and Tomasello (2009) argue that it is not the language skills specifically that predict success on ToM, but rather that language allows interaction among people. Having the ability to take the perspective of another and attribute mental states to others allows us to participate more intimately. That is, we can learn from each other because our sophisticated development of social cognition allows us to internalize not only the knowledge of the conversation, but the social interaction itself.

DHH children offer a unique perspective to studying ToM development because of their range of language learning experiences. Researchers have consistently found that DHH children who have parents who are also deaf or hard-of-hearing develop ToM around the same age as hearing children, significantly younger than DHH children who have hearing parents (Courtin, 2000; Meristo et al., 2007; Peterson & Siegel, 1999; Schick et al., 2007). DHH children who have parents that are also deaf or hard-of-hearing develop in a language-rich environment much like their hearing peers. They share a common sign language with their parents, siblings, and peers. Therefore, they do not typically experience language deprivation or language delays.

In contrast, DHH children who have hearing parents, who represent the vast majority of DHH children (about 95%), typically develop in language environments that are often restrictive.

Prior to identification of a hearing loss, most have limited access to the spoken language in their environment. Even after diagnosis, hearing aids do not provide sufficient access to speech for children with a severe to profound hearing loss to acquire spoken language. Newer technologies, such as digital hearing aids and cochlear implants, provide DHH children with better access to sound, but it is still not equivalent to normal hearing. While many DHH children learn sign language, most hearing parents of DHH children are typically not fluent signers, so the language environment is not as rich when compared to both DHH children of DHH parents and hearing children (Moeller & Schick, 2006).

DHH children who have hearing parents can experience severe to profound delays in the development of ToM (Peterson, Wellman, & Liu, 2005; Schick et al., 2007). Researchers suggest three reasons to account for the ToM delay in DHH children: 1) the language required to engage in the task is complex (Schick, et al., 2007); 2) knowledge of complement structure is required to develop ToM (de Villiers, 2005); and 3) the use of mental state language is required to engage in everyday conversations with others to access ToM concepts (Moeller & Schick, 2006; Peterson et al., 2005).

To investigate the role of language in ToM development, Schick et al. (2007) studied 176 DHH children who had either deaf or hearing parents, and who used American Sign Language (ASL) or oral English, and a control group of 42 typically-developing hearing children. DHH children were comprised of three groups: 1) ASL users who have deaf parents (average age = 6.0), 2) ASL users who have hearing parents (average age = 6.11), and 3) oral English language users who have hearing parents (average age = 6.0). Children were tested with tasks that included measures of nonverbal intelligence, false belief reasoning (both verbal and nonverbal), and language. The results indicated that the hearing children and ASL users who have deaf parents were indistinguishable in their false belief performance (both verbal and nonverbal), and both groups performed better than the other two groups of DHH children. In contrast, ASL and oral English users who have hearing parents were delayed in false belief, with a 50% group success rate around 7 years of age. Furthermore, DHH children did not perform better on the nonverbal task than the verbal task. Several studies using nonverbal false belief tasks continue to show delays in DHH children's understanding of ToM (see also de Villiers & de Villiers, 2000; Figueras-Costa & Harris, 2001; Woolfe, Want, & Siegel, 2002). These results suggest that the language demands of the false belief task are not the cause of the observed ToM delays.

Despite delays in ToM development, DHH children's developmental trajectory appears to parallel that of hearing children. Peterson et al. (2005) studied school-age DHH children using the ToM scale created by Wellman and Liu (2004). DHH children ranged in age from 5.5 to 13 years, and used a combination of sign and spoken language. They were compared to typically-developing preschool-age hearing children who ranged in age from 3.5 to 5.5 years. Results indicate that DHH children's responses were highly scalable and consistent with findings with hearing children found by Wellman and Liu (2004). All but two of the DHH children who had deaf parents passed all four tasks. DHH children who had hearing parents were profoundly delayed compared with hearing peers. Peterson and Wellman (2009) conducted a similar investigation with school-age DHH children ranging in age from 5 to 15 years, compared with preschool-age hearing children (3 to 6 years). While the DHH children progressed through a similar sequence of ToM understanding as hearing children, the average age of false belief acquisition was 4.9 years for hearing children, and 12 years for DHH children.

More optimistic developmental outcomes for DHH children have been found in a study that included children who had received cochlear implants at a relatively young age (2.9 years;

Remmel & Peters, 2009) and who had good spoken word recognition scores. Results showed that the DHH children did not differ significantly from a hearing control group in both ToM performance and on language comprehension and expression, both of which were significantly correlated with expressive language skills.

Some children with SLI experience difficulties in language and social interaction and have deficits related to social competence, despite normal intelligence and a lack of hearing or neurological issues (see Bishop, 1997). Children with SLI also experience ToM delays of 12-18 months compared with their typically-developing peers (Farmer, 2000; Farrant, Fletcher, & Mayberry, 2006; Norbury, 2005). For example, Farrar et al. (2009) studied the relationship between language and ToM in a group of 34 children with SLI (average age = 56 months) using a battery of assessments that included receptive vocabulary, sentential complements, grammar, and ToM. As expected, there was a relationship between overall language and ToM, with vocabulary and general grammatical development as the best predictors of ToM ability. However, sentential complements did not uniquely contribute to ToM. When two subgroups of children with mild and moderate language impairment were compared, there was a significant difference in ToM performance, with children who had a mild language impairment performing twice as high on ToM than children with a moderate language impairment.

Similarly, Andres-Roqueta, Adrian, Clemente, and Katos (2013) investigated several aspects of language and their relationship to ToM in children with SLI. They compared both age- and language- matched children (average ages 5.4 and 4.4, respectively) with and without SLI on a series of ToM and language measures (i.e., grammar, vocabulary, semantic-pragmatics). As predicted, children with SLI performed similarly to the language-matched group and performed worse than the age-matched group on measures of language and ToM. Moreover, grammar was the best predictor of ToM performance. To examine the long term effects of this delay, Botting and Conti-Ramsden (2008) looked at 16 adolescents with a history of SLI and found that they performed lower on both ToM and language measures than their typically-developing peers. These findings suggest that those with earlier impaired language can continue to show delays in ToM into adolescence.

In contrast, a study by Miller (2001) provides mixed evidence for ToM delays in children with SLI. Miller compared children with SLI and age- and language-matched typically-developing groups on measures of language and false belief conditions that ranged in low to high linguistic demand. For example, children were asked simpler questions, such as “where will the puppet look for the toy” and more complex questions, such as “what does the puppet think we’re pretending the block is?” The results showed that the language-matched group did not benefit from lower linguistic demands and performed poorly across all tasks. However, children with SLI performed similarly to their age-matched typically-developing peers in the less linguistically demanding condition, but performed worse in the more linguistically demanding condition.

In sum, language plays an important role in ToM development, specifically general language abilities and receptive vocabulary. The importance of language is supported by findings in both typical and atypical groups (e.g. DHH children and children with SLI).

Family Influences on ToM

During social interaction, children have the opportunity to engage in the world with others in ways they could not generate on their own (Gauvain & Perez, 2007), and these experiences can lead to changes in the way children think. For example, the way children converse and play with their siblings is different than with their parents. In light of these interesting differences, researchers have investigated whether certain interactions are predictive of children's ToM development. In this section I discuss two main environmental factors in which the family influences a child's socio-cognitive development: 1) conversational discourse with parents and siblings and 2) socioeconomic status. I also discuss the results of ToM training studies and the potential for scaffolding ToM in at-risk children.

Conversational discourse: Parental input.

There has been considerable research that demonstrates the important role of conversational input and its relationship with ToM (Dunn, Brown, & Beardsall, 1991; Jenkins, Turrell, Kogushi, Lollis, & Ross, 2003; Meins et al., 2002; Ruffman, Slade, & Crowe, 2002; Youngblade & Dunn, 1995). The amount of mental state talk mothers use with their young toddlers has a strong relationship with their child's ToM skills. For example, Ruffman et al. (2002) investigated mothers and children's use of mental state language and ToM three times over one year. Mothers' mental state utterances at time one and two predicted success on ToM tasks at time three. This finding has been replicated numerous times (de Rosnay & Hughes, 2006; Jenkins, et al., 2003; Symons, Fossum, & Collins, 2006), including additional longitudinal studies (Laranjo, Bernier, Meins, & Carlson, 2010).

Meins et al. (2002) refers to this maternal input as mind-mindedness; that is, treating the infant or child as an individual who has his or her own mind and can make intentional causal decisions. In this particular study, mothers and children were observed during free play at 6 months, and mothers' mental state language was coded for either appropriate or not appropriate considering the child's observed mental state. At 48 months, the child's ToM scores were correlated with the mother's use of appropriate mental states at 6 months.

It is plausible that rather than the mother's conversations influencing the child, the child's own topics of interest may dictate what types of conversations occur (e.g., some children may want to talk about the Princesses' feelings while others want to talk about cars). To address this, Meins et al. (2002) included preverbal infants to control for conversational input, and Ruffman et al. (2002) statistically controlled for children's input, language ability, their earlier ToM understanding, age, and mothers' education. Their results suggest that it is not the conversations initiated by the child that drives maternal discourse; it is the input coming from the mother that is important.

Almost all studies investigating mental state use in parent-child dyads have looked at mothers, not fathers. There is some indication that fathers and mothers may differ in their use of mental state talk. Jenkins et al. (2003) observed mother-child dyads and mother-father-child triads. They found that mothers used more mental states words during dyadic observed free play than fathers. They speculate that fathers have been found to focus on rough and tumble play and organized games more than mothers, and traditionally mothers are more involved in caretaking and comfort activities. These results should be interpreted with caution because the authors did not observe father-child dyads, therefore the presence of both parents may have influenced the findings rather than the gender of the parent.

Studies including DHH children supplement research findings with hearing children that conversations about mental states are important for ToM development. A hearing loss can limit the child's ability to overhear family discussions and to share thoughts and feelings, especially if the communication used at home is not consistent with the child's primary means of communication (Peterson & Siegal, 1995). Even children who are hard-of-hearing or have a cochlear implant miss a great deal of conversation due to the effects of noise, distance, and not being able to see a speaker's face. DHH children are at risk for less exposure to language, reduced opportunities for language-rich social play experiences with siblings, and limited access to eavesdrop on other's conversations that might involve a misunderstanding (Moeller & Schick, 2006; Peterson & Siegal, 1995; 1999). While deaf or hard-of-hearing parents who have DHH children can fluently engage in discussion about mental states using sign language, hearing parents who have DHH children are challenged to converse fluently in sign language, limiting the conversational experience (Lederberg & Everhart, 2000).

There is evidence that a mother's ability to communicate in sign language can influence her child's ToM ability. Moeller and Schick (2006) found that hearing mothers of DHH children who use sign language talk less about mental states than mothers of hearing children even though there were no differences in the amount of overall talk between the two groups. In addition, mothers who had better sign language skills had children with more mature ToM skills. More recently, Morgan et al. (2014) studied Swedish and UK mothers of hearing infants and children and compared them to mothers of DHH infants and children who used mostly spoken communication, and some used some sign language. All the DHH children had access to sound with either cochlear implants or hearing aids. They found that mothers of DHH children used less mental state language and had lower conversational quality, examined by turn-taking between speakers, compared to mothers of hearing children. Even mothers who used only spoken communication used significantly fewer mental state words and cognitive references than mothers of hearing children. Apparently, it is not just the mother's ability in sign language that is affecting mental state talk, but something related to having a child with a hearing loss.

Children with SLI offer an additional perspective in that they might receive similar conversational input as their typically-developing peers without hearing loss, even though they experience language delays. In one study, Farrant, Mayberry, and Fletcher (2012) investigated the relationship between maternal input, language, and ToM in both typically-developing children and children with SLI matched on age (average age 62 months). Typically-developing children performed better on ToM and sentential complements than children with SLI, however overall maternal input did not differ between the two groups. When adding sentential complements as a covariate, the significant group difference in ToM performance disappeared; suggesting that memory of complement structure is an important predictor of a child's ToM ability in this group of children.

Conversational discourse: Siblings and peers.

Siblings provide a unique learning relationship for children in that various types of behaviors and emotions are shared such as pretend play, affection, trickery, anger, conflict, and hostility (Dunn, Slomkowski, & Beardsall, 1994). Interactions with older siblings may provide the child with the benefits of a more skilled conversational partner, and the child may benefit from observing older siblings interacting with others, especially caregivers. Experiencing these opportunities with a familiar and close partner seems to foster several areas of cognitive development, especially ToM. Perner, Ruffman, and Leekam (1994) found that the number of siblings in a family was positively correlated to a child's false belief understanding. Many studies followed supporting Perner et al.'s (1994) findings that ToM is indeed contagious (Brown, Donelan-McCall, & Dunn, 1996; Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge, 1996; for counter evidence see: Cutting & Dunn, 1999). Additionally, these studies helped refine our understanding of this relationship in that it is older siblings, not younger ones, who seem to be important for social cognitive development (Ruffman, Perner, Naito, Parkin, & Clements, 1998). It is possible that older siblings provide more mature input related to mental states such as persuasion, coercion, trickery, and misunderstandings.

Part of the benefit of having a sibling may be in the types of interactions siblings have compared with mother and child interactions. For example, Youngblade and Dunn (1995) investigated pretend play behaviors and the interactions between children, mothers, and siblings. Their results suggested that children engage in more pretend play with their siblings than with their mothers, and that child-sibling discourse during play was related to child role enactment and role-play. Furthermore, child-sibling discourse, especially talk about feelings, predicted pretend play behaviors. More recently, Hughes, Lecce, and Wilson (2007) found that there was a higher frequency of mental state talk about emotions and desires between siblings than between friends. Additionally, conversations between child and sibling predicted ToM performance. Similarly, child-sibling dyads who worked at establishing shared meaning during play used more mental state language than those who disrupted the flow of play (Howe, Petrakos, Rinaldi, & LeFebvre, 2005).

Socioeconomic status.

Socioeconomic status (SES) has also been shown to have a strong relationship to a child's ToM, in that children growing up in low SES families perform worse on ToM tasks when compared to children who grow up in working-class or high SES families (Cole & Mitchell, 1998; Cutting & Dunn, 1999; Weimer & Guajardo, 2005). For example, Cole and Mitchell (1998) tested 57 children aged between 4 – 5 years on ToM tasks. In addition, parents completed a stress-questionnaire and a measure of SES related to their highest level of education. Results revealed that parents who reported high levels of stress tended to have children who performed worse on ToM. Further, SES showed to be a significant predictor of ToM. Families of professional status and are more educated have children who perform better on ToM tasks.

However, when accounting for the influence of SES, parent stress is no longer a significant predictor.

Children enrolled in Head Start programs provide further evidence for the role of SES in ToM development. Head Start is a federally funded program aimed at providing children born into low SES households' resources to succeed academically. An investigation of ToM in children from Head Start programs and two other non-Head Start preschools found that Head Start children performed significantly worse on false belief tasks than non-Head Start children (Weimer & Guajardo, 2005). In contrast, results from Lucariello, Durand, & Yarnell (2007) indicate no difference in children from low- and middle-SES families. It is likely that these conflicting results reflect differences in parent-child interactions and maternal input (Bradley & Corwyn, 2002; Hart and Risley, 1995; Hoff, 2003).

Clinical Implications & Intervention

In this review I examined several child and environmental factors that play important roles in ToM development. First, a child's language skills are directly related to ToM development, especially syntax and vocabulary, in both children who are developing typically as well as those who are developing atypically. Second, there are several environmental factors that help shape a child's developing ToM. The quality of maternal conversational discourse and the extent to which mothers talk about feeling and beliefs plays a central role in ToM development. Further, the presence of older siblings contributes to a child's ToM, suggesting the social interactions and conversations provided by older siblings helps scaffold development. Lastly, typically-developing children from low SES families may be at risk for delayed ToM, possibily because of the link between quality of maternal input and SES.

Several training and intervention studies provide evidence that aspects of ToM can be scaffolded, suggesting that interventions can be developed for at risk children (Hale & Tager-Flusberg, 2003; Lohmann & Tomasello, 2003; Wellman & Peterson, 2013). Research shows that mothers can be trained to talk more elaborately about past events with their children (Taumoepeau & Reese, 2013). The results showed that children benefited from mothers elaborative talk and performed better on ToM tasks at the end of training when compared to a control group. Other training studies have directly taught children aspects of ToM and language used to represent ToM, and have found positive results. In one study (Hale & Tager-Flusberg, 2003), children randomly assigned to one of three groups: 1) false belief, 2) sentential complements, and 3) relative clauses. The findings show that children in both the false belief and sentential complement training groups improved their ToM (see also, Allen & Kinsey, 2013; Benson, Sabbagh, Carlson, & Zelazo, 2012; Lohmann & Tomasello, 2003). A training study conducted with DHH children has shown that direct training in ToM results in significantly better ToM scores than control groups (Wellman & Peterson, 2013).

Clinicians who work with at-risk preschool-age children can assess a child's ToM abilities relatively easily. Preschool books include a great number of references to beliefs and emotions (Dyer, Shatz, & Wellman, 2000). Taken together, these training studies show that clinicians may be able to scaffold ToM by implementing tasks that involve mental state talk and vocabulary related to ToM. Furthermore, engaging in joint storybook reading using stories that require knowledge of false belief (e.g., *Little Red Riding Hood* or *Stone Soup*) help expose children to dual mental representations. Additionally, sharing these books and techniques with parents allows these conversations to occur more frequently.

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2 THE DEVELOPMENT OF THEORY OF MIND IN DEAF, HARD OF HEARING, AND HEARING PRESCHOOL CHILDREN

Theory of Mind (ToM) is a compilation of mental state concepts that helps us interpret human social activity and develops gradually beginning in infancy (Astington, 2003). Fundamental to understanding people is understanding that their beliefs and desires govern their actions. ToM has been shown to predict social popularity with peers, teacher-rated social competence, and skilled interaction with peers. Typically-developing hearing children undergo rapid change in ToM during preschool-age (Astington, 2003; Dunn & Cutting, 1999; Flavell, 2004), whereas deaf and hard-of-hearing (DHH) children have shown delays well into school-age, and some stretching into adolescence (Courtin, 2000; Jackson, 2001; Moeller & Schick, 2006; Peterson & Siegel, 1995; Peterson, Wellman, & Liu, 2005; Russell et al., 1998; Schick, de Villiers, de Villiers, & Hoffmeister, 2007; Woolfe, Want, & Siegel, 2002).

Traditionally, much of the research on ToM has been related to understanding false beliefs (Astington, 2003). False belief is the understanding that people have different beliefs about the same object or situation and that those beliefs may not be consistent with reality. This requires the child to understand that someone else's belief depends on the history of his or her perceptual access to the object or situation. Children learn that given knowledge of that history, it is possible to predict what belief the person has. Typically, children younger than age 4-5 do not have the ability to understand false belief; they misrepresent the mental states of others, but not their own.

Several meta-analyses examining hundreds of classic false belief studies from around the world have been conducted to see when children develop an understanding of false belief (Liu, Wellman, Tardif, & Sabbagh, 2008; Milligan, Astington, & Dack, 2007; Wellman, Cross, &

Watson, 2001). For example, Wellman et al. (2001) included several types of false belief tasks and were interested in how performance changed with age. They found that 30-month-olds were less than 20% correct, 44-month-olds were 50% correct, and 56-month-olds were 75% correct in passing the classic false belief task. Performance began to shift from being statistically below chance to above chance around age 4. This robust finding is consistent across cultures, false belief tasks, and conditions, suggesting that understanding false belief consistently develops around 4-5 years of age for typically-developing children.

For some time, several researchers have argued that false belief is just one step in a progression of the child's understanding of the mind (see Gopnik & Wellman, 1992; 1994). Some have argued that the fixation on false belief has prevented an examination of a more expansive view of socio-cognitive development (Carpendale & Lewis, 2004). This broader framework proposes that early beginnings of ToM development emerge from our everyday common sense psychology about the mind. Our everyday interactions with others require us to make predictions based on beliefs, desires, and emotions (Bartsch & Wellman, 1995; Nelson, 1996). Psychologists often characterize our everyday system of reasoning about the mind, world, and behavior as a belief-desire psychology (D'Andrade, 1987; Fodor, 1992; Wellman, 2011). For example, we might wonder why Mary went to open the drawer. She *wanted* cookies and *thought* there would be cookies inside the drawer. Belief-desire reasoning is seen in children as early as age 2, well before success on false belief between ages 4 – 5 (Bartsch & Wellman, 1995; Repacholi & Gopnik, 1997). Gopnik and Wellman (1992, 1994) suggest that desires and beliefs help children form a cohesive theory about how they understand people, and experiences with discussing desires and beliefs are usually embedded within social interactions with others. By adopting a broader definition of ToM as a series of related understandings about how the mind operates on intentions, perceptions, emotions, beliefs, and desires, we can comprehensibly capture the development of social cognition prior to false belief.

Research focused on the nature of conversations provides evidence for continuous progress in ToM throughout the preschool years. Mental-state verbs are unique in that they focus on abstract internal states and psychological processes; concepts that cannot be directly observed. Children begin using these terms around age 2 during their spontaneous conversations with others (Bartsch & Wellman, 1995), however, many are conversational phrases (e.g., “You know what?”). Before age 3, genuine references to mental states appear, along with statements that contrast their own mental states with those of others. With development, children begin using mental-state verbs to refer to others’ internal states, suggesting semantics, (i.e., lexical knowledge of mental state words) is important for success on ToM tasks, which rely heavily on this knowledge. For example, Bartsch and Wellman (1995) found that children demonstrated their ability to talk about desires around the third year, whereas conversations about beliefs were more frequent around the fifth year. This conversational shift is also seen in languages other than English, such as children in China acquiring either Mandarin or Cantonese (Tardif & Wellman, 2000).

There is further evidence for a sequence of ToM understanding that develops throughout preschool (Wellman & Liu, 2004). First, the results from a meta-analysis on over 45 studies investigating mental state development in preschool-age children suggest that children understand that two people can have different desires about the same object well before understanding that two people can have different beliefs about the same object. Following this development, children gain an understanding that only people given access to privileged information (e.g., seeing the contents of a box) will know the information. Based on these results, Wellman and Liu (2004) created a ToM scale composed of a series of tasks that represent a continuum of skills related to ToM. The first task, *diverse desires,* requires the child to recognize that someone else has a different desire about the same object than the child. The second task, *diverse beliefs,* involves the child judging her own belief versus someone else's belief about the same object. In the third task, *knowledge access,* the child sees what is inside an unmarked box while predicting the knowledge of someone else who has not seen the contents. In the fourth task, *contents false belief,* the child is involved in knowing what is inside a distinctive container and someone else having a false belief about the contents. In the fifth task, *explicit false belief,* the child judges how someone will search for an item, provided their mistaken belief. In the sixth task, *belief emotion,* the child will judge how someone might feel, when a prediction is incorrect. Lastly, in the seventh task, *real-apparent emotion*, the child judges a situation where a person can feel one emotion but display another emotion. Wellman and Liu (2004) used this ToM scale to assess 75 typically-developing hearing preschoolers ranging in age from 3 – 5 years. The results suggested that these tasks form a highly reliable scale that increases in developmental difficulty with *diverse desires* being the easiest, and *emotion understanding* the most difficult.

Two additional studies provide evidence that the scale measures ToM development, but may not represent a universal sequence. Wellman, Fang, and Peterson (2011) found that consecutive re-testings of 92 preschoolers from the United States and China progressed through these tasks in a consistent order with cultures, with the Chinese children understanding knowledge access before diverse beliefs, while the opposite was true for the American children. In a second study by Shahaeian, Peterson, Slaughter, and Wellman (2011), 135 3- to 6-year olds from Australia and Iran were compared on outcomes of the ToM scale. The results indicate cultural differences for Iranian children, such that these children first successfully understood knowledge access before diverse beliefs, similarly to Chinese children. There were no significant differences between Iranian and Australian children in their overall rates of ToM development. In summary, these studies suggest the tasks that make up the ToM scale are a reliable and scalable set of tasks based on Guttman scalograms and Rasch models. While there are cultural differences in the standard order of progression through the scale, typically-developing children progress through these tasks at similar rates.

Deafness and Theory of Mind

DHH children who have hearing parents are typically delayed in the development of ToM (Courtin, 2000; Jackson, 2001; Lundy, 2002; Marschark, Green, Hindmarsh, & Walker, 2000; Moeller & Schick, 2006; Russell et al., 1998; Woolfe, Want, & Siegel, 2002). The majority of DHH children also experience language delays: a skill that is highly related to ToM (Milligan et al., 2007). Some researchers have found that DHH children achieve an understanding of false belief between ages 7-8 (Schick et al., 2007), while others have found delays stretching into adolescence (Peterson & Siegel, 1995, 1999; Peterson, Wellman, & Liu, 2005). One exception to this is DHH children who have DHH parents, which make up 5% of the DHH child population. DHH children who have DHH parents have early exposure to a fluent language model, similar to hearing children. These children grow up in an environment using American Sign Language fluently with their DHH parents and peers. DHH children who have hearing parents typically can not access spoken language with their parents or peers, and may experience months, possibly years of language deprivation (Lederberg, Schick, & Spencer, 2013). Language skills have long been recognized as a predictor of ToM skills, especially false belief understanding (Milligan et al., 2007), therefore, it is not surprising that DHH children who have hearing parents are delayed in the acquisition of false belief.

While delays in false belief are well established, less is known about the sequence of ToM development in DHH children. Peterson et al. (2005) compared both DHH children who have hearing or DHH parents with hearing children using the ToM scale. DHH children ranged in age from 5.5 to 13 years and were in simultaneous communication classrooms (sign and spoken language). They were compared to hearing children who ranged in age from 3.5 to 5.5 years. All children were tested individually using the ToM scale (i.e., diverse desires, diverse beliefs, knowledge access, and false belief). A measure of language ability was collected using an experimenter-created measure, which suggested that the DHH children were language delayed and not fluent signers. According to a Guttman scale, children's responses were highly scalable and consistent with findings from hearing children found by Wellman and Liu (2004). All but two of the DHH children who have DHH parents passed all four tasks. The DHH children who have hearing parents acquired diverse desires and diverse beliefs at similar rates to DHH children who have DHH parents and hearing children, but showed significant delays in knowledge access and false belief.

Peterson and Wellman (2009) conducted a similar investigation, while adding a new task to the sequence. The new task was an understanding of pretense, which focuses on understanding pretend play within a socially shared situation. Pretense was initially introduced into the continuum of ToM understanding due to its' reflection of understanding others' mental states. Pretend thoughts between two people can be contrasting, just as desires about the same object can be contrasting. Thirty-three school-age DHH children and 60 preschool-age hearing children were compared on the progression of six steps in a ToM sequence (diverse desires, diverse beliefs, social pretend, knowledge access, false-belief, and hidden emotion). The DHH children ranged from 5 to 15 years of age, whereas the hearing children ranged in age from 3 to 6 years. For the tasks used previously, the results confirmed Peterson et al. (2005) findings that DHH children progress through the same sequence of ToM understanding as hearing children, however, at much later ages. The average age of the hearing children who successfully passed all tasks including false belief was 4.9, whereas the few DHH children who passed all tasks were 12 years old. Additionally, diverse desires and diverse beliefs seemed equally easy for DHH and hearing children. There is one important difference between the groups on the new social pretend task. DHH children understood social pretend before knowledge access, whereas the opposite was true for hearing children: they understood knowledge access before social pretend. While this new task is scalable in the sequence, it differed between the two groups of children. However this conclusion must be considered tentative, since this is the only study that has used the social pretend task with hearing or DHH children.

In another study, Wellman, Fang, and Peterson (2011) included 31 DHH children ranging in age from 4 to 12 years old (average age 8.3). They compared DHH school-age children to a group of hearing preschool-age children (with an average age of 3.5). The results showed both DHH and hearing children followed the same sequence of ToM understanding (diverse desires, diverse beliefs, knowledge access, false belief, and hidden emotion). Echoing previous research, DHH children successfully passed diverse desires and diverse beliefs with ease, whereas knowledge access and false belief were obtained by only 30% of the DHH children. Peterson, Wellman, and Slaughter (2012) also replicated this developmental pattern. Wellman et al. (2011) retested the DHH children two years later (i.e. average 10 years old) and the hearing children one year later (i.e. average 4 or 5 years old). The results revealed that on average, DHH children advanced less than one task between the ages of 8 to 10, whereas hearing children made much more progress (about one and a half tasks) between the ages of 4 to 5.

All these studies that examine development using the ToM scale with DHH children focused on only language-delayed school-age DHH children. In contrast, Remmel and Peters (2009) examined ToM development in two groups of DHH children with age-appropriate language, all with cochlear implants. One group was preschool-age (*M* age = 5.7), while the other was school-age (*M* age = 9.4). Fifteen preschool DHH children were compared with 30 typically-developing hearing children (*M* age = 5.2) on the ToM scale. The results were quite surprising in that overall, Remmel and Peters report that there were no significant differences in the overall performance on the scale between DHH preschoolers and the hearing children. However, a closer examination of the findings in the published results table for each individual task suggests that DHH children may still be delayed compared to the hearing children on specific tasks. Diverse desires and diverse beliefs were equally easy for preschool-age DHH and hearing children. However, only 40% of the preschool DHH children passed knowledge access compared to 83% of the hearing children, and 20% passed false belief compared to to 37%. Chi-square tests suggest that hearing children were significantly more likely to pass both knowledge access and false belief than DHH children.

The school-age DHH children performed very well. Thirteen of the 15 school-age DHH children passed all the tasks in the scale, with only two children failing false belief. Apart from group differences, Remmel and Peters also assessed whether the children followed a similar pattern of ToM development. Combining both preschool- and school-age children, the results from a Guttman scale indicate that 76% of the DHH children and 63% of the hearing children fit the standard sequence of the ToM scale.

The relatively high performance of DHH children in Remmel and Peters (2009) is in stark contrast to previous research and may not be generalized to typical DHH children. The sample only included DHH children who were early-identified with a hearing loss, received a cochlear implant, on average, at 1.2 years, and had middle-upper class parents. These children are not representative of DHH children in the US. For example, Niparko et al. (2010) conducted a national, longitudinal study investigating spoken language development in children following cochlear implantation. Their sample, which was representative of DHH children in US, found a much larger range of age of implantation and socioeconomic status. Their descriptive findings reveal that early implantation and higher socioeconomic status was associated with a steeper growth of comprehension and expression and higher rates of parent-child interactions. Both of these factors would be expected to result in better ToM development. For example, Schick et al. (2007) provides evidence that children who have early access to language perform better on ToM tasks. Remmel and Peters findings may show what is possible for young DHH children, but not necessarily typical. However, further research is needed to test this hypothesis.

In summary, although DHH children are delayed in ToM, both DHH and hearing children develop ToM sequentially. There is some suggestion the order of the sequence may be different. One study suggests DHH children develop social pretend before knowledge access, whereas hearing children show the reverse (Peterson & Wellman, 2009). Almost all research including school-age DHH children show severe delays in ToM, with only two studies (Remmel & Peters, 2009; Schick et al., 2007) that have investigated ToM in preschool-age children, and only Remmel and Peters (2009) has used the ToM scale.

Present Study

The first goal of the present study is to examine ToM in a relatively large diverse group of DHH preschool-age children; a time period when hearing children develop ToM. The age-appropriate ToM development in DHH children found by Remmel and Peters (2009) contradicts much of the other studies in the field. DHH children are very diverse in their language abilities, modalities, and family backgrounds. The small sample sizes typical of past studies do not reflect this diversity. These differences, in addition to examining the measurement characteristics of the items, motivate the present study in that it assessed ToM in a diverse sample of 72 DHH children: larger than in previous studies (e.g. n = 31 in Peterson & Wellman, 2009).

Second, ToM research has overwhelmingly focused on false belief tasks. The present study used the ToM scale, and only a few studies (Peterson et al., 2005; Peterson & Wellman, 2009; Peterson, et al., 2012; Remmel & Peters, 2009) have used this approach with DHH children. The present study also included the social pretend task. Only one study (Peterson & Wellman, 2009) used the social pretend task and found DHH children's understanding of pretense appeared earlier than knowledge access within the ToM scale. Thus, social pretend may be a strength of DHH children and is worth further investigation.

Third, while the scale is well documented as developmentally ordered in cognitive complexity, less is known about its measurement properties and whether the tasks assess a single construct. Almost all the studies used in investigating the ToM scale has been focused on the ordering of the scale using Guttman scalograms (see: Peterson & Wellman, 2009; Wellman & Liu, 2004). While a Guttman scale is useful and informative in describing the pattern or sequence of development, it ignores individuals who do not fit the sequence of development. Wellman and Liu (2004) also used a Rasch model to statistically test the difficulty and ordering of tasks in the scale. Neither of these statistical techniques provides a rigorous test of the theoretical assumption that these tasks all measure one construct, namely ToM. I tested this assumption by using confirmatory factor analysis. In addition, confirmatory factor analysis can be used to assess group differences between DHH and hearing children.

The proposed research is guided by five research questions:

1. Are DHH preschool children delayed in their ToM development compared to hearing preschool children? I hypothesize that DHH children are delayed in ToM development, overall, specifically on knowledge access and false belief, when compared to hearing children.
2. To what extent do the five tasks that make up the ToM scale exhibit the theoretically predicted order of difficulty for both DHH and hearing preschool children? I hypothesize that both DHH and hearing children follow the same overall sequence of ToM development consistent with past research with one exception: DHH children will find social pretend easier than knowledge access, while hearing children will find knowledge access easier than social pretend.
3. To what extent do the tasks that make up the ToM scale indicate a single construct? I hypothesize that the five tasks that make up the ToM scale do indicate a single construct, ToM.
4. To what extent do the ToM tasks exhibit equivalent measurement properties for both DHH and hearing children? I hypothesize that the ToM scale operates similarly in both groups of children, allowing the interpretation of true group differences with no substantial test bias.

5. How does language relate to ToM development for DHH and hearing children? I hypothesize that receptive vocabulary has a positive, significant relationship with children's ToM scores.

Methodology

Participants

This study is part of two larger on-going longitudinal studies. Data collected on the DHH children began in 2011 and ended in 2013. The initial sample of participating DHH children was 122, but this included children who had been tested more than once on the same measures throughout the years. The first data collection time-point for these children was used in this study, decreasing the DHH sample to 101. Data collected on the hearing children started and ended in 2013 and were tested only once. While hearing children ranged in age from 33 to 62 months (*M* age = 50 months), DHH children ranged from 38 to 93 months (*M* age = 58 months). Age-matched groups were created to ensure that age would not confound our results. DHH children older than 62 months ($n = 29$) were removed from the analysis.

The final sample included 181 children (*M* age = 50 months) who participated in the study (109 were hearing, 72 were DHH). All children were in prekindergarten and kindergarten classrooms. DHH children were selected to participate based on the following eligibility criteria: 1) unaided hearing loss with a Better Ear-Pure Tone Average (BE-PTA) of 50db or greater in the better ear or at least one cochlear implant, 2) chronological age between 3 and 6 years, and 3) no diagnosed or teacher-suspected additional severe disabilities.

Hearing children were recruited from Head Start education programs, which are free of cost to low-income families. These children were selected to participate based on the following eligibility criteria: 1) English as their primary language, 2) chronological age between 2 and 5 years old, and 3) no diagnosed or teacher-suspected additional severe disabilities. The group of hearing children included 51 girls and 49 boys.

The sample of DHH children included 31 girls and 41 boys. DHH children used a range of communication including spoken English (67%), total communication (combination of sign and spoken language; 28%), and American Sign Language (ASL; 5%), and had either hearing aids (70%) or used cochlear implants (30%). The average age at which a child was identified with a hearing loss was 15 months (range: birth – 60 months), and the average age of amplification was 20 months (range: 2 – 56 months). Further, DHH children came from a range of socioeconomic backgrounds as measured by level of education completed by the parent. Thirty-two percent of parents completed either high school or some college and 28% finished college, while several did not provide their level of education. Additionally, DHH children showed significant language delays when compared to hearing children on the Peabody Picture Vocabulary Test (PPVT), a measure of receptive vocabulary: $t(158) = 5.438$, $p = .001$ (M standard scores = 80 and 95, respectively).

This study is part of two ongoing studies (protocols #H06218 and #H14057). I have obtained permission from Georgia State University's Institutional Review Board (IRB) to conduct the present study (protocol #H14245). All children were granted parental consent to participate in the study, and all children showed assent by their willingness to participate in testing.

Tasks and Procedure

The first author, who is a native signer and a child of a deaf adult (CODA), tested all the DHH children on ToM. Based on child preference and classroom communication type, the language most familiar with the child was used during testing. Both the first author and a

Graduate Research Assistant (GRA) tested the hearing children on ToM. The GRA was trained by the first author on administration of the tasks and was considered proficient. All children were tested individually in a quiet room within the child's school and participated in one testing session.

Theory of Mind.

Four tasks were used from the Wellman and Liu (2004) scale with the addition of one task from Peterson and Wellman (2009) (See Appendix A). The first task, *diverse desires (DD),* requires the child to judge whether he or she versus someone else has a different desire about the same object. The second task, *diverse beliefs (DB),* involves the child judging his or her own belief versus someone else's belief about the same object, where the child does not know the correct belief. The third task, *social pretend (SP)*, assesses understanding of the subjectively different mental states of different people within a social pretense episode. The fourth task, *knowledge access (KA),* the child sees what is inside an unmarked box while judging the knowledge of someone else who has not seen the contents. The fifth and last task, *contents false belief (FB),* involves the child knowing what is inside a distinctive container and someone else having a false belief about the contents.

Previous research indicates minimal ordering effects in which the tasks are presented to children (Peterson & Wellman, 2009; Wellman & Liu, 2004). Therefore, it is standard practice to use the hypothesized order of difficulty for the sample of interest, (*DD, DB, SP, KA, FB*), beginning with the easiest task (*DD*) and moving toward the more difficult task (*FB*). All five tasks include a test question, and three include a test and control question. As in previous research, for a child to pass a task, all control and test questions have to be correct (See

Appendix B for the score sheet). A passing score receives a 1, whereas a failing score receives a 0. Total scores for the ToM scale range from 0 to 5.

Language.

Children's receptive vocabulary was measured using the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997). During administration, an examiner presented an easel to the child with four pictures on each page. The examiner then speaks and/or signs a word and asks the child to point to the picture that best matches the word. The PPVT has been shown to have a test-retest reliability of .91 - .94 from samples of various ages. The measure was also found to have an internal consistency of .95 (Dunn & Dunn, 1997). Raw scores were used in the analyses.

Results

Group Differences in Theory of Mind

The first set of analyses addressed the first research question: are DHH children delayed in overall ToM scores compared to hearing children? Table 1 shows the number and percentages of DHH and hearing children passing ToM tasks and task correlations. DHH and hearing children were not significantly different on their overall ToM total scores: $t(179) = 1.099$, $p = .273$ ($M = 2.25$ and 2.42, respectively). Although there are no group differences in overall ToM performance, an examination of performance on individual tasks shows both similarities and differences between DHH and hearing children. Diverse desires and diverse beliefs seem to be equally easy for both DHH and hearing children, with about 90% across groups passing diverse desires, and 82% passing diverse beliefs. Furthermore, 6% of DHH and 6% of hearing children passed false belief, suggesting both groups experienced difficulty in achieving this milestone. The two groups also performed similarly on social pretend: 33% of DHH children and 32% of hearing children passed the social pretend task. In contrast, knowledge access was an easier task for hearing children (32% passing) than for DHH children (17% passing), $X^2 = 5.379$, $p = .020$.

Table 1

Descriptive Statistics for Both Groups on the Five ToM Tasks

	Diverse Desires	Diverse Beliefs	Social Pretend	Knowledge Access	False Belief
1. Diverse Desires	1	0.507*	0.089	-0.056	0.092
2. Diverse Beliefs	0.347*	1	0.158	0.000	-0.054
3. Social Pretend	0.064	0.199*	1	0.079	0.086
4. Knowledge Access	0.135	0.248*	-0.010	1	0.217
5. False Belief	0.079	0.132	0.221*	0.140	1
Number passing					
DHH Children ($n = 72$)	63 (88%)	60 (83%)	24 (33%)	12 (17%)	4 (6%)
Hearing Children ($n = 109$)	100 (92%)	87 (80%)	35 (32%)	35 (32%)	7 (6%)
Total ($N = 181$)	163 (90%)	147 (81%)	59 (33%)	47 (26%)	11 (6%)

Note. The top portion of the table contains correlations, with DHH children above the diagonal and hearing children below. The lower portion of the table contains number and percent passing each task for the two groups as well as the total sample.
* $p < .05$

The correlations in the top portion of Table 1 show correlations among the items for DHH children above the diagonal and correlations among the items for hearing children below the diagonal. These correlations are low and not homogeneous. The low correlations suggest little agreement between success on one item compared to success on the other items. In the DHH group above the diagonal, only one of the ten correlations was statistically significant. In the hearing group, only four of the ten item correlations were significant.

Developmental order.

The next analysis addressed the second research question: do the tasks differ in developmental order for DHH and hearing children on the ToM scale? Comparing across tasks, this passing rate suggests that social pretend was easier than knowledge access for DHH children, whereas social pretend and knowledge access were equally difficult for hearing children. I explored this developmental ordering by arranging the response frequencies for the five tasks to follow a Guttman scale (see Table 2). In table 2, pattern 4 suggests an understanding of social pretend before knowledge access, whereas pattern 7 suggests an understanding of knowledge access before social pretend. Seventy-eight percent of DHH children fit the sequence of ToM understanding put forth by Peterson and Wellman (2009) that includes pattern 4. That is, the vast majority of DHH children followed this hypothesized pattern of ToM understanding: diverse desires, diverse beliefs, social pretend, knowledge access, false belief. For hearing children, pattern 4 and 7 were equally likely: 71% of hearing children fit the sequence of: diverse

Table 2

Guttman Scale

	Task					DHH Children		Hearing Children	
Response Pattern	DD	DB	SP	KA	FB	*n* (%)	Age (in months)	*n* (%)	Age (in months)
1	-	-	-	-	-	3 (4%)	56	6 (6%)	47
2	+	-	-	-	-	3 (4%)	55	12 (11%)	47
3	+	+	-	-	-	31 (43%)	49	31 (29%)	50
4	+	+	+	-	-	15 (21%)	50	18 (17%)	45
5	+	+	+	+	-	3 (4%)	53	8 (7%)	52
6	+	+	+	+	+	1 (1%)	46	2 (2%)	55
Children who fit the above sequence (Total)						56 (78%)		77 (71%)	
7	+	+	-	+	-	4 (6%)	53	20 (18%)	57
Other Patterns						12 (17%)		12 (11%)	
Total						72 (100%)	50	109 (100%)	50

Note. A minus sign means a child failed the task and a plus sign means the child passed. The patterns represent the possible 6 patterns for the 5 dichotomous tasks (with the plausible substitution of pattern 7 in lieu of pattern 4 for hearing children). Pattern 4 represents the hypothesized pattern of ToM for DHH children (SP before KA), while pattern 7 represents the hypothesized pattern for hearing children (KA before SP).

desires, diverse beliefs, social pretend, knowledge access, false belief, and 72% of hearing children fit the sequence with knowledge access and social pretend reversed: diverse desires, diverse beliefs, knowledge access, social pretend, false belief.

Measurement Properties of the Theory of Mind Scale

The next series of analyses used confirmatory factor analysis (CFA) to address research questions three and four. CFA is a model-based measurement technique in which success on a test assessing a latent construct is determined by both individual responses and task properties (Embretson & Reise, 2000). CFA with categorical outcomes is mathematically equivalent to methods used in item response theory (Muthen, 1984; Takane & de Leeuw, 1987).

The logic for fitting models for measurement invariance includes four steps: 1) testing the configural model in each group, 2) testing the joint configural free model, 3) restricting loadings, and 4) restricting thresholds. To address the third research question: do the five items indicate a single construct, two single factor CFA models were estimated, separately for hearing and DHH children. The models were fitted separately for both groups using mean corrected weighted least squares for categorical data (WLSMV) and the Delta parameterization as implemented in the Mplus program. Further, Hu and Bentler (1999) suggest three fit indices to estimate model fit. Apart from the chi-square statistic, other indices of fit considered were the root mean squared error of approximation (RMSEA), and the comparative fit index (CFI). Hu and Bentler (1999) recommend that RMSEA be close to .06 and CFI close to .95, indicating good fit, however, others suggest these values are too conservative (Marsh, Hau, & Wen, 2004). The results for the single-group CFA models are shown on the top section of Table 3. As indicated by the chi-square statistic, the model seems to fit well for both DHH children, X^2 (5, N = 72) = 5.76, p = .330 and hearing children X^2 (5, N = 109) = 7.57, p = .181. Other fit indices indicated good fit for both DHH children (RMSEA = .05, CFI = .97) and hearing children (RMSEA = .07, CFI = .92). The acceptable fit at this stage of modeling suggests that these five tasks that make up the ToM scale reasonably measure one latent factor (i.e. ToM) for both groups, separately. Despite good fit of the single group model in each group, the measurement properties of the specific tasks might not necessarily be equal across groups. Therefore, I conducted a series of multiple-group models. Multiple-group analysis also used WLSMV estimation and the Delta parameterization as implemented in the Mplus program.

Table 3

Summary of Data Model Fit Statistics

	X^2	*df*	CFI	RMSEA	ΔCFI	ΔRMSEA
Models Separately in each Group						
DHH Children	5.76	5	0.97	0.05		
Hearing Children	7.57	5	0.92	0.07		
Multiple-group Models						
Free Model	13.33	10	0.944	0.06		
Restricted loadings	17.48	14	0.941	0.05	-.003	-.01
Restricted thresholds	24.50	18	0.891	0.063	-.05*	.01

Note. Results should be interpreted with caution because the models produced negative residual variances for task two (Heywood cases), meaning a correlation greater or equal to one was observed between that item and the latent factor. Alternative models were fit, including different estimators and trimming item two, and substantive tests were the same.
* denotes noninvariance using Chen (2007) for nested model testing: loading invariance is CFI Δ < -.005 and RMSEA Δ is >.010. Threshold invariance is CFI Δ is >-.005 and RMSEA Δ is >.010.

I first tested a multiple-group, free model. This is a joint-test of the findings from the single-group CFA model and addresses if these tasks indicate a single construct within groups. As displayed in Table 3, the multiple group free model showed adequate fit according to the chi square statistic, X^2 (10, N = 181) = 13.33, $p = .206$, and other fit index measures (RMSEA = .06, CFI = .94). This suggests that, in accord with the single group models, the five tasks that make up the ToM scale indicate a single construct, within both groups. Table 4 is a summary of the loadings, thresholds, and R^2 values for the multiple-group free model. The loadings indicate how each task loads onto the construct ToM, thresholds show the developmental ordering of the tasks, with negative values indicating easier items, and R^2 is the amount of variance explained in ToM by each task.

Table 4

Loadings, Thresholds, and R^2 for the Multiple Group Free Model

	DHH Children			Hearing Children		
Task	Loadings	Thresholds	R^2	Loadings	Thresholds	R^2
Diverse Desires	.66	-1.15	.43	.58	-1.39	.33
Diverse Beliefs	1.19	-.96	undefined	1.07	-.84	undefined
Social Pretend	.27	.43	.07	.36	.46	.13
Knowledge Access	-.02	.96	.00	.47	.46	.22
False Belief	-.04	1.59	.00	.36	1.52	.14
Latent Mean		.00			.00	
Latent Variance		1.00			1.00	

The final two multiple group CFA models addressed the fourth research question: are the measurement properties of the scale equivalent within groups. First, I tested for a multiple group model that restricted loadings. By restricting the loadings, or setting the loadings equal, I can estimate whether the tasks measure the single construct (i.e. ToM) equally across groups (Chen, 2007; Muthen & Christoffersson, 1981). As indicated by the fit indices in Table 3, this model also had adequate fit, X^2 (14, N = 181) = 17.45, p = .231 (RMSEA = .05, CFI = .94). This model suggests that the scale operates equally across the groups on the same metric. According to the model difference testing suggested by Chen (2007), the restricted loadings model and the free model meet the criteria of having measurement equivalence, with the change in CFI and RMSEA meeting the criteria (see Table 3). This allows me to move forward in testing the final, most restrictive model of restricted thresholds.

The last multiple-group model involved testing for threshold invariance, which helps describe the location of each task on the ToM scale based on task difficulty, within groups. As seen in Table 3 and Figure 1, the model has adequate fit and the thresholds (see Table 5) suggest a developmental ordering of the tasks, X^2 (18, N = 181) = 24.50, p = .140, (RMSEA = .06, CFI = .89). Further, the restricted threshold model and the restricted loading model are significantly different from each other, as indicated by the change in RMSEA, however the change in CFI does not meet the criterion. For a model to fail Chen's (2007) criteria, both goodness of fit statistics must not meet the criteria. In this case, RMSEA meets the criteria, so the model still holds.

Table 5

Loadings, Thresholds, and R^2 for the Multiple Group Restricted Thresholds Model

	DHH Children			Hearing Children		
Task	Loadings	Thresholds	R^2	Loadings	Thresholds	R^2
Diverse Desires	.65	-1.30	.39	.65	-1.30	.41
Diverse Beliefs	1.12	-.91	undefined	1.12	-.91	undefined
Social Pretend	.35	.44	.11	.35	.44	.12
Knowledge Access	.36	.62	.12	.36	.62	.13
False Belief	.26	1.54	.06	.26	1.54	.06
Latent Mean		-.08			.00	
Latent Variance		.93			1.00	

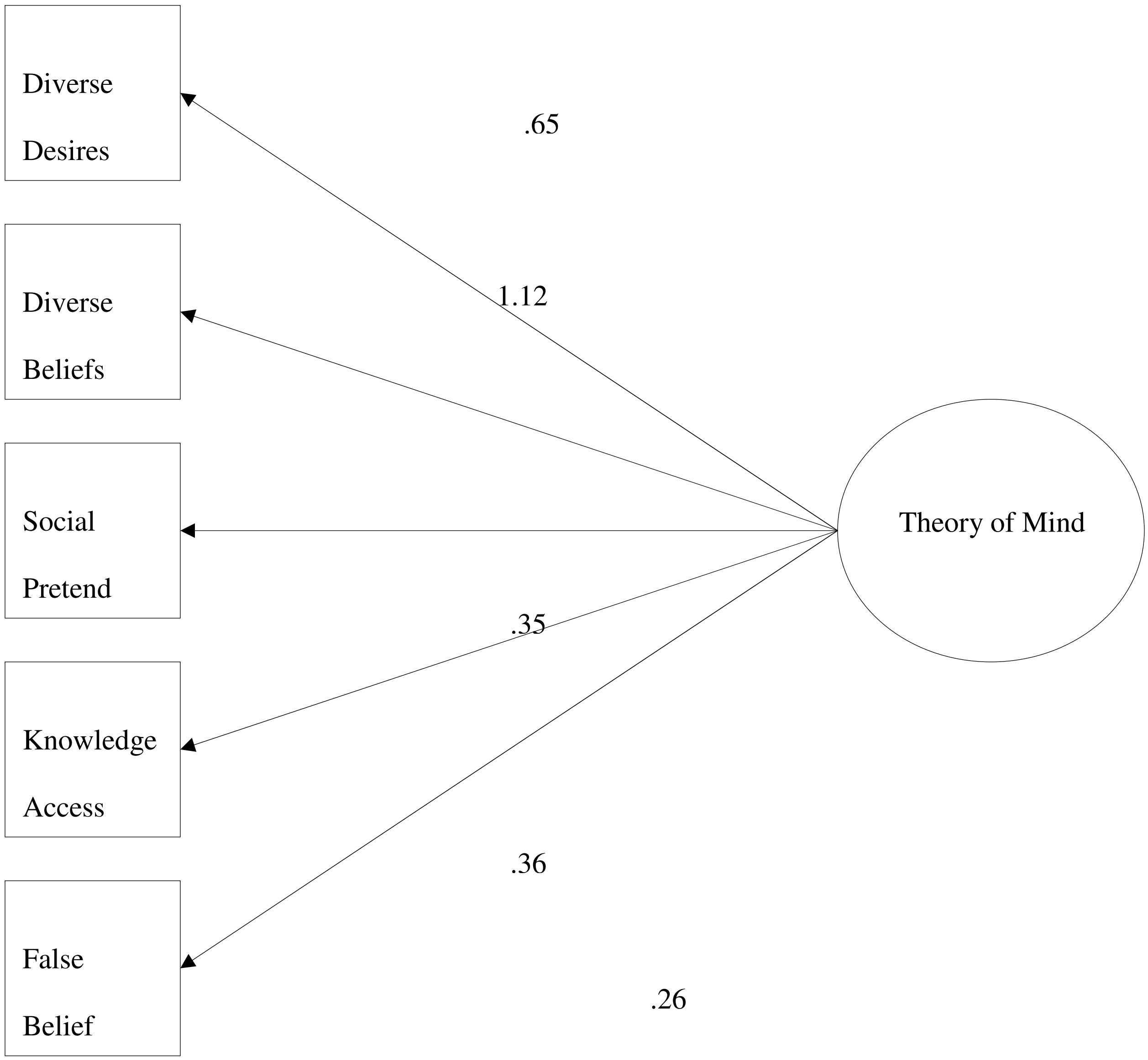

Figure 1. **Confirmatory Factor Analysis with Unstandardized Loadings of the Multiple Group Restricted Thresholds model: X^2 (18, N = 181) = 24.50, *p* = .140, (RMSEA = .06, CFI = .89).**

Table 5 is a summary of the loadings, thresholds, and R^2 for the multiple-group restricted thresholds model (i.e. the final model). The first column displays the unstandardized loadings, which are parameter estimates expressed on the probit metric. In the third column, the R^2 values are the standardized estimates and can be interpreted similarly to the loadings. That is, R^2 is interpreted as the amount of variance explained in ToM by the individual tasks. Lastly, the second column estimates threshold values, which is the expected value of the latent factor (i.e., ToM) at which a child transitions from a value of 0 to a value of 1 (transitioning from incorrect to correct), on each task. Looking at Table 5, the unstandardized threshold values for diverse desires and diverse beliefs are negative, indicating that these tasks are particularly easy for both groups. Moving toward false belief, the values begin increasing, indicating that the tasks increase in developmental difficulty. Lastly, while these models have adequate fit suggesting that these five tasks indicate a single construct, individually they are not strong. In table 5, the R^2 values indicate that diverse desires is the only task that seems to account for individual variability, whereas the other four tasks account for very little. In fact, there is such little variance to be explained that diverse beliefs is undefined. Table 5 also shows the latent mean and variances, which are relative to the z-score of the hearing group and were fixed to zero and one, respectively. The variance estimated for DHH children is very close to one, whereas the mean is very close to zero. This indicates that the groups are equivalent in performance on the ToM scale.

Lastly, the fifth research question inquires about the relationship between receptive vocabulary and overall ToM scores. The results indicate that receptive vocabulary had a small, positive correlation with overall ToM scores for DHH children, $r(59) = .288$, $p = .027$. There was also a similar, positive relationship for hearing children, $r(105) = .272$, $p = .005$.

Conclusions

The present study adds to the current literature involving ToM and both DHH and hearing children. First, the findings suggest that DHH children are not delayed in their overall ToM development compared to hearing children. This is in contrast to the study hypothesis, but in accord with findings from Remmel and Peters (2009). In a much smaller sample, Remmel and Peters found no group differences between preschool-age DHH and hearing children, specifically that both of the groups performed very well overall on ToM. In contrast, the current sample of DHH and hearing children performed very poorly.

It is not surprising that the DHH children were delayed in their overall ToM, but it is surprising to find that the hearing children were equally delayed in ToM. This is most likely because all hearing children came from low SES backgrounds, having been a sample of convenience from Head Start programs. SES has been shown to have a strong relationship to a child's ToM, in that children growing up in low SES families perform worse on ToM tasks when compared to children who grow up in working-class or high SES families (Cole & Mitchell, 1998; Cutting & Dunn, 1999; Weimer & Guajardo, 2005).

Further, in accord with the majority of studies using the ToM scale, the present study found that this sample of preschool-age DHH children show similar delays compared to school-age DHH children in ToM (Peterson et al. 2005; Peterson & Wellman, 2009; Wellman et al. 2011). Our findings echo results found for DHH children by Peterson and Wellman (2009), however, DHH children who passed false belief in that study were on average 12 years old, whereas hearing children were five years old. Although, in the present study only four DHH and six hearing children passed false belief, these children were, on average, 50 months old; the age that is consistent with hearing children passing false belief.

In addition to comparing the children's overall performance, I examined children's performance on individual tasks. The first two tasks, diverse desires and diverse beliefs, were equally easy for both groups of children and false belief was equally difficult for both groups. However, knowledge access was shown to be easier for hearing children than DHH children, a finding supported by previous research studies (Peterson & Wellman, 2009; Remmel & Peters, 2009).

Why might knowledge access be easier for hearing children than for DHH children? This task requires the ability to represent two minds (the child's and another). It is one step closer from understanding false belief in that to understand knowledge access, the child does not need to represent false beliefs, but unknown beliefs (e.g. a clearly marked box versus an unmarked box). One speculation for the difficulty of this task is that, unlike pretend play, DHH children do not often experience situations where individuals may not know something (e.g. like the contents of a box). Not only do the test and control questions require knowledge of mental state vocabulary, but also call upon social experiences of knowing and not knowing privileged information (e.g. "What does Mary *think* is in the box?") Perhaps knowledge access is an easier concept for hearing children due to their social learning experiences.

A second goal of the present study was to investigate the developmental ordering of the tasks in the ToM scale for both DHH and hearing children. The findings suggest that the vast majority of DHH children followed the predicted order of difficulty of the tasks in the ToM scale: diverse desires, diverse beliefs, social pretend, knowledge access, false belief, however, contrary to our hypothesis based on the results from Peterson and Wellman (2009), the results for hearing children are unclear. An equal proportion of hearing children followed the order of difficulty found for the DHH children, while others saw a reverse ordering for social pretend and knowledge access: diverse desires, diverse beliefs, knowledge access, social pretend, false belief.

An equal number of hearing children passed both social pretend and knowledge access, however, according to follow up analyses, hearing children were more likely to pass knowledge access than DHH children. Further, there were no group differences in passing social pretend. Since social pretend has only been used in one study, I re-examined the Guttman without the social pretend task and found that 83% of DHH and 89% of hearing children fit the 4-step ToM scale. This is much higher than the percentages that include the social pretend task as part of the scale, and is also similar to the proportion of children who follow the developmental sequence found by Peterson and Wellman (2009). Further, as indicated by the CFA models, the social pretend task is not predicted well by ToM as a construct ($R^2 = .12$). Future researchers may consider excluding the social pretend task from the ToM scale. Although there is no clear result for whether social pretend is a strength for DHH children, it does seem to be an earlier developing skill for DHH children than knowledge access. The CFA results also confirm the findings of the Guttman scale, indicating that these tasks increase in developmental difficulty similarly in both groups.

The second set of contributions of the present study was to investigate the measurement properties of the ToM scale. As indicated by the CFA results, these five tasks do indicate a single construct, namely ToM. Further, the scale operates similarly in both groups of children, so the results of the present study indicate true group differences, and not substantial test bias. However, the individual tasks were found not to predict much variability in the overall latent construct (i.e. ToM). In this case, interpretation is limited to an overall score based on five tasks, which together indicate a single construct, but separately are poor estimators of ToM.

Future research should include several tasks measuring the same skill (e.g. ToM). Recent research has indicated additional, more complex tasks that are scalable in the ToM sequence (e.g., sarcasm, emotion understanding; Peterson et al., 2012). Overall, the sample of children in the present study performed poorly on the current five-step ToM scale, so adding more complex tasks beyond false belief will not be useful. The results of the present study suggest researchers should have multiple indicators of each of these levels of ToM to determine which tasks have good measurement properties. That is, the scale may require more items for each task (e.g. several false belief tasks). In addition to adding more tasks, CFA should be used with larger samples; perhaps samples that do not experience existing language or environmental deficits, which in turn, cause ToM delays. Most importantly, however, better tasks are needed. While the overall fit of these CFA models was acceptable, the quality of the items in measuring a single construct was quite poor. Although there was estimation trouble in these models, the lack of sensitive measurement corresponds to the weak correlation matrix (see Table 1) as well as to the 25% of cases failing to fit the Guttman scalogram. It is possible that stronger measurement models could suggest that dependable measurement has not yet been attained using the ToM scale.

Lastly, I asked the question, how does receptive vocabulary relate to ToM development for DHH and hearing children? A meta-analysis investigating language and ToM by Milligan et al. (2007) suggested that performance on ToM tasks was related to measures of general language (27% of the variance explained) and receptive vocabulary (12% of the variance explained). Milligan et al. (2007) also found that earlier language ability predicted later ToM performance, suggesting a causal relationship between language and ToM. These findings are important regarding the children in the present study because the DHH children experienced significantly language delays while the hearing children were developing age-appropriate language.

The results were consistent with previous research for hearing children in that receptive vocabulary was positively correlated with overall ToM scores for both DHH and hearing children. Except for two studies (Peterson et al., 2012; Remmel & Peters, 2009) previous studies using the ToM scale with DHH children have excluded using standardized measures of language. The present study confirms and extends the findings for DHH preschoolers that receptive language has a positive relationship with ToM, similar to hearing children. Although intriguing, researchers conducting future studies may want to include several measures of language ability, specifically measures of complement structure (de Villiers & Pyers, 2002), which is suggested to be strongly related to ToM.

In conclusion, DHH and hearing children follow similar sequences in developing a ToM, however, knowledge access seems to be an easier skill for hearing children than DHH children. Further, the measurement properties of the specific five-step ToM scale indicate the scale operates similarly in both groups, allowing the interpretation of true group differences. However, the individual tasks of the scale may need to be reexamined. Future research should consider larger sample sizes, additional tasks, more sensitive tasks, and the continuation of this methodology to develop the best ToM scale for administration to diverse groups. Future studies should also include hearing children from a range of SES backgrounds in order to get clearer results.

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APPENDICES

Appendix A
<u>*Diverse Desires:*</u>

[Display doll and pictures of a carrot and cookie. Place pictures apart from each other and in the middle of the two pictures]:

Here is a girl. Her name is Mary. Mary wants a snack. Here are two snacks: a carrot and a cookie.

Pretest Question: **Which do you like best? [PAUSE FOR RESPONSE.] That's a good choice. But Mary does not like [cookies]. She likes [carrots]. Mary's favorite is [carrots].**

Test Question: **OK Mary can choose only one snack. Which will she pick?** [If no answer, prompt: Will she pick a cookie or a carrot?]

<u>*Diverse Beliefs:*</u>

[Display girl doll and pictures of a car and a box. Place pictures apart from each other and Mary in the middle of the two pictures]:

Mary wants her cat. The cat is hiding. The cat could be in the car or in the box.

Pretest Question: **Where do you think the cat is?** [PAUSE FOR RESPONSE] **That's a good idea. But Mary thinks the cat is in** [opposite of child's choice].

Test Question: **Where will Mary look for her cat?** [If no answer: Will she look in the car or in the box?]

<u>*Social Pretend:*</u>

[Display a blue cup**].**

[Mary goes away.] **Bye-bye Mary! Mary can't see us and Mary can't hear us.**

Look! I have a cup! What color is the cup? [PAUSE FOR RESPONSE]. **You are right. This cup is blue.** [Or correct the child in telling him/her the cup is blue].

Now, let's pretend to paint this cup green. Tester paints cup with brush. **Now it's your turn to paint the cup green.** Tester allows child to paint cup with brush.

Tester asks, **"What color are you painting the cup?"** Child should say green, if not give correct response. [After a period of time…] **Yes, you are painting the cup green. OK now we have finished pretending**.

Control Question: **When we pretended before, what color did we pretend to paint this cup? Right, green.**

Child should say green, or correct child in telling the cup was painted green.

(Doll arrives). **Here comes Mary. Hi Mary! Mary did not see us pretending.**

Test Question: **What color does Mary think the cup is?**

<u>*Knowledge Access:*</u>

[Mary goes away.] **Bye-bye Mary! Mary can't see us and Mary can't hear us.**

[Display closed box]: **Here is a box.**

Pretest Question 1: **What do you think is in it?** [PAUSE FOR RESPONSE. Any response is acceptable]. **That's a good guess. Let's open it. Oh, look! There is a dog in it!** [Display toy dog; then close it inside the box.]

Control Question 1: **What is in the box?** Child should answer dog. If child does not answer correctly, show them the dog again.

[Doll enters]. **Mary has never looked inside this box before. She has never opened it.**

Control Question 2: **Here comes Mary. Hi Mary! Has Mary looked inside this box?**

Test Question: **Does Mary know what is in this box?**

<u>*False Belief:*</u>

[Mary goes away.] **Bye-bye Mary! Mary can't see us and Mary can't hear us.**

[Display closed crayon box]: **Here is a crayon box. What do you think is in the box?** [If no answer, or answer other than "crayons" tester continues: **What is in a box like this?**]

Let's look in the box. Oh! There is a spoon in it. [Tester closes spoon in box].
Control Question 1: **Okay, what is in the box?**

[Doll arrives]. **Here comes Mary. Hi Mary! She has not looked inside this box.**

Test Question: **What does Mary think is in the box?**
Control Question 2: **Did Mary look in the box?**

Appendix B

Child # ____________________

Diverse Desires:

Which snack do you like?

a. Carrot
b. Cookie
c. Other ____________

Which snack will Mary pick?

a. Carrot
b. Cookie
c. Other ____________

Diverse Beliefs:

Where do you think the cat is?

a. Car
b. Box
c. Other _______________

Where will Mary look for her cat?

a. Car
b. Box
c. Other ____________

Social Pretend:

What color is the cup?

a. Blue
b. Other __________

What color are you painting the cup?

a. Green
b. Blue
c. Other ____________

What color did we pretend to paint?

a. Green
b. Blue
c. Other ___________

What color does Mary think the cup is?

a. Green
b. Blue
c. Other _____________

Knowledge Access:

What do you think is in here?

____

What is in the box?

a. Dog
b. Other ____________

Has Mary looked in the box?

a. Yes
b. No

Does Mary know what is in the box?

a. Yes
b. No

False Belief:

What do you think is in the box?

a. Crayons
c. Other _____________

What is in the box?

a. Spoon
b. Crayons
c. Other ____________

What does Mary think is in the box?

a. Spoon
b. Crayons
c. Other ___________

Did Mary look in the box?

a. Yes
b. No