

Understanding of Emotions and False Beliefs Among Hearing Children versus Deaf Children

Margalit Ziv^{*,1,2}, Tova Most¹, Shirit Cohen¹

¹Tel Aviv University

²Al-Qasemi Academic College of Education

Received September 21, 2012; revisions received December 10, 2012; accepted December 13, 2012

Emotion understanding and theory of mind (ToM) are two major aspects of social cognition in which deaf children demonstrate developmental delays. The current study investigated these social cognition aspects in two subgroups of deaf children—those with cochlear implants who communicate orally (speakers) and those who communicate primarily using sign language (signers)—in comparison to hearing children. Participants were 53 Israeli kindergartners—20 speakers, 10 signers, and 23 hearing children. Tests included four emotion identification and understanding tasks and one false belief task (ToM). Results revealed similarities among all children's emotion labeling and affective perspective taking abilities, similarities between speakers and hearing children in false beliefs and in understanding emotions in typical contexts, and lower performance of signers on the latter three tasks. Adapting educational experiences to the unique characteristics and needs of speakers and signers is recommended.

Emotion understanding and theory of mind (ToM) are two major aspects of social cognition (Brown & Dunn, 1996; LaBounty, Wellman, & Olson, 2008; Laible & Tompson, 1998) in which deaf¹ children reveal developmental delays compared to hearing children (Peterson, Wellman, & Slaughter, 2012; Rieffe, Terwogt, & Smit, 2003). The objective of the current study was to investigate these two major aspects of social cognition in two subgroups of deaf children—those with cochlear implants who communicate orally (speakers) and those who communicate primarily using sign language

(signers)—in comparison to hearing children. The study aimed to increase our understanding regarding the strengths and difficulties of deaf children in emotion understanding and in ToM.

Understanding Emotions Among Hearing Children and Deaf Children

Developing an understanding of emotions is a gradual process that begins in the first year of life, when infants become sensitive to the emotional significance of facial expressions and vocal intonations (Flavell, 2004). At 2 years of age, toddlers begin to identify and label simple emotions (Denham et al., 2003). At around 3 years, children are capable of expressing their emotions verbally, talking about the feelings of others, and understanding situations and circumstances that stimulate emotions (Brown & Dunn, 1996; Denham, Zoller, & Couchoud, 1994). Emotional development requires exposure to interactions in a linguistic social context; children's understanding of emotions improves when they interact with siblings and friends (Taumoepeau & Ruffman, 2008) and discuss emotional experiences with their parents (Symons, 2004).

A significant milestone in developing an understanding of emotions is the ability to identify and label emotions based on facial expressions. Studies have assessed children's ability to recognize six universal facial expressions: happiness, sadness, anger, fear, disgust, and surprise (e.g., Altshul Schorr, 2005).

*Correspondence should be sent to Margalit Ziv, Al-Qasemi Academic College of Education, Bake El Garbia, 30100, Israel (e-mail: margalit.ziv@gmail.com).

Findings highlighted a developmental pattern where children could identify and label happiness and sadness around 2 years of age but only gradually develop the ability to identify and label anger, fear, disgust, and surprise (Flavell, 2004; Gray, Hosie, Russell, & Ormel, 2001).

An essential aspect of emotion understanding is children's capacity to understand another person's emotions when those feelings differ from the child's or from what may be customary in certain situations (Denham et al., 2003). For example, it is important for a child to understand that although he or she is afraid of snakes, another child may not be afraid of snakes and may even like to touch and play with them. Research on hearing children has shown that, at age 3 years, children can already understand that people differ from one another in their emotional preferences and experiences. Understanding others' feelings constitutes an essential basis for the processing of more complex emotional and cognitive situations, such as concealed feelings, mixed feelings, and false beliefs.

Research on deaf children has also examined the ability to identify and label the six universal facial expressions of happiness, sadness, anger, fear, disgust, and surprise (Dyck, Farrugia, Schochet, & Holmes-Brown, 2004; Gray et al., 2001; Hosie, Gray, Russell, Scott, & Hunter, 1998). Studies included participants from a broad age spectrum, ranging from preschool to high school. Some research indicated that the ability of deaf children to identify emotions from facial expressions resembled that of hearing children (Hosie et al., 1998), whereas other researchers reported lower performance by deaf children and adolescents (Dyck et al., 2004; Gray et al., 2001; Most, Weisel, & Zaychik, 1993). For example, Hosie et al. (1998) found a similar level of performance in hearing children (aged 4–8 and 8–12 years) and same-age deaf children who had hearing parents and who communicated through simultaneous communication (speech and signs). Both groups exhibited similar difficulties in labeling certain emotions based on facial expressions, in particular disgust and surprise. In contrast, Dyck et al. (2004) and Gray et al. (2001) found a delay in tasks involving identifying and labeling emotions among deaf children aged 6–11 and 12–18 years compared to their hearing peers. Gray et al. (2001) suggested that, although stimuli were

visual (facial expressions) and thus did not require hearing abilities, deaf children experience difficulties in identifying emotions because this ability develops in an auditory-linguistic context.

Other studies examined the understanding of emotions using stimuli other than facial expressions alone. Gray, Hosie, Russell, Scott, and Hunter (2007) asked deaf children aged 7–11 years who used simultaneous communication to match a photograph of a facial expression (depicting one of the six basic emotions) to the emotion being experienced by characters who appeared in a series of illustrated scenarios portraying emotion-provoking contexts. Each scenario described a situation that simulated a particular emotion, for example a girl receiving a gift (happiness) and a girl whose ice cream fell on the floor (sadness). Findings indicated that hearing children performed this task better than deaf children. In another study, Rieffe et al. (2003) compared 9- and 11-year-old deaf children, who communicated in sign-supported Dutch, to hearing children in their understanding of short stories about sadness and anger. Results showed that the deaf children's emotional attributions and explanations focused on sadness caused by unfulfilled desires, whereas hearing children referred both to sadness and anger. Additionally, the explanations of emotions provided by the deaf children focused on the outcomes of events rather than on the processes and multiple causes that might lead to these outcomes. The researchers suggested that deaf children have a narrower and less flexible perception of emotional situations due to restricted opportunities to learn from their own and others' experiences via the auditory channel.

Recent studies that examined emotion understanding in children with cochlear implants assessed identification and understanding of emotions that were presented through different sensory modes: visual, auditory, or combined auditory-visual. Altshul Schorr (2005) investigated the ability of 5- to 14-year-old, unilaterally cochlear-implanted deaf children to label emotions that were expressed either auditorily by nonverbal vocal stimuli or visually by illustrations of typical emotion-provoking contexts. No differences emerged between the deaf and hearing children when labeling visually presented emotions. Both groups achieved a high level of performance (70–80% success)

in identifying emotions from illustrations. Neither age at implantation nor duration of implantation use was found to be associated with performance on these tasks. However, the children with cochlear implants exhibited greater difficulty in identifying emotions than their hearing counterparts via the auditory channel. Nevertheless, both groups revealed the same developmental pattern for identifying different emotions; they made more mistakes when asked to label nonverbal vocal expressions of fear, disgust, and surprise than when labeling happiness and sadness, thereby substantiating the literature on facial expressions that showed a developmental pattern for the various emotions.

Most and Michaelis (2012) recently examined emotion identification by young children, aged 4–5 years, all speakers, with varying degrees of hearing loss in comparison to hearing peers. The participants were presented with a set of neutral sentences, expressing the six basic emotions in three modes: auditory, visual, and combined auditory–visual. The study indicated that hearing children outperformed children who had profound hearing loss (cochlear implant users) in all three modes, but no differences emerged between the hearing group and the group with moderate to severe hearing loss (hearing aid users) in any of the three modes.

In light of the inconsistent findings that have emerged thus far regarding the identification and understanding of emotions among deaf children and the importance of focusing on early development among children with varying communication modes, the present study examined emotion identification and understanding in young deaf children. Participants were kindergartners with cochlear implants who used spoken language and kindergartners who were native sign language users.

Development of ToM Among Hearing Children and Deaf Children

ToM is the cognitive ability to explain and understand human behavior and social situations by referring to the mental states on which they are based: beliefs, desires, intentions, and emotions (Colle, Baron-Cohen, & Hill, 2007; Flavell & Miller, 2000; Remmel & Peters, 2008). ToM is essential for understanding and assigning

meaning to human interactions as well as for appropriate social functioning.

A central aspect in the development of ToM is the ability to understand false beliefs, that is, mistaken beliefs about situations, which children usually acquire at the age of 4–5 years (Wellman, Cross, & Watson, 2001). In a standard false belief test (Wimmer & Perner, 1983), children are told a story about a protagonist who holds a false belief regarding the location of an object because the protagonist did not see the object being moved from its original location to a new one. The participating children, who know the object's new location, are asked where the protagonist will look for the object—in its original location or its new one. Studies have shown that 3-year-old hearing children do not yet understand that the protagonist will act according to his/her false belief rather than in accordance with the children's own knowledge; therefore, they reply that the protagonist will look in the new location. In contrast, 5-year-olds understand the protagonist's false belief, which differs from their knowledge of the object's actual location, and they reply that the protagonist will look in the original location (Wellman & Liu, 2004).

Peterson and Siegal (1998) were the first to examine the understanding of false beliefs among deaf children. Participants were deaf children aged 8–13 years, with hearing parents, who communicated by means of spoken language. The study underscored a significant delay in achieving an understanding of false beliefs in the deaf children's group, only at the age of 8–10 years, compared to age 5 in the hearing group. Another study found that orally communicating deaf children had difficulty understanding false beliefs even when the tasks involved very little language and simple syntactic structures (Woolfe, Want, & Siegal, 2002). Similar results were found among children who acquired sign language at preschool or primary school (Courtin & Melot, 2005; Schick, deVilliers, deVilliers, & Hoffmeister, 2007). Researchers have suggested that the reason for these difficulties is related to the limited participation of orally communicating deaf children and of children who acquire sign language as their second language in high-quality social interactions involving mental discourse, in their family or educational setting (Jeanes, Nienhuys, & Rickards,

2000; Macaulay & Ford, 2006; Preisler, Tvingstedt, & Ahlstrom, 2002).

Whereas the majority of ToM studies on deaf children have focused on understanding false beliefs, Peterson and colleagues (Peterson & Wellman, 2009; Peterson, Wellman, & Liu, 2005) carried out a more comprehensive study of children's development of the ability to understand a variety of situations in which the mental state of one character differed from that of another. Examining deaf children with hearing parents, who communicated by means of spoken language, the researchers used a hierarchy of tasks that was developed in order to reveal the developmental sequence of ToM. The battery assessed understanding of different desires, beliefs, accessibility to knowledge, false beliefs, and concealment of real emotions. Findings pinpointed the same developmental sequence in acquisition of mental states among hearing children and deaf children: In both groups, different desires were easiest to understand, and false beliefs and hidden emotions were the most difficult. Yet, deaf children exhibited a developmental delay in comparison to hearing children.

Recent studies on ToM among children with unilateral cochlear implants revealed inconsistent findings. Peterson (2004) found that implanted children aged 4–12 years demonstrated a 3- to 5-year delay in acquiring ToM, whereas other studies (Peters, Rimmel, & Richards, 2009; Rimmel & Peters, 2008) found that implanted children aged 3–12 years exhibited only a small delay. Furthermore, some children in the two latter studies showed no delay at all compared to hearing children, both with respect to ToM and with respect to their linguistic ability. Researchers concluded that implants assist in the development of spoken language, including mental and emotional terms, and consequently also render an impact on development of ToM. Researchers did not find an association between age at implantation and the ability to understand false belief, although a positive correlation emerged between duration of implantation use and performance on tasks involving false beliefs (Macaulay & Ford, 2006; Rimmel & Peters, 2008). Children who had been using implants for a longer period of time were more successful in performing false belief tasks compared to children who had been implanted for a shorter time period.

Contrary to findings regarding a delay in development of ToM among deaf children who used spoken language or who acquired sign language late, research on deaf children with deaf parents, who acquired sign language as infants, portrays a different picture. Among signing children from medium to high socioeconomic backgrounds who had no additional developmental difficulties, ToM development resembled that of hearing children (Courtin, 2000; Peterson, 2004; Schick et al., 2007; Woolfe et al., 2002). Researchers explained that the normal ToM abilities of these children derived from the natural acquisition of their mother tongue—sign language—which enabled them to participate in conversations and interactions with family members and peers (Woolfe et al., 2002). Courtin (2000) added that the spatial attributes of sign language actually helped signers in acquiring ToM because they visually demonstrate the speakers' different points of view.

An important factor affecting the development of ToM is children's exposure to intact linguistic input and rich conversations with adults—both parents and teachers (Harris, 2005). These conversations include adults' use of rich mental-state vocabulary (Adrián, Clemente, & Villanueva, 2007), varied syntactic structures (deVilliers & deVilliers, 2000), and different people's points of view (Bernard & Deleau, 2007). Whereas Israeli children with cochlear implants receive systematic and coordinated linguistic enrichment in spoken Hebrew at home and in their educational settings, the linguistic input of signing children is problematic (Ziv, Malki, & Meir, 2007). At home, native signers are exposed to Israeli Sign Language (ISL), but in their early educational settings, which they begin to attend when they are only a few months old, the staff members are rarely proficient in ISL and instead use spoken Hebrew or variations of signed Hebrew. In signed Hebrew, the speakers accompany their speech with signs, some of which they invent, and thus expose children to low-quality linguistic input that usually focuses on “here and now” events.

In conclusion, previous research testing ToM focused on false belief understanding among deaf children from a wide age range and revealed, first, a developmental delay among children of hearing parents who use spoken language and, second, some positive impact of cochlear implant; signing children

of deaf parents who also had proficient signing teachers showed no delay in understanding false beliefs. The current research explored the development of ToM among Israeli deaf children at young ages, focusing on children with cochlear implants who use spoken language and on native signers.

The Current Study

The study's objective was to provide an in-depth examination of emotion understanding and false belief understanding among deaf children as compared to hearing children. The study was innovative in several ways. First, it focused on kindergarten ages, when children develop the basis for lifelong social cognition, rather than on a broad age range, as customary in previous studies. Second, the two subgroups of research participants represented the population of deaf children in Israel, including both children with cochlear implants who communicated through spoken language and children who were native signers. It should be noted that in Israel children who use sign language are a minority (around 10%) of the deaf children, and the majority of educational settings encourage spoken language. Third, the study included a variety of tasks in order to provide a rich depiction of social cognition in deaf children as compared to hearing children.

Based on these innovative aspects, we presented an open research question rather than unidirectional hypotheses. Our main research question was: How do deaf kindergartners understand emotions and false beliefs, as compared to hearing kindergartners? Specifically, we compared children who use cochlear implants and communicate through spoken language as well as children who are native signers with hearing children.

Method

Participants

Participants were 53 Israeli children aged 5–7 years, divided into three groups:

Deaf children with cochlear implants who communicate in spoken language. All 20 children (8 boys, 12 girls; mean age = 6.6 years, SD = 0.71) had severe to

profound hearing loss (in the better ear, prior to implantation), had hearing parents, used spoken Hebrew as their main mode of communication, and were implanted with a unilateral cochlear implant. Age at implantation ranged between 2:2 and 5:0 (years:months; mean age = 2.5, SD = 1.13), and cochlear implants varied (Nucleus, Advanced Bionics, and Med El). Regarding educational inclusion track, all children attended a standard kindergarten classroom with hearing children. Nine of the children were enrolled in general education classrooms in which each was the only deaf child. The other 11 children were in general education classrooms where they were part of a small group of deaf peers.

Deaf signers. All 10 children (5 boys, 5 girls; mean age = 6.2 years, SD = 0.75) had severe to profound hearing loss, had deaf parents, and attended a special education kindergarten for deaf children. Both the children and their parents used ISL as their main mode of communication. The majority of these children ($n = 8$) used hearing aids, and two children used a unilateral cochlear implant.

Hearing children. All 23 children (11 boys, 12 girls; mean age = 5.10 years, SD = 0.61) were native Hebrew speakers and, according to their teachers, had no diagnosed disabilities.

Socio-economic status (SES) was evaluated in the three groups (speakers, signers, and hearing children) by maternal education (Curenton, Craig, & Flanigan, 2008; Levin & Aram, 2012). Chi-square analysis revealed that maternal education in the hearing group and in the speakers' group was significantly higher than in signers' groups, $\chi^2(3) = 8.70, p < .05$.

Measures

The assessment battery comprised five measures: one language measure, three measures of emotion understanding, and one measure of ToM. Gender bias was controlled in all tasks by utilizing an evenly balanced presentation of male and female stimuli (photographs, story protagonists, illustrated scenarios). Test stimuli and questions were presented verbally to the speakers and the hearing group and were presented using ISL to the signers.

Language test. To ensure participants' general language proficiency of at least 5 years of age, as required for understanding the tasks' demands, we administered to all the participants the standardized Hebrew version of the Peabody Picture Vocabulary Test-R (PPVT-R), presented via spoken or signed language, to assess vocabulary comprehension (Nevo & Oren, 1979). The sign language version was administered by a native signer, who received training on administering the test from the third author.

Emotion Understanding Measures

Emotion identification from faces. A series of 24 close-up color photographs (15 × 21 cm), comprising facial expressions of six emotions, was used to assess children's emotion identification ability in two tasks: labeling and pointing. In a pilot study presenting a large pool of faces to 10 hearing children aged 5–8 years who did not participate in the current study, these 24 photographs were identified as depicting the expected emotions. Four photographs each depicted happiness, sadness, anger, fear, disgust, and surprise (two photographs each of boys and two of girls around age 5–8 years).

Before testing the participants, the examiner presented three photographs to each child to practice the instructions and ensure that the child understood them. In the labeling task, the experimenter then presented the 24 photographs in random order, one at a time, and asked the child to label the emotion depicted in each photograph. An incorrect answer received a score of 0,

a partially correct answer received a score of 1, and a fully correct answer was scored 2, yielding a possible range of 0 to 48. A partially correct answer included responses in the same direction as the correct answer, but not the exact correct response (e.g., sad instead of angry; happy instead of surprised). Next, in the pointing task, the examiner placed six photographs at a time in front of the child (one selected randomly for each emotion). The examiner asked the child to point to each of the emotions following her verbal or signed request (e.g., "Show me the sad child"). A correct response was scored 1 and an incorrect response received a score of 2, yielding a potential range of 0 to 24.

Understanding emotions elicited in a typical context. To assess children's understanding of these six basic emotions, we presented a series of 12 color illustrations (15 × 21 cm) showing typical situations that elicit each emotion (two situations per emotion). Table 1 presents the 12 situations along with their sources. The pictures were illustrated for the purpose of the current study by a professional artist, with the protagonists' faces not shown (drawn either in profile or seen from the back). All of the emotion situations except surprise were presented by a single picture. Each surprise situation was presented by a sequence of two pictures—one depicting the initial state of affairs and the other depicting the unexpected event. In addition, following Ruffman, Slade, and Crowe (2002), who reported that children confused sadness with anger in a similar task, these emotions were distinguished in the current study

Table 1 The situations for each of six emotions, and their sources

Emotion	Situation	Source
Happiness	A woman gives the girl a present	Ruffman et al. (2002)
	A man gives the boy ice cream	
Sad	The boy had a toy and it broke	Ruffman et al. (2002)
	The girl had a balloon and it burst	Present study
Anger	The boy ruined his friend's tower of blocks	Ruffman et al. (2002)
	The girl grabbed her friend's toy	Present study
Fear	A lion chased the girl	Taumoepau and Ruffman (2006)
	The boy stayed alone in the room	Present study
Disgust	The boy looked at a girl who had a runny nose	Present study
	The girl looked at her brother's dirty diaper	Taumoepau and Ruffman (2006)
Surprise	A magician pulled a rabbit out of his hat	Present study
	The boy opened a bag of potato chips and a dog jumped out of it	

as follows: Sadness was presented through situations in which the child was alone, and anger was presented in social situations where the child interacted with others. All the pictures were presented in a pilot study to 10 hearing children who did not participate in the current study and were found valid.

Each child was presented with 12 illustrated situations, one at a time, and was first asked to describe the situation in order to ensure understanding of the depicted event. The child was then presented, via spoken or sign language, with the test question: What does the child in the picture feel? An incorrect answer received a score of 0, a partially correct answer was scored 1, and a fully correct answer was scored 2, yielding a possible range of 0 to 12. A partially correct answer included responses of the same valence as the correct answer, but not the exact target response (e.g., sad instead of angry; happy instead of surprised). A similar procedure was used previously by Gray et al. (2007).

Affective perspective taking from stories. Four stories (Denham, 1986) were presented via spoken or sign language and were accompanied by illustrations. Two stories presented a protagonist's feelings that contradicted the participant's and two presented a protagonist's feelings that resembled the participant's. To confirm the difference in emotional response between the participant and the story character, 1–2 weeks before testing, the examiner asked each child whether he/she liked to stay alone and whether he/she liked touching or playing with snakes, and all children responded that they disliked both situations. The two stories were then told 1–2 weeks later: one about a child who likes to stay alone at home and one about a child who likes snakes. Similarly, the situations described in the two stories in which participants felt similarly to protagonists were checked 1–2 weeks before testing, ensuring that children felt as expected. The stories were about a child who gets a present and is happy and about a child who wakes up scared from a nightmare. Concerning each of the four stories, the participant was first asked a control question about the story events and was then presented with a forced-choice test question on what the child in the story felt (e.g., “Does the child

in the story feel happy or sad?”). Each correct response received a score of 1, and an incorrect answer was scored 0, yielding a possible range of 0 to 4.

Understanding of false belief (ToM). Two stories, presented via spoken or sign language and enacted using props, assessed standard change-of-location false belief understanding by asking children where an uninformed protagonist would look for a displaced object (Wimmer & Perner, 1983). Children were first asked two control questions concerning the object's initial location and current location and were then asked a forced-choice test question about where the protagonist would look for the object (e.g., “Will she look in the cupboard or in the refrigerator?”). Each correct response received a score of 1, and an incorrect answer was scored 0, yielding a possible range of 0 to 2.

Procedure

Deaf participants were recruited via organizations for education and rehabilitation of deaf kindergartners. Hearing participants were recruited from three kindergartens in central Israel. Signed consent forms were obtained from all parents. The experimenter held two individual sessions with each child, 1–2 weeks apart, in a quiet room at the child's kindergarten. Each session lasted approximately 25 min. The emotion identification task and understanding emotions in contexts were administered in the first session, and the affective perspective taking and false belief tasks were administered in the second session. The first half of the PPVT-R test was administered in the first session, and the remaining half was administered in the second session.

A native signer was hired to communicate with those children who used sign language; she underwent training to familiarize with the administration procedures and tasks. She presented the tasks in sign language in the presence of the primary experimenter, who ensured that the signs and expressions were the same for each administration. Communication with all the other participants was through spoken Hebrew. At the beginning of each session, the examiner checked the sensory aids of the deaf children to ensure that they were functioning properly. Sensory aids' functioning

was checked by the examiner using a stetoclip listener, a listening device for the hearing aid or a signal checker for the cochlear implant.

Results

We first examined children's linguistic ability, tested by the PPVT-R scores, and found that children from all three groups performed within the normal range for their age. A one-way ANOVA, followed by a Tukey post-hoc test ($p < .05$), revealed that the scores of deaf signers (mean = 90.4, SD = 4.32) and hearing children (mean = 86.08, SD = 7.17) were higher than those of deaf implanted children (mean = 78.4, SD = 10.7), $F(2, 49) = 18.24, p < .001, \eta^2 = .30$.

Each child then received a score for the percent of correct responses regarding each of the following tasks: emotion identification from facial expressions (labeling and pointing), understanding emotions elicited in a typical context, affective perspective taking from stories, and understanding false belief. Table 2 presents descriptive statistics for all tasks among hearing children and the two subgroups of deaf children—speakers and signers.

For each of the facially expressed emotion identification tasks—labeling and pointing—we performed a 3×6 (Group [speakers, signers, hearing children] \times Emotion [happiness, sadness, anger, surprise, disgust, fear]) repeated-measures ANOVA, followed by Bonferroni post-hoc tests ($p < .05$). The labeling test showed no significant main effect of group ($p > .05$), but a significant main effect did emerge for emotion, $F(5, 250) = 46.10, p < .001, \eta^2 = .48$. Additionally, Bonferroni tests revealed significantly better labeling beyond group of faces depicting happiness (mean = 98.44%, SD = 1.05), sadness (mean = 94.56%, SD = 1.59), and

anger (mean = 95.31%, SD = 2.26) than labeling of fear (mean = 70.18%, SD = 6.06), which was labeled significantly better than surprise (mean = 40.39%, SD = 5.69) and disgust (mean = 36.41, SD = 5.66).

For the pointing test, the results showed main effects of group, $F(2, 50) = 5.49, p < .001, \eta^2 = .18$, and emotion, $F(5, 250) = 10.10, p < .001, \eta^2 = .17$. Bonferroni tests revealed significantly better pointing scores among the hearing and speakers' groups than among the signers but no significant difference between the hearing and speakers' groups. Additionally, Bonferroni analysis indicated that, beyond group, happiness (mean = 70.87, SD = 4.86) and surprise (mean = 70.87, SD = 4.86) were significantly more difficult to identify by pointing to the appropriate facial expression than were anger (mean = 95.10, SD = 1.94), sadness (mean = 91.15, SD = 2.64), fear (mean = 86.48, SD = 3.32), and disgust (mean = 86.88, SD = 3.2).

To examine children's understanding of emotions elicited in typical contexts (illustrations), we again performed a 3×6 (Group [speakers, signers, hearing children] \times Emotion [happiness, sadness, anger, surprise, disgust, fear]) repeated-measures ANOVA, followed by Bonferroni tests ($p < .05$). The analysis revealed main effects of group, $F(2, 50) = 3.30, p < .05, \eta^2 = .12$, and of emotion, $F(2, 250) = 63.39, p < .001, \eta^2 = .56$. Bonferroni analysis revealed that the hearing group performed significantly better than the signers, whereas the speakers did not differ significantly from either of the other two groups (hearing children or signers). In order to further examine the source of difference in the performance of the three groups, ANCOVA with mother education as a covariate was performed. This analysis revealed similar group differences, $F(2,46) = 4.75, p < .01, \eta^2 = .17$, indicating no effect of mother's education.

Table 2 Mean and standard deviations (in percentages) of correct responses for study measures

	Signers		Speakers (implanted)		Hearing children	
	Mean	SD	Mean	SD	Mean	SD
Labeling emotions from faces	4.21	71.66	2.98	69.27	2.77	76.72
Pointing to emotions from faces	4.54	72.5	3.21	88.33	2.99	89.85
Understanding emotions in contexts	4.55	65.83	3.22	71.87	3.01	79.16
Affective perspective taking from stories	15.81	95	28.56	85.02	29.98	89.13
Understanding false belief	48.3	30.01	44.12	70.03	39.13	80.43

Comparisons among the emotions revealed that children scored significantly better at identifying happiness (mean = 97.19%, SD = 1.5) and sadness (mean = 95.83%, SD = 1.65) from illustrations of typical contexts than at identifying anger (mean = 83.65%, SD = 3.7) and fear (mean = 81.54%, SD = 4.57), which in turn were identified significantly better than disgust (mean = 58.55%, SD = 5.96), which was identified significantly better than surprise (mean = 16.92%, SD = 4.98).

Regarding the affective perspective taking scores, a one-way ANOVA revealed no significant differences between the groups in identifying emotions from stories. Finally, a one-way ANCOVA performed on the false belief scores with mother education as a covariate revealed a significant main effect of group, $F(2, 46) = 5.87, p < .01, \eta^2 = .20$. Bonferroni tests revealed that the hearing group performed significantly better than the signers, but the speakers did not differ significantly from either of the other two groups.

Pearson correlations were conducted between all the different tasks, as seen in Table 3. Significant correlations emerged between identification of facially expressed emotions (labeling and pointing) and understanding of emotions elicited in a typical pictorial context. Also, a significant correlation emerged between emotion understanding in contexts and children's understanding of false belief.

Discussion

The current study examined two aspects of social cognition—understanding of emotions and false beliefs—among two subgroups of deaf children, speakers and signers, and among hearing children. The findings portray a rich picture: The kindergartners from all three

groups exhibited comparable abilities in labeling facially expressed emotions (photographs) and in understanding emotions of others from stories, even emotions that differed from their own. On three tasks—pointing to facially expressed emotions, identifying emotions elicited in typical contexts (illustrations), and understanding false beliefs (ToM)—signers' performance level was significantly lower than that of hearing children, with speakers' performance falling in between. Regarding the pointing task, signers also exhibited significantly lower performance than speakers. With respect to response patterns for the six different emotions studied, no differences were found among the three groups.

Group Similarities and Differences

An important finding of the current study relates to the similar performance levels evidenced by all three groups of children—cochlear-implanted speakers, signers, and hearing children—on tasks involving the identification of emotions by labeling facial expressions and by understanding story protagonists' emotions even when they differed from one's own. On the emotional labeling task, participants were asked to name (using speech or sign) the emotion felt by the photographed child with respect to six basic emotions. The success rate among children from the three groups ranged from approximately 70% to 77%, indicating that kindergartners across the board possessed a similar active vocabulary with respect to these six emotions, as well as a comparable ability to match the appropriate word to the facial expression.

These findings are consistent with those of Hosie et al. (1998) but contradict the findings of Dyck et al. (2004), which revealed a delay among deaf children and adults in performing a similar task. The difference

Table 3 Pearson correlations (two-tailed) among the different tasks

	Identification by pointing (faces)	Emotion understanding (contexts)	Affective perspective taking (stories)	Understanding false belief
Labeling emotions	.390**	.528**	0.165	−0.008
Identification by pointing	—	.301*	0.168	0.238
Emotion understanding		—	0.225	.353**
Affective perspective taking			—	−0.036

* $p < .05$, ** $p < .01$.

between the current findings and Dyck et al.'s may stem from methodology. In Dyck et al.'s study, the photographs showed facial expressions of adult males and females, whereas in the current study the tool comprised photographs of boys and girls from the same age group as the participants. According to Anastasi and Rhodes (2005), accuracy in perceiving emotions represented in faces increases when the stimuli depict people in the participants' same age group. Furthermore, in Dyck et al. (2004), the photographs were displayed on a computer screen, and speed of performance was considered as a measure of success on the task. In the current study, in contrast, the facial expressions were displayed by means of printed photographs and presented to the participants at a pace that was adjusted to their responses, and speed of performance was not regarded as a measure of success.

The children from all three groups were also all quite successful on the task involving understanding others' emotions as depicted in spoken or signed stories. Between 85% and 95% of hearing children and deaf children (both speakers and signers) were able to understand someone else's emotion, both when it resembled and when it differed from what they themselves felt. For example, they were able to recognize that a boy who liked staying home alone felt happy, rather than sad, when his parents went out without him. Previous studies have shown that hearing children succeed on this task at the age of 3 years (Denham, 1986). To the best of our knowledge, the current study was the first to examine how deaf children understand the emotions of others and showed that the vast majority of children aged 5–7 years had no difficulty performing this task. Future studies should examine younger deaf children (aged 3 and 4) to see whether they acquire this ability at the same age or later than hearing children. This line of research is important because understanding others' emotions serves as a basis for comprehending more complex mental states in other people, including false beliefs.

In contrast, group differences did emerge with regard to the other two tasks of emotion understanding (pointing out a target emotion from a set of photographed faces and understanding emotions elicited in illustrated typical contexts) and with regard to the false belief task. The cochlear-implemented speakers resembled

the hearing peers in both of these abilities, corroborating the performance levels found for hearing children in previous studies (Altshul Schorr, 2005). That is, both of these groups found it easy to merely point to an appropriate emotion named by the examiner from among a set of photographed facial expressions (succeeding about 88% and 90% of the time for speakers and hearing children, respectively). Unsurprisingly, they were more successful at merely pointing than they were at generating a label to match a given face.

In contrast to the tasks involving labeling and pointing to emotions in photographed facial expressions, which examined participants' perception of the visually expressed emotions, the illustrations tapping children's ability to understand the emotions elicited in typical social contexts did not provide direct information on protagonists' emotions. Blank or inaccessible faces required the kindergartners to first understand the events depicted by the illustrations, in order to correctly infer how the protagonist felt in each situation. Thus, this task examined participants' higher cognitive understanding of the relation between an event that happened to the protagonist and the emotion that he/she experienced. The finding that the implanted speakers did not differ significantly from their hearing peers in inferring emotions from context (about 72% vs. 79% correct, respectively) indicates a higher cognitive ability that goes beyond the perceptive capacity required for labeling and identifying facial expressions. Indeed, this context-dependent task is more similar to the processing required in everyday life for understanding emotions in the social contexts in which they arise. Previous studies have shown that deaf children are liable to have difficulty performing cognitive tasks requiring an understanding of cause and effect and deductive thinking (Spencer, 2010). Inferring emotions from typical scenarios may stem from these cognitive difficulties.

On the false belief task, the average success rate of implanted children (70%) was higher than that found by previous studies examining false belief ability among speakers without implants (Peterson et al., 2005). The current study suggests that the cochlear implant may play a role in the development of ToM in children from an early age. It is important to note, however, that the variance among the group of

implanted speakers remained quite high in the current study, as previously reported (Rommel & Peters, 2008). Some succeeded on the task, whereas others found it difficult. Additionally, the group of implanted speakers scored lower than hearing children and signing children on the PPVT-R, indicating that some of them also have vocabulary delays that may have an impact on social cognition. The variance in false belief task performance among implanted speakers must be taken into consideration, and the ability of each child must be assessed individually to determine the extent of the implant's contribution to each child's functioning level.

The results on emotion understanding and false belief for the kindergartners who signed revealed a different pattern. The signing group performed significantly lower than their deaf and hearing counterparts on the pointing task (photographed faces) and lower than hearing children on the identification of emotions from context (illustrations with unidentifiable faces). They also demonstrated significantly poorer performance on the false belief task compared to the hearing children, although previous studies have not indicated that development of ToM is delayed among these children (Courtin, 2000; Courtin & Melot, 2005; Peterson, 2004; Schick et al., 2007).

The lower social cognition abilities found in the current study than in previous research for signing children cannot be explained by their lower SES background, based on analyses that controlled mothers' education level. Rather, the low level of achievement may derive from the complex linguistic and educational conditions of Israeli signers. Specifically, Israeli signing children are exposed to ISL as their mother tongue at home, but in educational settings, where many of them spend 8 hours daily, the majority of the educational staff is not proficient in sign language and uses spoken Hebrew and nonsystematic signed Hebrew (Ziv et al., 2007). Thus, from a young age, signing children are often exposed to limited vocabulary, non-intact syntactic structures, and only few conversations on topics that go beyond here-and-now events, including peoples' mental states. This situation may indeed impede the development of children's social cognition in general and of understanding emotions and false beliefs in particular.

Response Patterns for the Six Different Emotions

In addition to exploring participants' level of success in identifying and labeling emotions, we explored the patterns of responses that indicate the developmental sequence of emotion understanding. Response patterns were similar among the children from all three groups. As in previous studies on both hearing children and deaf children, happiness and sadness were easier to label, whether through facial expressions or in typical contexts, than were the other emotions (Gray et al., 2007; Hosie et al., 1998). Disgust and surprise were the most difficult to label, whereas anger and fear posed an intermediate level of difficulty. Previous studies suggested explanations for the greater difficulty in understanding disgust and surprise. Researchers noted that discourse on disgust is less prevalent than discourse on other emotions (Gray et al., 2001). They explained surprise as a complex emotion that comprises understanding of the basic emotion of happiness as well as understanding of expectations or beliefs that were not realized (Golan, Baron-Cohen, Hill, & Golan, 2006).

The similarity in response patterns among hearing children, implanted speakers, and signers indicates that, despite the differences in their overall scores on some of the tasks, their developmental sequence for learning to identify the different emotions is similar. This finding coincides with previous research that demonstrated a similar sequence in the development of understanding of emotions among deaf children in a broad age range and hearing children (Gray et al., 2001; Hosie et al., 1998). It strengthens previous findings by demonstrating a similar developmental foundation during early childhood for hearing children and deaf children, whether implanted speakers or signers.

Furthermore, the groups' similar developmental sequence for emotion understanding adds to previous studies that pointed to a similarity in the sequence of ToM development between hearing and deaf children, despite the developmental delay exhibited by deaf children (Peterson et al., 2005). Finally, the correlations found in the current study among the rates of success on emotion understanding in contexts and false belief tasks suggest that these tasks represent interlinked

aspects of social cognition that develop during early childhood for all three groups.

Study Limitations and Recommendations for Further Research

One strength of the current study lies in its investigation of emotion understanding and false beliefs among deaf kindergartners by means of a series of tasks, assessing various aspects of these socio-cognitive abilities. Nevertheless, this considerable variety of tasks does not cover all aspects of social cognition and also cannot fully simulate the complex and integrative processing required for understanding social behavior and social interactions in everyday life. Hence, future research should examine additional social-cognition aspects, such as mental states other than false belief, as recommended by Peterson et al. (2012). A more comprehensive approach should also include testing children's executive function, which has been found to associate with social cognition (Carlson, Moses, & Breton, 2002). Furthermore, social cognition and social functioning of deaf children should be examined in natural situations, tapping multiple sources such as peer ratings, teacher ratings, self-ratings, and direct observations, and these findings should be compared to children's success on experimental tasks.

A limitation of this study that should be addressed in future research is the limited information about the children's linguistic skills that was provided by the PPVT-R. It should be noted that the PPVT-R may overestimate the vocabulary of children who sign because of the iconic nature of sign language. Additional measures that might better relate both to emotion understanding and to ToM may include children's cognitive vocabulary and morphosyntax skills (Astington & Jenkins, 1999).

Educational Implications and Summary

The study's findings, depicting both abilities and delays in the social cognition of deaf children, can assist in planning educational programs to enhance the social cognition of these children. It is important to provide professionals with theoretical and practical knowledge regarding the development of social cognition among deaf children. Professionals should be encouraged to promote the understanding of emotions and ToM

among deaf children by fostering specific basic skills such as visual and auditory perception of emotions, enhancing understanding of emotions' elicitation in typical social contexts, improving children's understanding of mental states, and facilitating conversations about emotions and mental states in real-life social situations (Nellson, 2005). In addition to educational work with the children, parents should be instructed in how to implement these guidelines in discussions with their children (Ziv et al., 2007).

In applying these recommendations, it is essential to adapt the educational program to the specific attributes of the participating children (Ziv et al., 2007). The current study highlighted different attributes and needs of speakers with cochlear implants and of signers. Children with cochlear implants vary greatly in their social cognition skills, and, therefore, individuals' particular abilities and difficulties must be identified to personalize and adapt educational programs to each child and family. Importantly, despite the small percentage of signing children in the overall population of deaf children in Israel, their special characteristics and needs should be recognized and addressed. They should be provided diverse and varied experiences in sign language, which is their mother tongue (Jetske & Roseland, 2006). Among other things, this involves hiring professionals who are deaf and/or highly proficient in sign language and establishing clear linguistic and educational guidelines. Signing children's educational experience should ensure exposure to rich mental-state vocabulary and provide children with opportunities to express their desires, emotions, and thoughts, as well as to respond to those of others. Promoting both linguistic and social abilities of deaf children can help enrich their experiences and abilities in these domains, as well as enhance their well-being and ability to successfully integrate into the larger society.

Note

1. The use of the term "deaf" in the paper is inclusive to those who are both audiological deaf and hard of hearing.

Conflicts of Interest

No conflicts of interest were reported.

Acknowledgment

We thank Dee B. Ankonina for her helpful comments on early versions of the manuscript.

References

- Adrián, J. E., Clemente, R. A., & Villanueva, L. (2007). Mother's use of cognitive state verbs in picture-book reading and the development of children's understanding of mind: A longitudinal study. *Child Development, 78*, 1052–1067. doi:10.1111/j.1467-8624.2007.01052.x
- Altshul Schorr, E. (2005). Social and emotional functioning of children with cochlear implants (Unpublished doctoral dissertation). Department of Human Development, University of Maryland.
- Anastasi, J. S., & Rhodes, M. G. (2005). An own-age bias in face recognition for children and older adults. *Psychonomic Bulletin & Review, 12*, 1043–1047. doi:10.3758/BF03206441
- Astington, J. W., & Jenkins, J. M. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental Psychology, 35*, 1311–1320. doi:10.1037/0012-1649.35.5.1311
- Bernard, S., & Deleau, M. (2007). Conversational perspective-taking and false belief attribution: A longitudinal study. *British Journal of Developmental Psychology, 25*, 443–460. doi:10.1348/026151006X171451
- Brown, J. R., & Dunn, J. (1996). Continuities in emotion understanding from three to six years. *Child Development, 67*, 789–802.
- Carlson, S. M., Moses, L. J., & Breton, C. (2002). How specific is the relation between executive function and theory of mind? Contributions of inhibitory control and working memory. *Infant and Child Development, 11*, 73–92. doi:10.1002/icd.298
- Colle, L., Baron-Cohen, S., & Hill, J. (2007). Do children with autism have a theory of mind? A non-verbal test of autism vs. specific language impairment. *Journal of Autism and Developmental Disorders, 37*, 716–723. doi:10.1007/s10803-006-0198-7
- Courtin, C. (2000). The impact of sign language on the cognitive development of deaf children: The case of theories of mind. *Journal of Deaf Studies and Deaf Education, 5*, 266–276. doi:10.1093/deafed/5.3.266
- Courtin, C., & Melot, A. M. (2005). Metacognitive development of deaf children: Lessons from the appearance-reality and false belief tasks. *Developmental Science, 8*, 16–25. doi:10.1111/j.1467-7687.2005.00389.x
- Curenton, S. M., Craig, M. J., & Flanigan, N. (2008). Use of decontextualized talk across story contexts: How oral storytelling and emergent reading can scaffold children's development? *Early Education and Development, 19*, 161–187. doi:10.1080/10409280701839296
- Denham, S. A. (1986). Social cognition, prosocial behavior and emotion in preschoolers: Contextual validation. *Child Development, 57*, 194–201. doi:10.2307/1130651
- Denham, S. A., Blair, K. A., DeMulder, E. D., Levitas, J., Sawyer, K., Auerbach-Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? *Child Development, 74*, 238–256. doi:10.1111/1467-8624.00533
- Denham, S. A., Zoller, D., & Couchoud, E. A. (1994). Socialization of preschoolers' emotion understanding. *Development Psychology, 30*, 928–936. doi:10.1037/0012-1649.30.6.928
- deVilliers, J. G., & deVilliers, P. A. (2000). Linguistic determinism and the understanding of false beliefs. In P. Mitchell (Ed.), *Children's reasoning and the mind* (pp. 191–228). Hove, England: Psychology Press, Taylor and Francis.
- Dyck, M. J., Farrugia, C., Shochet, I. M., & Holmes-Brown, M. (2004). Emotion recognition understanding ability in hearing or vision impaired children: Do sounds, sights or words make the difference? *Journal of Child Psychology and Psychiatry, 45*, 789–800. doi:10.1111/j.1469-7610.2004.00272.x
- Flavell, J. H. (2004). Theory of mind development: Retrospect and prospect. *Merrill-Palmer Quarterly, 50*, 274–290. doi:10.1353/mpq.2004.0018
- Flavell, J. H., & Miller, P. (2000). Social cognition. In D. Kuhn, & R. S. Siegler (Eds.), *Handbook of child psychology: Volume 2. Cognition, perception and language* (pp. 857–898). New York, NY: John Wiley.
- Golan, O., Baron-Cohen, S., Hill, J. J., & Golan, Y. (2006). The “reading the mind in films” task: Complex emotion recognition in adults with and without autism spectrum conditions. *Social Neuroscience, 1*, 111–123. doi:10.1080/17470910600980986
- Gray, C. D., Hosie, J. A., Russell, P. A., & Ormel, E. A. (2001). Emotional development in deaf children: Facial expressions, display rules, and theory of mind. In M. D. Clark, M. Marschark, & M. Karchmer (Eds.), *Context, cognition and deafness* (pp. 135–157). Washington, DC: Gallaudet University Press.
- Gray, C. D., Hosie, J. A., Russell, P. A., Scott, C., & Hunter, N. (2007). Attribution of emotion to story characters by severely and profoundly deaf children. *Journal of Developmental and Physical Disabilities, 19*, 145–159. doi:10.1007/s10882-006-9029-1
- Harris, P. L. (2005). Conversation pretense and theory of mind. In J. W. Astington, & J. A. Baird (Eds.), *Why language matters for theory of mind* (pp. 70–83). New York, NY: Oxford University Press.
- Hosie, J. A., Gray, C. D., Russell, C. D., Scott, C., & Hunter, N. (1998). The matching of facial expressions by deaf and hearing children and their production and comprehension of emotion labels. *Motivation and Emotion, 22*, 293–313. doi:10.1023/A:1021352323157
- Jeanes, R. C., Nienhuys, T. G., & Rickards, F. W. (2000). The pragmatic skills of profoundly deaf children. *Journal of Deaf Studies and Deaf Education, 5*, 237–247. doi:10.1093/deafed/5.3.237
- Jetske, K. F., & Roseland, V. H. (2006). Language development in deaf children's interactions with deaf and hearing adults: A Dutch longitudinal study. *Journal of Deaf Studies and Deaf Education, 11*, 238–251. doi:10.1093/deafed/enj032
- LaBounty, J., Wellman, H. M., & Olson, S. (2008). Mothers' and fathers' use of internal state talk with their young children. *Social Development, 17*, 757–775. doi:10.1111/j.1467-9507.2007.00450.x
- Laible, D. J., & Thompson, R. A. (1998). Attachment and emotional understanding in preschool children. *Developmental Psychology, 34*, 1038–1045. doi:10.1037/0012-1649.34.5.1038

- Levin, I., & Aram, D. (2012). Mother-child joint writing and story-book reading and their effects on kindergartners' literacy: An intervention study. *Reading and Writing: An Interdisciplinary Journal*, 25, 217–249. doi:10.1007/s11145-010-9254-y
- Macaulay, C. E., & Ford, R. M. (2006). Language and theory of mind development in prelingually deafened children with cochlear implants: A preliminary investigation. *Cochlear Implants International*, 7, 1–14. doi:10.1002/cii.22
- Most, T., & Michaelis, H. (2012). Auditory, visual, and auditory-visual perception of emotions by young children with hearing loss versus children with normal hearing. *Journal of Speech, Language, and Hearing Research*, 55, 1148–1162. doi:10.1044/1092-4388
- Most, T., Weisel, A., & Zaychik, A. (1993). Auditory, visual and auditory-visual identification of emotions by hearing and hearing impaired adolescents. *British Journal of Audiology*, 27, 247–253.
- Nellson, K. (2005). Language pathways into the community of mind. In J. W. Astington, & J. A. Baird (Eds.), *Why language matters for theory of mind* (pp. 26–49). New York, NY: Oxford University Press.
- Nevo, B., & Oren, A. (1979). *Hebrew version of Peabody Picture Vocabulary Test*. Haifa, Israel: University of Haifa Press.
- Peters, S., Rimmel, E., & Richards, D. (2009). Language, mental state vocabulary, and false belief understanding in children with cochlear implants. *Language, Speech and Hearing Services in Schools*, 40, 245–255. doi:10.1044/0161-1461
- Peterson, C. C. (2004). Theory of mind development in oral deaf children with cochlear implants or conventional hearing aids. *Journal of Child Psychology and Psychiatry*, 45, 1096–1106. doi:10.1111/j.1469-7610.2004.t01-1-00302.x
- Peterson, C. C., & Siegal, M. (1998). Changing focus on the representational mind: Deaf, autistic and normal children's concepts of false photos, false drawings and false beliefs. *British Journal of Developmental Psychology*, 16, 301–320. doi:10.1111/j.2044-835X.1998.tb00754.x
- Peterson, C. C., & Wellman, H. M. (2009). From fancy to reason: Scaling deaf and hearing children's understanding of theory-of-mind and pretence. *British Journal of Developmental Psychology*, 27, 297–310. doi:10.1348/026151008X299728
- Peterson, C. C., Wellman, H. M., & Liu, D. (2005). Steps in theory of mind development for children with deafness or autism. *Journal of Child Development*, 76, 502–517. doi:10.1111/j.1467-8624.2005.00859.x
- Peterson, C. C., Wellman, H. M., & Slaughter, V. (2012). The mind behind the message: Advancing theory-of-mind scales for typically developing children and those with deafness, autism and Asperger syndrome. *Child Development*, 83, 469–485. doi:10.1111/j.1467-8624.2011.01728.x
- Preisler, G., Tvingstedt, A. L., & Ahlstrom, M. (2002). A psychosocial follow-up of deaf preschool children using cochlear implants. *Childcare, Health & Development*, 28, 403–418. doi:10.1046/j.1365-2214.2002.00291.x
- Rimmel, E., & Peters, K. (2008). Theory of mind and language in children with cochlear implants. *Journal of Deaf Studies and Deaf Education*, 14, 218–236. doi:10.1093/deafed/enn036
- Rieffe, C., Terwogt, M., & Smit, C. (2003). Deaf children on the causes of emotions. *Educational Psychology*, 23, 159–168. doi:10.1080/01443410303229
- Ruffman, T., Slade, L., & Crowe, E. (2002). The relation between children's and mothers' mental state language and theory of mind understanding. *Child Development*, 73, 734–751. doi:10.1111/1467-8624.00435
- Schick, B., deVilliers, P., deVilliers, J., & Hoffmeister, R. (2007). Language and theory of mind: A study of deaf children. *Child Development*, 78, 376–396. doi:10.1111/j.1467-8624.2007.01004.x
- Spencer, P. E. (2010). Play and theory of mind: Indicators and engines of early cognitive growth. In M. Marschark, & P. E. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education* (pp. 407–424). New York, NY: Oxford University Press.
- Symons, D. K. (2004). Mental state discourse, theory of mind and the internalization of self-other understanding. *Developmental Review*, 24, 159–188. doi:10.1016/j.dr.2004.03.001
- Taumoepeau, M., & Ruffman, T. (2006). Mother and infant talk about mental states relates to desire language and emotion understanding. *Child Development*, 77, 465–481. doi:10.1111/j.1467-8624.2006.00882.x
- Taumoepeau, M., & Ruffman, T. (2008). Stepping stones to others' minds: Maternal talk relates to child mental state language and emotion understanding. *Child Development*, 79, 284–302. doi:10.1111/j.1467-8624.2007.01126.x
- Wellman, H., Cross, D., & Watson, J. (2001). Meta-analysis of theory of mind development: The truth about false belief. *Child Development*, 72, 655–684. doi:10.1111/1467-8624.00304
- Wellman, H. M., & Liu, D. (2004). Scaling of theory of mind tasks. *Child Development*, 75, 523–541. doi:10.1111/j.1467-8624.2004.00691.x
- Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, 13, 103–128.
- Woolfe, T., Want, S. C., & Siegal, M. (2002). Signposts to development: Theory of mind in deaf children. *Child Development*, 73, 768–778. doi:10.1111/1467-8624.00437
- Ziv, M., Malki, L., & Meir, I. (2007). Theory-of-mind in children with hearing loss: Its development and guidelines for parents. *Literacy and Language*, 28, 102–118. [Hebrew].