DEVELOPMENT OF THEORY OF MIND IN DEAF AND HEARING CHILDREN: THE EFFECTS OF COMMUNICATIVE EXPERIENCES

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Development of Theory of Mind in Deaf and Hearing Children: The Effects of Communicative Experiences

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ABSTRACT

Development of Theory of Mind in Deaf and Hearing Children:

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The present study investigated understanding of false beliefs in deaf and hearing children. Two nonverbal false belief tests were used to compare deaf children (mean age: 5.2) with two groups of hearing children. The comparison of deaf and hearing children attending preschool (mean age: 5.0) who are matched in terms of spatial cognitive skills showed that hearing children were performing better than deaf children even when tested nonverbally. However deaf and hearing children without preschool experience (mean age: 4.8) who are matched in terms of their parental education level, but not spatial cognitive skills did not differ. Two verbal false belief tests were also used for hearing children Hearing children with preschool experience performed better than the ones without preschool experience in both nonverbal and verbal false belief tests. Skill in spatial cognition was found to be a mediating variable between preschool experience and verbal false belief understanding. The level of dialogical communication during a play session between mother and child was found related to performance on the verbal false belief test in hearing children. Although no association was found between false belief understanding and the number of mental state terms produced by the mothers of deaf and hearing children, there was a significant correlation between the number of mental state terms produced by the mothers and the children. The results are discussed with regard to the effects of language and conversational competence in the acquisition of a theory of mind.

KISA ÖZET

Duyan ve İşitme Engelli Çocuklarda Zihin Kuramı Gelişimi:

İletişimsel Deneyimlerin Etkileri

E.Burcu Sancar

Bu çalışmada duyan ve işitme engelli çocukların 'yanlış kanı' anlayışları araştırılmıştır. İşitme engelli çocukları (yaş ortalaması: 5.2) iki grup duyan çocukla karşılaştırmak için iki tane sözel olmayan 'yanlış kanı atfı' testi kullanılmıştır. Buna ek olarak sadece duyan çocuklar için iki tane sözel 'yanlış kanı atfı' testi uygulanmıştır. İşitme engelli çocuklar, sözel olmayan kognitif beceriler açısından eşit oldukları, yuvaya giden duyan çocuklarla (yaş ortalaması: 5.0) karşılaştırıldığında, testin dilsel gereklilikleri azaltılmış olmasına rağmen duyan çocukların daha iyi performans gösterdiği bulunmuştur. Ancak işitme engelli çocuklar kognitif beceriler açısından kendilerinden daha düşük performans gösteren fakat ebeveynlerinin eğitimleri açısından eşitlendikleri yuvaya gitmeyen duyan çocuklarldan (yaş ortalaması:4.8) 'yanlış kanı atfı' testlerinde herhangi bir fark göstermemişlerdir. Ayrıca duyan çocuk grupları arasında da hem sözel, hem sözel olmayan 'yanlış kanı atfı' testlerinde anlamlı bir fark olduğu ve yuvaya giden duyan çocukların gitmeyenlerden daha iyi performans gösterdiği bulunmuştur. Yuvaya gitme deneyimi ve sözel 'yanlış kanı atfı' testi arasında Uzamsal Dönüştürme Testinin 'aracı etkisi' olduğu gösterilmiştir. Oyun süreci boyunca anne ve çocuk arasında kurulan karşılıklı iletişim seviyesinin duyan çocuklardaki sözel 'yanlış kanı' anlama performansıyla ilgili olduğu, ancak işitme engelli ve duyan çocuklardaki sözel olmayan 'yanlış kanı' anlama performanslarıyla ilgili olmadığı bulunmuştur.

Her ne kadar 'yanlış kanı' anlamanın, işitme engelli ve duyan çocukların annelerinin sözel ve de işaretle ürettikleri 'zihinsel durum' terimleriyle ilgili olmadığı bulunsa da, annelerin ve hem işitme engelli hem de duyan çocukların ürettikleri 'zihinsel durum' terimleri sayısı birbirleriyle ilişkili çıkmıştır. Sonuçlar zihin kuramının ediniminde dilin ve iletişim kabiliyetinin etkileri açısından tartışılmıştır.

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

Theory of Mind (ToM) can be defined as the cognitive achievement that enables one to represent mental states, such as beliefs, desires, hopes, and fears of the self and the others and to attribute such mental states to others and, more importantly to use these attributions in the prediction and explanation of behavior (Garfield, Peterson, Perry, 2001). A practical understanding of mental states helps one to realize that their own behavior and the behavior of others may be formed by cognitive abstractions (i.e. representations), which are not part of the immediately perceptible world (Peterson & Siegal, 2000). Mitchell & Lacohee (1991) states that theory of mind is the representational capability of the mind, that helps to understand that people can have different representations of knowledge and both the self's and the other's beliefs could be changed on the basis of new information. In fact it has been pointed out that autistic children who, through failure to develop theory of mind, are 'mind blind' (Baron-Cohen, Tager-Flausberg, & Cohen, 1993) are likely to be handicapped in appreciating others' beliefs and emotions (Peterson & Siegal, 2000).

Majority of the studies examining theory of mind development have utilized false-belief tasks. False-belief tasks require the understanding that the mind is a representational system, which does not simply reflect reality (e.g. Peterson & Siegal, 2000; Hale & Tager-Flusberg, 2003). In false belief tasks, the child is presented with a scenario in which a character does not have a knowledge that the child possesses. As a result, the child has to understand that the character's belief differs from the child's own and the character will act on the basis of his own belief. There are three different versions of false belief tasks, change-in-location task, appearance-reality task, and unexpected contents task are the frequently used

measures of theory of mind development in children (Baron-Cohen, Tager-Flusberg, Cohen, 1993).

It is a robust and much-replicated finding in the literature that sometime during the preschool years, between 4 and 5 years of age, children acquire this metarepresentational ability to understand that people have thoughts and beliefs about the real world and they act not on the basis of the way things really are, but on the basis of their beliefs (Astington, Gopnik, 1991; Ruffman, Perner, Parkin, 1999; Wellman, Cross, Watson, 2001). Therefore 4- and 5-year-olds can pass false belief tasks, while 3 year olds are poorer performers on these tasks (e.g. Dunn, Brown Slomkowski, Tesla & Youngblade, 1991; Jenkins & Astington, 1996; Farrar & Maag, 2002; Jackson, 2001; Peterson & Siegal, 1999).

Language Development and Theory of Mind

Language development has been suggested to be an influential factor on the acquisition of theory of mind and the linkage between language and false belief understanding has been stated by many researchers (Astington & Jenkins, 1999; Farrar & Maag 2002; Hale & Tager-Flusberg, 2003). Astington & Jenkins (1999) have pointed out that there is a unidirectional relationship between language and theory of mind; i.e. early language abilities predict later performance of children on theory of mind tasks. Moreover, their further analysis of the data shows that it is the syntax (the structural features) of language, which is of particular importance for theory of mind development. Farrar & Maag (2002) also indicated that there were strong associations between early language development and later performance on theory of mind tests. However, they did not posit the direction of the relationship. When they conducted further analysis like Astington & Jenkins (1999) did, they found that even after removing the effects of vocabulary and vocabulary growth, the

association between the early grammatical development and theory of mind measures remained. Both findings are consistent with the argument of De Villiers & De Villiers (2000) that it is the acquisition of the syntax of complementation that enables the child to develop the representational ability required for false-belief understanding. A further finding about the influence of language on theory of mind is stated by Hale & Tager-Flusberg (2003). According to their findings, training preschool children with a mean age of four about sentential complements but not relative clauses significantly increased the scores on theory of mind tasks.

Conversational Experience and Theory of Mind

Research with hearing children has established that interpersonal communication is important in the development of theory of mind. According to Jenkins & Astington (1996), family size is one of the most important factors. In their study, family size remained to be influential in children's false belief understanding even after the effects of age and language were partialed out. Furthermore, another interesting finding was that when children had less linguistic competence, family size emerged to be an important predictor of false-belief understanding. Based on their findings, they suggest that presence of siblings can compensate for lesser linguistic ability, thus theory of mind is not merely a matter of vocabulary and syntax; early conversational experience can prompt social understanding, which contributes to theory of mind development.

Dunn, Bretherton and Munn (1987) also indicated the importance of early communicative experiences of children by showing in a longitudinal study that there is a strong relation between the mental state talk of the mother and the older sibling and the child's speech about mental states. Furthermore in another study Dunn, Brown, Slomkowski, Tesla and Youngblade (1991) found that children's

participation in family discourse about feelings and causality as well as positive interaction with siblings had an important impact in their development of theory of mind. Perner, Ruffman and Leekam (1994) highlighted the importance of early communicative experiences of children by showing that number of siblings in a family is strongly associated with children's reasoning in theory of mind tasks. It was suggested that early social interaction with siblings have a beneficial effect on the understanding of false belief. A similar finding was also obtained by Youngblade and Dunn (1995) indicating that children participate more in pretend play with their siblings than with their mothers and the amount of pretend play was related to children's developing understanding of other people's beliefs and feelings. It was also shown in another study (Lewis, Freeman, Kyriakiou, Mariadaki-Kassotaki, & Berridge, 1996) that elder siblings had an important effect on children's developing theory of mind, suggesting the significance of social environment in providing the child an opportunity to play and converse with siblings which is an in important factor in the development of theory of mind.

Another factor that is related to children's early communication experiences is the socioeconomic background of the family. Previous research has pointed out that amount of parental talk with the child is strongly related to the social and economic conditions of the family (Hart & Risley, 1992, 1995). Several studies have shown that the socioeconomic status of the family is a factor that affects children's developing a theory of mind, highlighting the importance of early communication experiences (Cole & Mitchell, 1998; Cutting & Dunn, 1999; Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991).

The evidence demonstrates that development of theory of mind is dependent upon both language and social experience and develops with the contributions of

both linguistic and social competence, acquired through conversation and interaction with others (Garfield, Peterson, & Perry, 2001).

Deaf Children and Theory of Mind

Development of theory of mind in deaf children is a relatively new area of research and yields important outcomes in understanding the role of language and social experience in theory of mind development. Several studies have claimed that there are serious delays in the development of ToM in deaf children of hearing parents (Peterson & Siegal, 1998,1999; Woolfe, Want, & Siegal, 2002; Lundy, 2002; de Villiers & de Villiers, 2000; Jackson, 2001; Courtin, 2000; Rhys-Jones & Ellis, 2000; Peterson, 2002; Courtin & Melot, 1998; Peterson, 2004). Several factors, such as delayed language development and deprivation from early communication opportunities were pointed out to account for this observed delay in deaf children of hearing parents.

Delayed Language Development in Deaf Children

In contrast to deaf children of deaf parents and hearing children of hearing parents who go through a normal pattern of language development (Courtin & Melot, 1998), a child who is born profoundly deaf into a hearing family is likely to experience many departures from the normal course of development of language (Garfield, et al., 2001; Marschark, 1993). In cases where both child and parents are deaf or hearing, the parents and child communicate through a common channel of communication. But ninety percent of deaf children are born to hearing parents and these children cannot have access to conventional language because of their profound hearing deficits that prevent them from acquiring the language spoken around them. Moreover as Marschark (1993) stated some of the hearing parents of deaf children do not choose to learn or to expose their children to a conventional sign language and

chose to educate them in oral language with the help of hearing amplifiers and through the use of lip reading. Even when hearing parents made extensive efforts to learn sign language, it was rare for them to attain the same level of proficiency as a native signer (Lundy, 2002; Lederberg, Everhart, 2000). Thus it was proposed that many profoundly deaf children had no available means of conversing with any of their hearing family members, especially about topics that have no visual referent, until they enter a signing primary school (Garfield et al., 2001). However, another line of research about deaf children showed that deaf children of hearing parents who are not exposed to sign language often develop their own gesture systems, called 'homesign', to communicate with members of the surrounding hearing community (Goldin-Meadow, 2003; Morford, Goldin-Meadow, 1997). Moreover it was found that despite the absence of a shared linguistic code, deaf children still succeeded in referring to nonpresent by generating novel gestures. Although they do this less frequently than hearing children, they were able to extend their communication beyond the 'here and now' (Morford & Goldin-Meadow, 1997). However these gesture systems developed by deaf children were not developed into a system that meet the requirements of a full language (Goldin-Meadow, 2003).

Communicative Experiences in Deaf Children

Although a line of research examining the effect of hearing impairment in mother-child interaction showed that there was no difference between hearing and deaf children in terms of the security of their attachment and mother's responsiveness (Lederberg & Mobley, 1990), Marschark (1993) acknowledged that deaf children have difficulty in communicating with family members and friends and are especially deprived of talk about mental states. Furthermore Courtin and Melot (1998) stated that hearing mothers of deaf children discussed their emotions and

intentions rarely and even if they did, they adopted a didactic role that discourages conversational exchange.

The literature concerning the development of theory of mind in hearing children showed that early communication opportunities were of great importance for the development of theory of mind (e.g. Dunn, Brown, Slomkowski, Tesla & Youngblade, 1991). However deaf children of hearing parents have difficulty in access to conversations about other people's beliefs and intentions since their hearing impairment prevents them from hearing their family members discuss feelings, thoughts, and intentions. Moreover deafness is also an obstacle for deaf children of hearing parents in sharing their thoughts and feelings (Marschark, 1993). Thus a normally intelligent and sociable deaf child with no impairments apart from auditory handicap is likely to be blocked from conversation owing to the simple lack of a fluently shared common language (Garfield et al., 2001). Several researchers have theorized that restricted interpersonal communication about mental processes account for the observed delays in ToM development in deaf children (Courtin, 2000; Rhys-Jones, Ellis, 2000; Peterson, Siegal, 2000).

In a similar line Peterson & Siegal (1998) compared the false belief performance of autistic and signing deaf children of hearing parents with hearing children of hearing parents. The results revealed that there was no difference between deaf and autistic children (mean ages are 8,5 and 10 respectively), both performing poorer than hearing counterparts. It was suggested that the deprivation from abstract mental state conversations deaf children of hearing parents experience while growing up could be the reason of their poorer performance. It was also stated that the hearing parents of deaf children rarely achieved the same level of fluency in sign language as a native speaker and they usually reported that they often had particular problems

conversing about abstract concepts like thoughts and beliefs (Garfield et al., 2001). Similar findings were also reviewed in Peterson and Siegal (2000) indicating that deaf children of hearing parents were delayed in the acquisition of theory of mind and performed no better than autistic children. This was suggested to be due to the rare sharing of emotions and intentions of hearing mothers with their deaf children. They suggested that spontaneous mention about mental contents might trigger the growth of the level of social understanding and increase the performance on ToM tasks by motivating them to focus on one's own and other's abstract ideas, mistaken and pretend beliefs.

Previous studies demonstrated that theory of mind is acquired significantly earlier in deaf children of deaf parents than in deaf children of hearing parents. Courtin (2000) found that native signers performed even better than hearing children of hearing parents. Moreover the performance of deaf native signers was above late-signing children, which was in turn better then the performance of orally educated profoundly deaf children. However the native signer's better performance than the hearing children was attributed to the low social economic status (SES) of the hearing children who participated in the study in order to match the SES level of deaf children. In another study by Peterson and Siegal (1999), hearing children and native signing children performed similarly in false belief tasks. Furthermore their performance exceeded the orally educated deaf and non-native signing children from hearing families. It was concluded that being exposed to a shared language facilitated the performance of native signer deaf children, whereas the deaf children who learnt sign language in their preschool years or educated in oral speech were severely delayed in their theory of mind understanding. Moreover another study by Woolfe, Want and Siegal (2003) showed the effect of positive siblings relations in deaf

children of deaf parents predicting ToM scores over the effect of age, as also found for hearing children (e.g. Dunn, Brown, Slomkowski, Tesla and Youngblade, 1991).

From a similar point of view, Woolfe, Want & Siegal (2002) present another finding that emphasizes the importance of early communication. When they compared native signing deaf children (of deaf parents) and late signer deaf children (of hearing parents) they have found that despite their younger age, native signing children's performance on theory of mind tasks were significantly better than their late-signing counterparts who were matched for BSL (British Sign Language) proficiency and spatial mental age. Moreover, these two groups performed similarly on executive function tasks. Thus, their finding suggests that language alone was not capable of explaining the difference between these two groups. It was concluded that the earlier expression of theory of mind in native signer children was the end product of social understanding mediated by early conversational experience, which late signer deaf children seemed to fall behind in terms of their later access to communication means.

In an interesting study by Lundy (2002), it was demonstrated that there was a 3-year delay in the development of ToM in deaf children of hearing parents. Deaf children who were attending schools teaching sign language were able to pass traditional ToM tasks between the ages of 7 and 8. It was suggested that since most deaf children entered school and began to learn sign language at about 3 years of age, by the age 7 and 8 they would have been interacting with their teacher who communicates in sign language for about four and a half years, which was the age hearing children usually pass ToM tasks. Thus 4 years of accessible language and mentalistic conversation was suggested to facilitate deaf late-signing children to pass the ToM task at 7-8 years of age. In another study although age was also found to be

correlated with theory of mind performance, the deaf children between the ages of 13-16 were able to perform significantly better in the standard false belief tests than the younger deaf children (Russell, Hosie, Gray, Scott, Hunter, Banks & Macaulay, 1998). Thus there is a consensus about the delayed theory of mind development of deaf children of hearing parents when tested with standard false belief tests, but it is not clear until what age this delay continues.

However a contradictory finding is stated by Jackson (2001), she did not find any significant difference of theory of mind performance among deaf groups with different communicative experiences (native signers, non-native signers, orally educated deaf children) and hearing children performed better than the deaf groups. Moreover it was also found that there was a strong association between language ability and theory of mind performance and it was suggested that properties specific to language were required for ToM development, over and above age-related experiences.

In their detailed review of ToM development in normally developing, deaf, blind, autistic children and children with Williams syndrome Garfield, Peterson, and Perry (2001) presented a framework that demonstrates ToM was dependent upon both language and social experience and produced by a combination of language acquisition with children's growing social understanding, acquired through conversation and interaction with others. Moreover, it was reported that deaf children who are earliest to develop concepts of false belief are the ones who have greatest access to fluent and varied communication with family members.

Peterson and Siegal (2000) concluded that children with normal social intelligence, normal social experience and normal linguistic development would develop theory of mind normally, however impairment in any of these areas would

impair theory of mind development. Furthermore the findings that report a similar pattern of development in deaf children of deaf parents with the hearing children of hearing parents (e.g. Peterson, 1998) suggests that theory of mind requires both social interaction and the linguistic skill to converse with family members and peers about mental states.

Measurement of Theory of Mind

There is a debate in the literature about the use of standard false belief tests for assessing development of theory of mind in both deaf and hearing children (Marschark, Green, Hindmarsh, Walker, 2000; Figuaras-Costa & Harris, 2001). Call and Tomasello (1999) stated that the use of standard false belief tests with young children was problematic since they rely on sophisticated linguistic interactions in which the children were asked what another person would do or even what another person would think or believe. According to Call et al., (1999) this kind of questions involve use of linguistic structures in which one proposition is embedded in another and they require the children to imagine a situation that conflicts with what the child knows to be the case in reality, this might require some skills of inhibition, rather than theory of mind. They suggested that this might create alternative explanations for why children younger than three are not able to pass false belief tests.

Indeed, there are findings showing that when the theory of mind tasks are modified, even 3 years olds are able to pass those tasks (Mitchell & Lacohee, 1991; Siegal & Beattie, 1991). Chandler and Hala (1994) were able to show that 3-year-olds perform better on false belief tests when the tests were acted out with the personal involvement of the children and linguistic demands were minimized (e.g. Chandler, Fritz, & Hala, 1989). Moreover the results of the meta-analysis study of Wellman, Cross and Watson (2001) showed that the active participation of the

children in the test aided performance supporting Chandler and Hala (1994). Similar findings were also reported for deaf children who perform above chance levels in 'false photograph', 'false drawing', and 'draw false belief' tests, when the procedure was revised in a way to make the context more salient for the child or getting the child's active participation in the test (Peterson & Siegal, 1998; Peterson, 2002).

However most of the studies investigating development of theory of mind in deaf children utilized verbal false belief tasks through the use of sign language or oral language depending on the education and the preference of children (e.g. Peterson, Siegal, 1998,1999; Jackson, 2001; Courtin, 2000; Russell, Hosie, Gray, Scott, Hunter, Banks, Macaulay, 1998, Lundy, 2002). Several studies developed nonverbal measures to assess development of theory of mind in deaf children due to the fact that the linguistic characteristic of ToM tasks could be an important factor that is contributing to the observed delay in development of ToM in deaf children (e.g. de Villiers & de Villiers, 2000; Figuaras-Costa & Harris, 2001).

In a study by de Villiers, de Villiers (2000) a verbal standard 'unexpected contents' and a nonverbal version of the 'unexpected contents' test were used to examine the understanding of false beliefs in orally educated moderately to severely deaf children. In this nonverbal version in spite of asking what a protagonist would think is in a familiar box with unexpected contents, stories illustrated in multi-picture sequences were presented and the children were asked whether the protagonist would be surprised or not after finding the unexpected contents in a familiar box. It was found that in both standard verbal false belief test and non-verbal false belief test oral deaf children were delayed in comparison to hearing children. Thus, on the basis of this finding it was concluded that it was not the language of the tasks that lead to delay.

In another study, Figureas-Costa and Harris (2001) adapted the non-verbal false belief test originally developed by Call and Tomasello (1999), to investigate development of false belief understanding in orally educated severely and profoundly deaf children. This nonverbal test was a hiding-finding game that requires the personal involvement of the child who plays the game with two experimenters. In contrast to the findings of de Villiers et al., (2000), the non-verbal test facilitated performance of deaf children in comparison to the verbal version of this test, in which children are explicitly asked about the false belief of the experimenter. Despite this facilitation, only older deaf children with a mean age of 9.7 years performed above chance levels on this non-verbal task as compared to the younger group with a mean age of 5.6 years, who are at the average age when hearing children normally pass standard false belief tests.

1.1. Statement of Problem

The literature about development of theory of mind in deaf children is in agreement that deaf children are severely delayed in their false belief understandings. The reasons suggested to account for this delay are the obstacles that deaf children encounter in their development of language, conversation and social experience, which are also pointed out as the important factors that affects the development of theory of mind in hearing children (Garfield et al., 2001). However the communicative experiences of deaf children with their mothers have not been studied in relation to theory of mind development. Moreover, most of the researches base their findings on the verbal false belief tests whose use are also controversial in hearing children (Chandler & Hala, 1994).

The aim of the present study was to investigate the effects of differences in communicative experiences of deaf and hearing children of hearing parents on their

development of ToM using two non-verbal false belief tasks. In addition to this, hearing children were also tested with verbal false belief tests in order to detect any differences due to the nonverbal characteristics of the tests. Three factors were investigated as aspects of communicative experiences children have at home. The first one was the child's hearing status (i.e. deaf or hearing child of hearing parents). The second variable was the interactional style the child had with mother through dialogical communication and the last one was their exposure to mental state terms (such as *think, know*, etc.) in their communication with mother.

Moreover both hearing and deaf children were compared in terms of their level of cognitive development assessed with the Spatial Transformation Test (Levine, Huttenlocher, Taylor & Langrock, 1999), which was administered nonverbally and measures the ability to mentally transform spatial stimuli. In the present study it was aimed to match deaf and hearing children in terms of their performance on the Spatial Transformation Test and their social economic background.

The age range of deaf children in this study was between preschool years to early primary school years. In contrast to Lundy's (2002) sample, the deaf children in this study were not educated in sign language. Thus, the children did not have any experience with a communication partner who communicates in sign language and as a result it was expected that the interactional style the deaf children have with their mothers and their exposure to mental state terms, not age, would be important predictors in their performance on non-verbal false belief tasks. Moreover it was also proposed that children's use of mental state terms would be dependent on their exposure to mental state terms.

In summary, this study conducted a detailed analysis of the communicative experiences of deaf and hearing children and examined the children's performance on false belief tests in relation to their communicative experiences.

1.2. Hypotheses

In line with the previous literature, the following hypotheses are formed:

1) Deaf children will perform lower than their hearing counterparts on false belief tests.

2) The more dialogical responsiveness is achieved in the interaction between the mother and the child, the better the child will perform on false belief tests.

3) The more the child is exposed to mental state terms (in speech and gesture for both deaf and hearing children), the better the child will perform on false belief tests.

4) The more the child is exposed to mental state terms (in speech and gesture for both deaf and hearing children), the more the child will produce mental state terms.

2. METHOD

2.1. Participants

The total sample consists of three groups of children: a) 12 severely and profoundly deaf children from hearing families with a mean age of 5 years 2 months (range: 4,6 to 7,0); b) 17 normal hearing children from hearing families with a mean age of 4 years 8 months (range: 3,0 to 7,0); c) 15 normal hearing children from hearing families, attending the day care center of Bogazici University in Istanbul, with a mean age of 5 years (range: 4,3 to 6,6). Initially the total sample included 50 children; however six children who failed the training items of the spatial transformation test were eliminated from the study (one child from the deaf group, four from the hearing group not attending preschool and one from the hearing group attending preschool). Thus the final sample included 44 children.

In the deaf group there were 8 girls and 4 boys and they had all been diagnosed with congenital hearing loss equal to or greater than 70dB HL. According to the classification system used by Turkish Medical Association hearing loss more than 60dB is in the severe category and the hearing loss over 95dB is in the profound category (Yucel, 2004). The children had no known handicaps apart from deafness. All of the children had hearing aids and only one of them had cochlear implant for one and a half year. Their parents were not deaf and did not know sign language. All deaf children expect one had attended a special education program for deaf children emphasizing speech therapy for a period of at least one year. These special education programs principally taught children vocalization using a method called lip reading. Furthermore, 4 of the deaf children had begun the first grade in the primary school for deaf after attending special deaf education. These school children were also included in the study, since previous research on the development of theory of mind

Table 1- Characteristics of the experimental groups

Group	Hearing Status	Education Experience	Number of Participants			Mean Age in Years (in months)	Paternal Education Level (Mean number of years of schooling)	Maternal Education Level (Mean number of years of schooling)	Mean Number of Siblings	
			Girls	Boys	Total				Elder	Younger
1	Deaf	Special Deaf Education	8	4	12	5.2 (68.0)	7.2	6.7	1.1	0.3
2	Hearing	No Preschool Experience	5	12	17	4.8 (61.5)	7.4	7.4	1.1	0.2
3	Hearing	Preschool Experience	3	12	15	5.0 (64.9)	13.3	11.7	*	

(*) data concerning the number of siblings was not collected from this group

in deaf children indicated that even at school ages deaf children may not achieve a full understanding of false beliefs (e.g. Peterson & Siegal, 1999; Rhys-Jones & Ellis, 2000; Lundy, 2002 among others). All of the children were from lower-middle SES families living in Istanbul.

In the hearing group there were 5 girls and 12 boys, who did not attend preschool and only one had started the first grade in primary school. These children had no known mental or physical disability. The selection criterion for this group was its comparability to the deaf group in terms of family background. They were from lower-middle SES families living in Istanbul, the parents of the children had similar occupational status and educational background with those of the deaf sample.

The comparison of the deaf and the hearing groups on a nonverbal cognitive capacity test revealed that the hearing group scored significantly lower than the deaf group. Thus an additional group of hearing children from hearing families was included in the study as a comparison group with some preschool education experience and comparable level of cognitive competence. In this second hearing group there were 12 boys and 3 girls. The children had no known mental or physical disability. They had been attending the day care center in Bogazici University in Istanbul for at least one year. They were from middle SES families and their parents were the staff and the faculty of the University. Table 1 illustrates the characteristics of the children in three groups.

2.2. Instruments

I) False Belief Tasks: Two non-verbal false belief tasks were used to measure the understanding of false beliefs in deaf children, whereas two nonverbal and two verbal false belief tasks were used for hearing children. The reason for using non-

verbal tasks in both groups is to create a standard testing situation in which the two groups can be compared and the reason for using two additional verbal false belief tasks in hearing children is to identify the possible performance differences due to the non-verbal characteristic of the non-verbal false belief tasks.

A) Non-Verbal False Belief Tests

a) *'Find the Sticker' Test*: The first non-verbal false belief test was developed by Call and Tomasello (1999). It also has a verbal version that was administered only to hearing children.

Materials: The materials were two identical opaque containers and cartoon stickers used as reward (see Appendix 1).

Procedure: Participants were introduced to a collection of stickers, with which they would play a hiding-finding game. Since this was a non-verbal test, a gesture (i.e. left hand held facing right hand and right hand in fist move to left hand) was used to refer to 'sticker' during the test. Before the testing began, the child was taught that this gesture refers to 'sticker' by first introducing the gesture with a sticker and then playing a game, in which they were required to do that gesture to take the sticker from the experimenter. At least 2 trials of this game were played to make sure that the child understood the relation between the gesture and the sticker. After the child succeeded on two successive trials of the gesturing sticker game, one experimenter (the hider) sat on a chair behind a table covered with a cloth and asked the child to sit on chair at the opposite side of the table, facing the hider. The hider showed the containers and a sticker to the child. The other experimenter (communicator) sat on a chair behind the hider so as to have a good view of the child's face and the hider's actions under the table. The communicator's role was to observe the hiding process and at the appropriate point in the procedure, to indicate for the child the sticker's

location by pointing to the appropriate box. The experiment had three phases: pretest, control tests and false belief tests. In all phases, the location of the sticker was randomized, with the restriction that it was never placed in the same container for more than two successive trials.

i) Pretest: The hider hid the sticker in one of the containers under the table. The cloth, which was placed on the table, restricted the child from seeing the hiding process. During this hiding process, the communicator leaned forward and intently observed the process. After the hider hid the sticker, the containers were placed on the table in full view of the child. At this point the communicator pointed the container containing the sticker, making sure that the child saw this pointing action. The hider, then, asked the child where the sticker was (by flipping and doing the gesture used to refer to 'sticker') and then permitted one of the containers to be chosen. If the child finds the sticker, it can be kept. Otherwise, the hider proposed trying to find another sticker and conducted another trial. Pretest trials were administered until the child gave correct responses on three consecutive trials. The main point of the pretest was to demonstrate that the children understood the intention of the communicator to help them in finding the sticker.

ii) Control Tests: Three necessary prerequisites for successful performance in the false belief task were tested in the control tests. These were: 1) the ability to follow the sticker as it is visibly moved from one container to another (visible displacement); 2) the ability to follow the sticker as the container in which the sticker is known to reside is displaced (invisible displacement); 3) the ability to override the communicator's indication by pointing when it is known to be false (ignore the communicator).

Children were presented with the trials of each type in the order (1, 2, 3). The children that fail one of these trials were presented with that trial one more time. Testing was not continued with children who could not pass any control trial twice.

The visible displacement test: The hider hid the sticker in one of the containers under the table and then presented the containers to the child on the table. The communicator pointed to the correct container. After that, the communicator turned his back covering his face with his hands. Then the hider opened both containers and then changed the place of the sticker in full view of the child and closed both containers. After that the hider told the communicator to turn back to the table and the communicator turned back and the hider asked the child to find the sticker.

The invisible displacement test: This was identical to visible displacement task, except that instead of changing the location of the sticker in full view of the child, the hider simply switched the locations of the containers after the communicator pointed the correct container and turned his back. The point of this test trial was to make sure that the child is able to follow the movement of the sticker as the container in which the sticker is known to reside is displaced (similar to a stage 6 object permanence task).

Ignore-communicator test: This was also identical to the visible displacement test except that the communicator pointed to the container after turning back to the table. Thus, as before, the hider hid the sticker and presented the containers to the child. In this case, however, instead of pointing to the correct container, the communicator turned his back covering his face with his hands. As the communicator was sitting with his back turned to the table,

the hider looked at him and then opened both of the containers and changed the location of the sticker. Because the sticker's location was changed while the communicator was not looking, when he turned back to the table he pointed to the incorrect container. After that the hider presented the containers to the child and asked the child to find the sticker.

iii) False Belief Tests: The hider hid the sticker under the table and presented the containers to the child, and at this point the communicator turned his back to the table. While he was not looking, the hider changed the locations of the containers. Then the communicator returned and pointed to the incorrect container (since he did not see that the locations of the containers were changed). The hider then asked the child to find the sticker. The difference of the test from the *ignore-communicator control test* is that until the moment the communicator pointed to the incorrect container, the child had no knowledge about the place of the sticker (in the control test the place of the sticker was changed in full view of the child by opening both containers). So after the communicator pointed to the incorrect container, the child must think that the communicator did not see the hider changing the locations of the containers, so he must be pointing to the incorrect container. Three trials of this false belief test were administered and the number of trials the child passed was counted as the child's score on the nonverbal 'find the sticker' false belief test.

b) '*What face: Surprised or not' Test*: The second nonverbal false belief test (de Villiers, de Villiers, 2000) was also administered to both deaf and hearing children. This test was developed as the non-verbal version of the unexpected contents task. There were four stories that were illustrated in five sequential pictures.

(see Appendix 2). The main difference from the verbal unexpected contents test was that in this non-verbal procedure, rather than verbally reporting what someone thinks is in the box, the child must predict whether a character is surprised or not when she sees the contents. They do this by choosing the picture of the right facial expression amongst those presented on separate cards to stick on the character's blank face in each story. This task asks the child to identify the other's reaction to the violation of expectation, whereas in the unexpected contents task the child is asked about the other's expectation. Thus, in a way this task goes one step further in the inferential chain and the 'what face' test is a more complex test than the 'unexpected contents' test.

i) Pretest: The aim was to establish that the children know the facial expression corresponding to surprise. A general idea of the procedure was demonstrated to the child by presenting multi-picture sequences involving a character, who is surprised by an event. In the pretest the children were given the chance to complete the character's face as directed, and were given corrective feedback if they chose the inappropriate expression.

ii) False Belief Test: Four stories each consisting of five pictures in sequence were presented to the child. In two of the stories the correct choice is the 'surprised' face and in the remaining two it is the 'not surprised' face depending on the character's seeing or not seeing an object being put into a container by the other character. Two of the stories were developed on the basis of the stories used in de Villiers et al. (2000). The other two were versions of these tests using different objects and containers.

In the 1st picture, a character is shown with an object (i.e. doll in the first story, pencil in the second story and key in both third and fourth stories).

After the picture was shown to the child, the experimenter pointed to the focal object in the picture to make sure that the child saw the object.

In the 2nd picture, the character emptied the usual contents out of a familiar container that predisposes the viewer to expect particular contents (i.e. bottles were removed from the refrigerator in the first story, trays were removed from the oven in the second story, crayons were removed from the crayon box in the third and forth stories). After the presentation of the 2nd picture, the experimenter pointed the contents emptied from the box.

In the 3rd picture, the character puts the object from the first picture (i.e. doll, pencil or key) into the familiar container in the 2nd picture (i.e. refrigerator, oven or crayon box).

Two different versions of pictures 2 and 3 were drawn. In one version (the 'not surprised' version) the friend of the character is closely watching the character's actions as the usual contents of the container are removed and the unusual contents are substituted. In the second version (the 'surprised' version), the friend does not see the substitution.

In the 4th picture, the friend is shown with the closed container and about to open it.

In the 5th picture, the friend opens the container and its unusual contents are revealed. In this picture the friend is drawn with a blank face. The child is asked to place the surprised or not surprised face on the blank face in the last picture.

The order in which children take the four different picture-stories was counterbalanced for each child. The number of correct answers in four false belief stories was counted as the child's score on the nonverbal 'what face' test.

B) Verbal False Belief Tests:

a) *'Find the Sticker' Test:* The verbal version of this test was also developed by Call and Tomasello (1999). It was administered only to hearing children. It had two trials and it was an enactment of Sally-Ann location change false belief task. Just like in the nonverbal version, the hider hid the sticker under the table as the communicator sat behind her and intently observed the hiding process. After that the hider presented the containers to the child on the table and the communicator turned his back covering his face with his hands. Following the communicator's turning back, the hider opened the containers and changed the location of the sticker in full view of the child. At this point, while the communicator's back was still turned to the table, the hider asked the child which container the communicator would point when he turned back to the table. After the child gave an answer, the communicator was asked to turn back to the table and to tell where the sticker was. The communicator pointed to the incorrect container and the hider asked the child the location of the sticker. Children's correct answers to both questions, i.e. the incorrect container the communicator would point and the correct container where the sticker was, were counted as the passing criteria for passing one trial. Moreover the number of trials the child passed was counted as the score of the child on the verbal 'find the sticker' test.

b) *Unexpected Contents Test*: The second verbal false belief test, which was used only with hearing children, is the unexpected contents test (described by Perner, Frith, Leslie, Leekham, 1989). Children were shown a familiar container (e.g. candy box, band-aid box or chewing gum box) and asked what is inside the container to make sure that the container was familiar to the child. After they have given the answers, the container was opened and the unexpected content (e.g. pencil, school

label) was revealed. Then the unexpected content was put back into the container and its lid was closed tightly. After this the children were asked what their friend or sibling who was not in the room would say was inside the container when he/she sees it. There were two trials of this test, each performed with different containers (candy box, band-aid box or chewing gum box) and different contents (pencil, school label). The order of the two trials was counterbalanced for each child. The number of trials the child passed was counted as the child's score on the verbal 'unexpected contents' test.

II) Assessment of Communicative Experiences

Communicative experiences children have at home with their family were assessed by an interview with the mother and a play session during which the child played with the mother. This assessment was done only with deaf and the hearing group who did not attend preschool.

A) *Communicative Experience Interview*: The interview included questions about the siblings, number of people living at home with the child, child's daily activities at home and outside the home. For the deaf children, additional questions were posed concerning the preferred communication style at home and outside the home. Some of the questions entailed some specific information about probable difficulties the child and the mother can have in their communication such as 'how well do you think your child can understand you when you communicate with him/her in your preferred communication style' and 'how well do you think you can understand your child when he communicates with you in his preferred communication style'. An additional question was also asked about the mother's planning to learn sign language in the future. This interview was recorded. The questions that were asked in the interview are presented in appendix 3.

B) *Assessment of Interactional Style:* Mothers were asked to play with their children, in the natural way they always do. They were videotaped during the free play with age-appropriate toys, the sets of which included living room and kitchen furniture, a carpenter set, dolls and a puzzle. The duration of the play session varied from child to child with a mean period of time 15 minutes and 26 seconds (range: 25 minutes 42 seconds to 7 minutes 48 seconds) for hearing children. For the deaf children the mean period of time was 17 minutes 16 seconds (range: 23 minutes 40 seconds to 8 minutes 21 seconds).

Coding procedure: The aim of this coding was to identify the amount of time the mother-child dyads spend in dialogical communication, either oral or gestural. First the communicative behaviors during the play session were identified using the criteria which is based on the previous communication coding procedures (Goldin-Meadow& Mylander, 1984; Lederberg & Everhart, 2000) and described below.

Communicative behaviors are defined as any oral (i.e., speech) or visual (i.e., gestures or attentional touch) behaviors used only to communicate something to the other person. The first criterion that is used to discriminate communicative behaviors from functional acts is that they should be intentional. Intentionality is indicated by either a) a look toward the partner or b) by responding to the partner's communication or c) an attempt to start a communication with the other. The second criterion is that communicative act cannot serve a purpose other than communication. For example, the child's moving his hand toward an object after pointing it, was not considered as a communicative behavior, since it is a functional act to get the object.

After the identification of the communicative behavior of a partner, the response of the other partner is important. In order for a communication attempt

(either visual or oral) to be considered as part of a shared communication, it should be responded by the other partner. The period of time in seconds in which the dyads continue their communication is coded. In cases in which a communicative attempt of a partner is not responded to by the other in more than 3 seconds, this is considered as the end of the dialogical communication. For example, mother asks the child 'where shall we put that?', child points to the place, mother shakes her head. All of these communicative behaviors are considered in a sequence of dialogical communication and the time elapsed in this communication is coded. If the child responds to the mother after 3 seconds, that communicative behavior was considered to be the beginning of another dialogical communication sequence.

This coding was done by the experimenter and a second coder also coded the play sessions of two deaf and two hearing children in order to establish reliability. The agreement was 75 %.

C) *Exposure to Mental State Language:* This is the measure of the extent to which children are exposed to mental state language (e.g., think, forget, understand, know, pretend etc.). It was assessed by calculating the number of mental state terms either in gesture or speech in the utterances produced by the mother during the play session. Since deaf children in this study are educated in lip reading, mental state terms produced by the mother in speech were also counted for deaf children.

D) *Production of mental state terms:* This is the measure of the children's own production of mental state terms. It was assessed during the play session by calculating the number of mental terms produced by the child in both gesture and speech.

III) Spatial Transformation Test:

An additional testing of cognitive development was included in the study to be able to compare the children in all groups in terms of nonlinguistic cognitive functioning. The spatial transformation test developed by Levine, Huttenlocher, Taylor, and Langrock (1999) was chosen specifically because it is a nonverbal test.

Materials: Each test item was presented in two cards, on one of them there were the target pieces, i.e. the two pieces that made the target shape when mentally moved, and on the other card there four choices in 2 X 2 array. The target pieces were printed in black on 13, 97 cm X 20.32 cm white cards. The four choice shapes were also printed in black and displayed on 22.86 cm X 25.40 cm white cards (see Appendix 4).

Procedure: The spatial transformation task consisted of 4 training items and 32 problems, each involving a different target shape. On each problem, the child was shown two halves of a shape that had been divided along the vertical axis. The child's task was to select the whole shape among the four choices in a 2 X 2 array that could be formed from the halves. An example of a spatial transformation task item is presented in Appendix 2. The target shape appeared eight times at each of the four possible positions in the 2 X 2 array. The position of the target shape in the choice array was randomly varied across trials, with the constraint that it could not appear in the same position on more than two consecutive trials.

During the administration of the test, both the stimulus card (card with the target pieces) and the choice array (card with four whole shapes) were placed on a table in front of the child. The choice array was placed closest to the child, and the stimulus card with the target pieces was placed directly above it. The four training items were presented before the test items. The training items consisted of familiar

objects, such as animals, furniture, fruits and clothes. On the first item, the cards were placed as described above and the experimenter pointed to the target pieces and made gesture for 'broken' (i.e. by first putting both hands in fists together facing down and then moving the hands in fists to sides facing each other). And then the experimenter made another gesture to refer to 'the whole' by putting the hands in fists facing each other and then flipped towards the choice array. No corrective feedback was given about the child's answer in the test items.

After the presentation of the training items, the test items were administered in the same way. Four different forms of the task were used in the study and the forms were counterbalanced in each group. The forms varied in the positioning of the target pieces for a particular target shape but were identical in the order of the 32 target shapes. The responses to the test items were coded as correct if the child initially points to the correct item. The responses were considered as incorrect if the child changes his/her mind and points the correct item after pointing the incorrect one.

2.3. Procedure

The deaf children and the hearing children who were not attending preschool were visited in their homes. The data from hearing group attending preschool were collected in the day care center.

Procedure with deaf children: The sessions began with the play session with the mother. The non-verbal false belief tests followed the play session. After the false belief tests, there was a small break, which was followed by the spatial transformation test. Then the mother was interviewed with the communicative experiences and demographical information questionnaire. The durations of the sessions were approximately three hours and the whole session was videotaped. The non-verbal false belief tests were presented in counterbalanced order to each child:

half of the deaf children received the 'find the sticker' non-verbal false belief test first, whereas the other half received the 'what face' non-verbal false belief test first.

Procedure with hearing children: The sessions started with the play session with the mother, which was followed with one of the non-verbal false belief tests. The order in which hearing children receive the two non-verbal false belief tests was counterbalanced: half of the children first took the 'find the sticker' non-verbal false belief test and the other half took the 'what face?' non-verbal false belief test first. After the two nonverbal false belief tests, there was a small break, which was followed by the two verbal false belief tests. Then there was another small break that was followed with the spatial transformation test. For half of the hearing children this order was counterbalanced: they first received the spatial transformation test and after a small break they were tested with the nonverbal false belief tests and then with the verbal false belief tests. The sessions ended with the interview with mother. This interview included the communicative experiences and demographical information questionnaire. The sessions lasted approximately three hours and the whole session was videotaped.

Procedure with hearing children attending preschool: These sessions were conducted in the day care center and the children were tested with the four false belief tests and the spatial transformation test. The children were initially tested with the spatial transformation test. The order in which the false belief tests were administered was similar to the other hearing group, i.e. they all received the two nonverbal false belief tests first and then the other two verbal false belief tests. Demographical data about the children was gathered from the day care center. Since the decision to add this group to the study was to provide a cognitively matched group of hearing children to compare the deaf sample in false belief understanding and further data collection and

coding could not be handled within the limited scope and time restrictions of the study, the play session data were not collected from this group.

3. RESULTS

Analyses concerning the demographical characteristics, such as age, parental education level and number of siblings are presented in the first section. The results of the Spatial Transformation Test are reported in the second section. The third section presents the results concerning the hypotheses. Further analyses are reported in the forth section. In the final section the regression analyses investigating relations between different variables are presented.

3.1. Demographical Characteristics:

The demographical characteristics of the children are presented in Table 1 in the methods section in page 17.

a) Age: A one-way ANOVA was conducted to investigate age differences between the groups (deaf children, hearing children not attending preschool and hearing children attending preschool); the test results were not significant, $F(2, 41) = .663$, $p = .521$. There was no age difference between the groups.

b) Education Levels of Parents: A one-way ANOVA was conducted to compare the groups in terms of the educational level of the parents. The parents' educational levels were calculated in terms of their years of schooling. The educational levels of fathers and mothers were analyzed separately. The results revealed a significant difference in the fathers' educational level between the groups, $F(2, 41) = 16.558$, $p = .000$. The post hoc LSD test showed that the educational level of the fathers of the deaf and the hearing children who did not attend preschool were not significantly different, $p = .858$, whereas that of the deaf and the hearing children

attending preschool were significantly different, p= .000. Furthermore the hearing children who did not attend preschool and those did were also significantly different in terms of their father's educational level, p= .000.

Another one-way ANOVA compared the groups in terms of maternal educational level; similar results were obtained. There was a significant difference between the groups in terms of the mothers' educational level, F (1, 41)= 10.907, p= .000. The post hoc LSD test showed that the maternal education level of the deaf and hearing children who did not attend preschool were not significantly different, p = .541. On the other hand, both the difference between the educational level of the mothers of the deaf and the hearing children attending preschool, and that between the hearing children who did not attend preschool and those who attend preschool were significant, p= .000.

Thus only the deaf and the hearing group with no preschool experience were similar in terms of their parental education level and the parental education level of hearing group with preschool education was significantly higher than that of the other groups.

c) Number of Siblings: The data concerning the number of siblings were collected only from the deaf and the hearing children who are not attending preschool. The t-test results indicated that the two groups were not different in terms of their number of elder siblings, t (27)= -.113, p= .910 and number of younger siblings, t (27)= -.565, p= .577.

3.2. Spatial Transformation Test

A univariate 2X3 ANOVA was conducted to compare the Spatial Transformation Test results of the male and female children in the three groups. The results revealed that male and female children did not differ in Spatial Transformation Test results, F (1, 38) = .199, p= .658. On the other hand there was a

Table 2- The Spatial Transformation Test Results

GROUP	Mean Age in Years (in months)	Mean Scores on Spatial Transformation Test			Standard Deviations of Spatial Transformation Test		
		Girls	Boys	Total	Girls	Boys	Total
Deaf (N=12)	5.2 (68.0)	14.2	16.2	14.9	3.9	4.1	3.9
Hearing (not attending preschool) (N=17)	4.8 (61.5)	11	12	11.7	3	3.3	3.2
Hearing (attending preschool) (N=15)	5.0 (64.9)	19.3	14.4	15.4	3.7	4.7	4.8

significant difference between the Spatial Transformation Test scores of the groups, F (2, 38) = 5.738, p= .007. The post hoc LSD test indicated that performance of the hearing group with no preschool education was significantly lower than the performance of both the deaf group and the hearing group attending preschool (p= .042 and p= .014, respectively). However the performance of the deaf group was not significantly different from the hearing group attending preschool, p= .755. There was no significant interaction between gender and group, F (2,38)= 2.293, p= .155. Means and standard deviations of the Spatial Transformation Test results are presented in Table 2.

Furthermore the correlation between age and Spatial Transformation Test results was significant, r (42) = .437, p = .003.

3.3. Testing of the Hypotheses

Before proceeding to testing of the hypotheses independent samples t-tests were conducted to see whether there was any difference with regard to gender in false belief performance. There was no significant difference between girls and boys in terms of false belief performance. For the nonverbal 'find the sticker' test, t (42)= .867, p= 395; for the nonverbal 'what face' test t (42)= .137, p= .892; for the verbal 'find the sticker' t (30)= -.397, p= .694; for the 'unexpected contents test' t (30)= .296, p= .769. The mean scores of the children in terms of gender are presented in Table 3. Since no gender difference was found, girls and boys were combined for the following false belief analyses.

Effect of Hearing Status

The first hypothesis of the study was concerned with the effect of hearing status on false belief test performance. In accordance with hypothesis 1 it was expected that deaf children would perform lower than hearing children in the nonverbal false belief tests.

Table 3- Means and standard deviations for the number of trials passed on false belief tasks by gender, for the whole sample.

Tasks(***)	Gender	Mean	Standard Deviation
Nonverbal 'Find the Sticker'*	Boys (N=28)	2.03	0.92
	Girls (N=16)	1.68	1.44
Nonverbal 'What Face'*	Boys (N=28)	2.03	0.88
	Girls (N=16)	2.00	0.73
Verbal 'Find the Sticker'**	Boys (N=24)	1.50	0.78
	Girls (N=8)	1.62	0.74
Verbal 'Unexpected Contents'**	Boys (N=23)	0.86	0.96
	Girls (N=8)	0.75	1.03

(*) tested with the whole sample

(**) tested with only the two groups of hearing children

(***) there were three trials in the nonverbal 'find the sticker' test and there were four trials in the nonverbal 'what face' test. There were two trials in the verbal 'find the sticker' test and there were two trials in the verbal 'unexpected contents' test

As was noted in the methods section, while deaf children were matched with the hearing children not attending preschool in terms of parental level of education, they were matched with the hearing children attending preschool in terms of a nonverbal cognitive skill test In the following analyses the deaf children were compared with the two hearing groups separately in order to see the effects of these two variables. A one-way ANOVA was conducted to compare the three groups in terms of their performance on the nonverbal 'find the sticker' false belief test. It was revealed that there was not a significant difference between three groups, $F(2, 43) = 2.243$, $p = .119$. However given the observable difference in the mean scores of

hearing children with preschool experience (M= 2.4) from deaf children (M= 1.66) and hearing children without preschool experience (M= 1.64), a post hoc analysis was carried out. LSD test showed that hearing children attending preschool performed better than deaf children and hearing children without preschool experience at marginal significance levels (p= .062 for hearing children without preschool experience and p= .094 for deaf children). This finding reported with marginal significance is extremely informative given the fact that the population at hand is a special population which is nonrepresentative and therefore it has a low sample size. Thus the probability levels within the interval from 0 to.10 are considered as significant in the following analyses.

Another one-way ANOVA was conducted to examine whether there was any difference between three groups of children in terms of their performance on nonverbal 'what face' test. It was found that there was no difference between groups, F (2,43)= .878, p= .423. Means and the standard deviations of the number of trials passed by the groups in the two nonverbal false belief tests are presented in Table 4.

Table 4- Mean and standard deviations of the number of trials passed on the non-verbal 'find the sticker' and the non-verbal 'what face' test in three groups.

GROUP	Mean number of trials passed in the nonverbal 'find the sticker' test * (Standard Deviation)	Mean number of trials passed in the nonverbal 'what face' test * (Standard Deviation)
Deaf (N=12)	1.667 (1.3)	2.083 (0.9)
Hearing (no preschool experience) (N= 17)	1.647 (1.1)	1.823 (0.8)
Hearing (attending preschool) (N=15)	2.400 (0.7)	2.100 (0.6)

(*) there were three trials in the non-verbal 'find the sticker' test and there were four trials in the non-verbal 'what face' test

Further analyses were conducted with the number of trials children passed in the nonverbal 'find the sticker' test. First of all, the number and the percentage of children who passed 0,1,2, or 3 trials were calculated and they are presented in table 5. Conservatively we included only those children who did not pass any of the trials (with the score of 0) and those who passed all of the 3 trials. The results of the chi-square comparing deaf and hearing children who did not attend preschool showed that there was no significant difference between them, $\chi 2$ (N=18)=. 000, p= 1.000. However the difference between deaf and hearing children attending preschool was significant, $\chi 2$ (N=17)= 4.650, p= .082 and hearing children attending preschool performed better than deaf children. The difference between hearing children attending preschool and those not attending preschool was also significant, $\chi 2$ (N=17)= 4.650, p= .082, hearing children with preschool experience performed better than hearing children without preschool experience. Thus although no significant difference was found between the deaf and hearing children without preschool experience, there was a significant difference between deaf and hearing children with preschool experience. Moreover both deaf and hearing children without preschool experience were performing worse than the hearing children with preschool experience.

However a similar test could not been performed with the nonverbal 'what face' test, since 61% of children were passing the two trials of the test, whereas only 4% of the children could not pass any of test trials (with the score of 0) and only 4% of them passed the all four trials of the test, suggesting that majority of the children were performing at chance level on this test.

Table 5- The number and percentages of children who passed 0, 1, 2 and 3 trials in the nonverbal 'find the sticker' test.

Number of trails passed in nonverbal 'find the sticker' test	0	1	2	3
Hearing children without preschool experience	4 (23%)	3 (17%)	5 (29%)	5 (29%)
Deaf Children	4 (33%)	1 (8%)	2 (16%)	5 (41%)
Hearing children with preschool experience	0 (0%)	2 (13%)	5 (33%)	8 (53%)

Furthermore one-sample Kolmogorov-Smirnov tests (two-tailed) were carried out to determine whether children's performance on the two nonverbal false belief tests significantly departed from chance. Separate tests were carried out for the three groups. The deaf group did not perform above chance on the two tests D [n=12]= .871, p= .435 for nonverbal sticker test and D [n=12]= 1.039, p= .230 for nonverbal 'what face' test. The hearing group not attending preschool did not perform above chance on the two tests D [n=17]= .853, p= .461 for nonverbal sticker test and D [n=17]= 1.205, p= .110 for nonverbal 'what face' test. The hearing group attending preschool performed above chance on the nonverbal sticker test, D [n=15]= 1.261, p= .083 and they performed above chance on the nonverbal 'what face' test D [n=15]= 1.612, p= .011. This indicates that the hearing children attending preschool are indeed different from the others in the false belief performance.

The results showed that deaf children were performing at chance level on the nonverbal false belief tests. Furthermore cognitively matched group of hearing children were performing better than the deaf children on the nonverbal false belief test. Thus hypothesis 1 was confirmed.

Dialogical Responsiveness:

The second hypothesis predicted that children who achieve higher levels of dialogical responsiveness with their mother would perform better on false belief tests (i.e. on nonverbal tests for deaf children, on both nonverbal and verbal tests for hearing children). The percentage of time elapsed in dialogical communication with the mother in the play session was calculated as a measure of the dialogical responsiveness achieved with the mother. This data were collected only from deaf and hearing children who did not attend preschool. These children were selected from similar parental education levels in order to create a similar testing situation in terms of their family backgrounds. There were 12 deaf children (8 female, 4 male) and 17 hearing children (5 female, 12 male).

Initially a univariate 2X2 ANOVA was performed to see whether the percentage of time children spent in dialogical communication with their mothers differed in terms of the hearing status and gender of children. The results showed that there was not a significant difference between the groups in terms of either hearing status or gender, $F(1,25)= 1.420$, $p= .245$ for hearing status and $F(1,25)= 1.053$, $p= .315$ for gender. Moreover there was no interaction of hearing status and gender, $F(1,25)= 1.415$, $p= .245$. Mean percentages of time spent in dialogical communication are presented in Table 6 in terms of hearing status and gender. Thus although hearing children achieved more dialogical responsiveness than deaf children, the difference was not significant.

Table 6- Mean percentage of time spent in dialogical communication and mean number of mental state terms produced by the mothers during the play session by hearing status and gender of children

Group	Mean percentage of time spent in dialogical communication			Mean number of mental state terms produced by mother		
	Girls	Boys	Total	Girls	Boys	Total
Deaf (N=12)	41.0	39.8	40.6	0.2	2.7	1.0
Hearing (N=17)	41.0	58.2	53.1	2.4	1.6	1.8

Dialogical Responsiveness and Nonverbal False Belief Performance:

In order to test hypothesis 2 which predicted that children who have high levels of dialogical communication with their mother would perform better on false belief tests, the children were divided into two groups according to high versus low level of dialogical communication by using the median split. There were 15 children (10 hearing, 5 deaf) in the high-communication group with a mean of 63,1 % of time, whereas there were 14 children (7 hearing, 7 deaf) in the low-communication group with a mean of 31,7 % of time. A univariate 2X2 ANOVA comparing the nonverbal 'find the sticker' false belief test scores in terms of the hearing status and the dialogical communication level showed that there was no difference between the hearing and deaf groups, $F(1, 25) = .000$, $p = .989$ and there was also no difference between the high and low communication groups, $F(1,25) = .110$, $p = .743$. Furthermore no interaction was detected between hearing status and dialogical communication level, $F(1, 25) = .350$, $p = .560$. Mean numbers of trials passed in terms of dialogical communication level and hearing status are presented in Table 7.

Another univariate 2X2 ANOVA comparing the nonverbal 'what face' false belief test scores in terms of hearing status and the dialogical communication level showed that there was no difference between the hearing and deaf groups, F (1,25)= .511, p= .482 and there was also no difference between the high and low communication groups, F (1,25)= .020, p= .888. Furthermore no interaction was found between hearing status and dialogical communication level, F (1, 25) = .511, p= .482. Mean number of trials passed in terms of dialogical communication level and hearing status are presented in Table 7.

The results revealed that neither the hearing status nor the level of dialogical communication had any significant effect on children's performance the nonverbal false belief tests.

Dialogical Responsiveness and Verbal False Belief Tests:

Independent samples t-tests were carried out to explore the effect of dialogical communication on the verbal false belief tests in hearing children, only those with no preschool education. In line with hypothesis 2 there was a significant difference between the low and high dialogical communication groups in terms of their 'unexpected contents' false belief test results, t (14)= 2.874, p= .021. The children who had higher levels of dialogical communication with their mothers performed better on the verbal 'unexpected contents' test.

However the level of dialogical communication did not have a significant effect on the verbal 'find the sticker' test, t (15)= .788, p= .443. Since the effect of dialogical communication level was observed in hearing children in one of the tasks, hypothesis 2 was supported for hearing children. Mean number of trials passed by the hearing children in the verbal false belief tests in terms of their levels of dialogical communication are presented in Table 7.

Table 7- Mean number of trials passed by the deaf and hearing children in low- and high-dialogical communication groups in the nonverbal and verbal false belief tests.

Dialogical Communication	Mean number of trials passed in nonverbal 'find the sticker' test* (standard deviation)			Number of trials passed in nonverbal 'what face' test* (standard deviation)			Number of trials passed in verbal 'find the sticker' test* (standard deviation)	Number of trials passed in verbal 'unexpected contents' test* (standard deviation)
	Deaf	Hearing	Total	Deaf	Hearing	Total	Hearing	Hearing
Low-Dialogical Communication Group (N=14)	1.8 (1.4)	1.5 (1.5)	1.7 (1.4)	2.0 (1.2)	2.0 (0.5)	2.0 (0.9)	1.2 (0.9)	0 (0)
High-Dialogical Communication Group (N=15)	1.4 (1.3)	1.7 (0.9)	1.6 (1.0)	2.2 (0.4)	1.7 (0.9)	1.8 (0.8)	1.6 (0.6)	0.8 (0.9)

(*) There were three trials in the nonverbal 'find the sticker' test and there were four trials in the nonverbal 'what face' test. There were two trials in the verbal 'find the sticker' test and there were two trials in the verbal 'unexpected contents' test.

Mental State Terms:

The third hypothesis was related to the mental state terms produced by the mothers during the play session and predicted that the children who are exposed to more mental state terms would perform better on false belief tests (i.e. on nonverbal tests for deaf children, on both nonverbal and verbal tests for hearing children). The mental state terms produced in both modalities, i.e. gesture and speech were counted for both deaf and hearing groups. This data were collected only from 12 deaf and 17 hearing children who did not attend preschool.

Initially a univariate 2X2 ANOVA with hearing status and gender as the independent variables was preformed to compare the number of mental state terms produced by mothers. The results showed that there was not a significant difference between the groups in terms of either hearing status or gender, $F(1,25) = .308$, $p = .584$ for hearing status and $F(1,25) = .846$, $p = .367$ for gender. Moreover there was no interaction of hearing status and gender, $F(1,25) = 2.833$, $p = .105$. The mean number of mental state terms produced by the mothers of hearing and deaf children by children's gender are presented in Table 6. Although the mothers of hearing children produced more mental state terms than the mothers of deaf children, this difference was not significant.

Mental State Terms and Nonverbal False Belief Tests:

In order to test hypothesis 3 which predicted that children who are exposed to high levels of mental state terms would perform better on false belief tests, the children were divided into two groups according to high versus low levels of exposure to mental state terms by using the median split. There were 15 children (11 hearing, 4 deaf) in the high-exposure group with a mean number of 3.0 mental state terms, whereas there were 14 children (6 hearing, 8 deaf) in the low-exposure group

with a mean number of 0 mental state terms. A univariate 2X2 ANOVA comparing the nonverbal 'find the sticker' false belief test scores in terms of the hearing status and level of the exposure to mental state terms showed that there was no difference between the hearing and deaf groups, F (1,25)= .101, p= .753 and there was also no difference between the high and low levels of exposure groups, F (1,25)= .696, p= .412. In addition, no interaction was detected between hearing status and level of exposure to mental sate terms, F (1,25)= .800, p= .380. Mean numbers of trials passed in terms of level of exposure to mental state terms and hearing status are presented in Table 8.

Another 2X2 univariate ANOVA comparing the nonverbal 'what face' false belief test scores in terms of the hearing status and the level of exposure to mental state terms showed that there was no difference between the hearing and deaf groups, F (1,25)= .297, p= .591 and there was also no difference between the high and low exposure groups, F (1,25)= .297, p= .591. Furthermore no interaction was found between hearing status and level of exposure to mental state terms, F (1, 25) = .041, p= .841. Mean number of trials passed in terms of level of exposure to mental state terms and hearing status are presented in Table 8.

Contrary to hypothesis 3, the results showed that neither the hearing status nor the level of exposure to mental sate terms had any significant effect on the nonverbal false belief tests.

Mental State Terms and Verbal False Belief Tests:

Independent samples t-tests were also carried out to explore the effect of level of exposure to mental state terms on the verbal false belief tests in hearing children. The results indicated that the level of exposure to mental state terms did not have a significant effect on the verbal 'find the sticker' test, t (15)= .867, p= .400. Likewise

there was no significant difference between the low and high exposure groups in terms of their 'unexpected contents' false belief test, t (14)= -.619, p= .546. Thus it is revealed that the level of exposure to mental state terms did not have any significant effect on the verbal false belief test performance.

Table 8- Mean number of trials passed by the deaf and hearing children in low- and high-mental state terms exposure groups in the nonverbal and verbal false belief tests.

Exposure to mental state terms	Mean number of trials passed in nonverbal 'find the sticker' test* (standard deviation)			Number of trials passed in nonverbal 'what face' test* (standard deviation)			Number of trials passed in verbal 'find the sticker' test* (standard deviation)	Number of trials passed in verbal 'unexpected contents' test* (standard deviation)
	Deaf	Hearing	Total	Deaf	Hearing	Total	Hearing	Hearing
Low-Exposure Group (N=14)	1.3 (1.5)	1.6 (1.3)	1.5 (1.4)	2.1 (1.2)	2.0 (0.6)	2.0 (0.9)	1.6 (0.5)	0.3 (0.8)
High-Exposure Group (N=15)	2.2 (0.9)	1.6 (1.2)	1.8 (1.0)	2.0 (0)	1.7 (0.9)	1.8 (0.7)	1.3 (0.9)	0.6 (0.8)

(*) There were three trials in the nonverbal 'find the sticker' test and there were four trials in the nonverbal 'what face' test. There were two trials in the verbal 'find the sticker' test and there were two trials in the verbal 'unexpected contents' test

Mean number of trials passed in the verbal false belief tests by hearing children are presented in Table 8 in terms of the level of exposure to mental state terms.

Relation between Mental State Terms of Mothers and Children:

In line with hypothesis 4 which states that the more a child is exposed to mental state terms, the more he/she would produce mental state terms, there was a significant correlation between the number of mental state terms produced by mother and the number of mental state terms produced by the children, r (27) = .794, p= .000.

3.4. Further Analyses

Further analyses were conducted 1) in order to examine the effect of preschool experience on verbal false belief tests in the two hearing groups; 2) to test the association between number of siblings and false belief performance; and 3) to compare the two nonverbal false belief tests in order to see whether there was any performance difference between them and to compare the two verbal false belief tests to examine whether there was any performance difference between them.

False Belief Tests and Preschool Education: The effect of preschool education was examined in the hearing children's performance on the verbal 'find the sticker' false belief test. There were 2 trials of this test and the scores could range from 0 to 2. The results of the t-test revealed that there was no significant effect of preschool experience on this test, t (30)= -.474, p= .639. Another t-test was conducted to examine the effect of preschool education on verbal 'unexpected contents' false belief test. There were 2 trials on this test and the scores could range from 0 to 2. There was a significant difference between the hearing children attending preschool and those who did not attend preschool, t (29)= -2.108, p= .044. The children attending preschool performed better than the ones who were not attending preschool. Mean numbers of trials passed on the verbal false belief tests are presented in Table 9.

Table 9- Mean number of trails passed by the hearing children in the verbal 'find the sticker' test and the verbal 'unexpected contents' test.

GROUP	Mean number of trials passed in the verbal 'find the sticker' test * (Standard Deviation)	Mean number of trials passed in the verbal 'unexpected contents' test * (Standard Deviation)
Hearing (not attending preschool) (N= 17)	1.470 (0.7)	0.50 (0.8)
Hearing (attending preschool) (N=15)	1.600 (0.7)	1.20 (1.0)

(*) There were two trials in the verbal 'find the sticker' test and there were two trials in the verbal 'unexpected contents' test.

False Beliefs and Number of Siblings: The results of the correlation analyses revealed that there was a significant correlation between the number of elder siblings and performance on the verbal 'unexpected contents' belief test: r (15)= .583, p= .018. However number of elder siblings was not correlated with the performance on other false belief tests: r (27)= -.222, p= .247 for nonverbal 'find the sticker test', r (27)= -.026, p= .893, for nonverbal 'what face' test, r (15)= .342, p= .179 for verbal 'find the sticker'. Moreover there was no significant correlation between the number of younger siblings and the false belief tests: r (27) = .303, p= .110 for the nonverbal 'find the sticker' test, r (27)= -.129, p= .506 for nonverbal 'what face' test, r (15)= -.336, p= .187 for verbal 'find the sticker', r (15)= -.365, p= .164 for unexpected contents.

The Comparison of the False Belief Tests: Two paired samples t-tests were conducted to compare the children's performances on the false belief tests. In order to do that, the proportion scores were calculated for each test by dividing the number

of trials passed by the child to the total number of trials in the test. The results of the t-test comparing the children's performance on the two nonverbal false belief tests revealed a significant difference between the nonverbal 'find the sticker' test (M= .63) and the nonverbal 'what face' test (M= .50), t (43)= 2.178, p= .035. The same analysis was conducted with the verbal false belief tests used with only hearing children and results revealed that there was a significant difference between the verbal 'find the sticker' (M=. 77) and in the verbal 'unexpected contents' test (M= .41), t (30)= 3.926, p= .000.

The results show that children are performing better on the nonverbal 'find the sticker' compared to the other nonverbal 'what face' test, whereas they are performing better on the verbal 'find the sticker' test compared to the 'unexpected contents' test. Since the previous analysis concerning the testing of the hypotheses showed that meaningful results are obtained only from the two false belief tests: nonverbal 'find the sticker' and verbal 'unexpected contents', the following regression analyses are conducted with those false belief tests.

3.5 Regression Analyses

The first set of regression analyses investigated the factors that would account for variability in performance on the nonverbal 'find the sticker' test. One subset was concerned with the demographical variables and the other one was concerned with the communicative experience variables. The second group of regression analyses was conducted to investigate the factors that would predict performance on the verbal 'unexpected contents' test in the two groups of hearing children with and without preschool experience. One subset was concerned with the demographical variables and the other one was concerned with the communicative variables. The last set of regression analyses was performed to the test whether spatial cognition

was a mediator variable between preschool experience and verbal 'unexpected contents' false belief test.

Nonverbal False Belief Test: In order to examine the predictive values of hearing status, Spatial Transformation Test scores and age on the nonverbal 'find the sticker' test performance of hearing children without preschool experience and deaf children, a standard multiple regression analysis was performed. The results revealed that the regression model was not significant, with R= .318, R square= .101, Adjusted R square= -.007; F (3, 28)= .935, p=. 438, as none of the variables entered in the equation yielded significant results. In other words, the effect of hearing status, Spatial Transformation Test scores and age did not predict children's nonverbal false belief performance. Table 10 shows the beta weights and the significance levels of the all variables in the equation.

Table 10- Results of multiple regression analysis predicting deaf and non-preschool hearing children's nonverbal 'find the sticker' false belief scores

Predictor	Beta	t	*p*
Hearing Status	-.124	-.594	.558
Age	-.161	-.731	.471
Spatial Cognition Test	.395	1.673	.107

Another multiple regression analysis was conducted in order to examine the predictive values of hearing status, Spatial Transformation Test scores and age on hearing children attending preschool and deaf children's performance on the nonverbal 'find the sticker' test. With R= .351, R square= .123, Adjusted R square= .009, the regression model was not significant, F (26, 3)= 1.076, p= .379. However the inspection of beta weights showed that hearing status predicted the nonverbal

'find the sticker' test scores at a marginal significance level (p= .097). In other words although hearing status, Spatial Transformation Test scores and age did not together predict the variance on the nonverbal 'find the sticker' test, hearing status was the variable that alone has a predictive value at a level which is very informative in such a small-size sample. Table 11 shows the beta weights and the significance levels of the all variables in the equation.

Table 11- Results of multiple regression analysis predicting deaf and preschool-hearing children's nonverbal 'find the sticker' false belief scores.

Predictor	Beta	t	*p*
Hearing Status	-.341	-1.729	.097
Age	.080	.368	.716
Spatial Cognition Test	.038	.177	.861

In order to examine the predictive values of age, Spatial Transformation Test, and preschool experience on the performance on nonverbal 'find the sticker' test in hearing children with and without preschool experience, another multiple regression analysis was conducted. With R= .418, R square= .175, Adjusted R square= .086, the regression model was not significant, F (3, 31)= 1.978, p= .140. However the inspection of beta weights showed that preschool experience significantly predicted the nonverbal 'find the sticker' test scores (p= .025). In other words although preschool experience, Spatial Transformation Test scores and age did not together predict the variance on the nonverbal 'find the sticker' test, preschool experience was the variable that alone has a predictive value. Table 12 shows the beta weights and the significance levels of the all variables in the equation.

Table 12- Results of multiple regression analysis predicting hearing children's (those with preschool experience and those without preschool experience) nonverbal 'find the sticker' false belief scores

Predictor	Beta	t	*p*
Preschool Experience	.447	2.362	.025
Age	.128	.687	.498
Spatial Cognition Test	-.235	-1.159	.256

Another multiple regression analysis with the nonverbal 'find the sticker' test was performed in order to examine the predictive values of the communicative experience variables, such as percentage of time spent in dialogical communication, number of mental state terms produced by mother and the number of elder siblings in the deaf and the hearing group who did not attend preschool. However none of the variables in the equation yielded significant results, $F(3,25) = 1.091$, $p = .371$. Thus none of the communicative experience variables examined in the regression analysis contributed significantly to the prediction of variability in understanding nonverbal false belief. Table 13 shows the beta weights and the significance levels of each of the predictor variables.

Table 13- Results of multiple regression analysis (with communicative experience related variables) predicting children's nonverbal 'find the sticker' false belief scores.

Predictor	Beta	t	*p*
Percentage of time spent in dialogical communication	-.225	-1.015	.320
Number of mental state terms produced by the mother	.291	1.317	.200
Number of elder siblings	-.219	-1.158	.258

Verbal False Belief Test:

The predictive values of age, preschool experience, level of father's education and spatial cognition skills in the verbal 'unexpected contents' test were analyzed with several regression analyses due to the low sample size. First a standard multiple regression was performed to examine the predictive values of age, preschool experience and level of father's education on verbal 'unexpected contents' test. The results revealed that with R= .500, R square= .250 and adjusted R square= .167, the model was significant, F (3,10)= 3,007, p= .048. Moreover age was found to be significantly contributing to the variability in the verbal 'unexpected contents' test, p= .068. Table 14 shows the beta weights and the significance levels of each of the predictor variables. Another standard regression analysis was conducted to examine the predictive values of age, preschool experience and Spatial Transformation Test scores on verbal 'unexpected contents' test. Father's education level was excluded from the model since it did not yield any significant results in the previous analysis. It was found that the model was significant, F (3,30)= 3.832, p= .021. However although the variables together significantly predicted false belief performance, none of them were significant in their contribution to the model. Table 15 shows the beta weights and the significance levels of each of the predictor variables.

Table 14- Results of the first multiple regression analysis predicting children's verbal 'unexpected contents' false belief scores.

Predictor	Beta	t	*p*
Experience of preschool education	.364	1.541	.135
Age	.334	1.901	.068
Level of father's education	-.031	-.130	.897

Table 15- Results of the second multiple regression analysis predicting children's verbal 'unexpected contents' false belief scores.

Predictor	Beta	t	*p*
Experience of preschool education	.245	1.383	.178
Age	.255	1.472	.153
Spatial cognition test	.258	1.368	.183

In order to investigate the contribution of the variables that would account for the variance in the verbal 'unexpected contents' test, stepwise regression analyses were performed. First stepwise regression analysis was conducted with preschool education experience, age and father's years of education as the independent variables. The results revealed that preschool education experience, with R= .367, R square= .135, Adjusted R square= .105, F (1,29)= 4.509, p= .042, was a significant variable predicting approximately 13% of variance in children's verbal false belief scores. Age was also a significant predictor of children's verbal false belief performance together with preschool experience, with R= .500, R square= .250, Adjusted R square= .196, F (2,28)= 4.666, p= .018. In other words, in addition to the effect of preschool education experience, an additional 12% of the variation in children's verbal false belief performance was accounted by age. The model indicated that preschool education experience and age together predicted 25% of variance in verbal 'unexpected contents' false belief test, however father's years of education did not yield any significant results. Table 16 shows the beta weights and the significance levels of each of the predictor variables.

Table 16- Results of the first stepwise regression analysis predicting children's verbal 'unexpected contents' false belief scores.

Predictor	Beta	t	*p*
Experience of preschool education	.343	2.088	.046
Age	.341	2.076	.047
Paternal years of education	-.031	-.130	.897

An additional stepwise regression was performed to examine the predictor value of Spatial Transformation Test scores, preschool education and age on the verbal 'unexpected contents' test. Father's education level was excluded from the model since it did not yield any significant results in the previous analysis. The results showed that with R= .448, R square= .201, Adjusted R Square= .173, Spatial Transformation Test scores was the only variable that alone significantly predicts 20% of the variance in the verbal false belief test, F (1,29)= 7.297, p= .011. The other variables, preschool experience and age, did not yield significant results in this model when entered with Spatial Transformation Test. Table 17 shows the beta weights and the significance levels of each of the predictor variables.

Table 17- Results of stepwise regression analysis predicting children's verbal 'unexpected contents' false belief scores.

Predictor	Beta	t	*p*
Experience of preschool education	.222	1.236	.227
Age	.234	1.336	.192
Spatial cognition test	.448	2.701	.011

Another regression analysis with the independent variables percentage of time spent in dialogical communication and number of elder siblings was performed with

the verbal 'unexpected contents' test in hearing children from whom play session data was collected. Considering the low sample size of this group, only two independent variables could be tested in one analysis. The results revealed that regression model with R= .615, R square= .378, Adjusted R square= .282, was significant F (2, 15)= 3.944, p= .046. In this regression model accounting for 37% percentage of variance, only the number of elder siblings was significant (p= .018) with a beta weight of .716. Table 18 shows the beta weights and the significance levels of each of the predictor variables.

Table 18- Results of stepwise regression analysis (concerning the communicative experience related variables) predicting children's verbal 'unexpected contents' false belief scores.

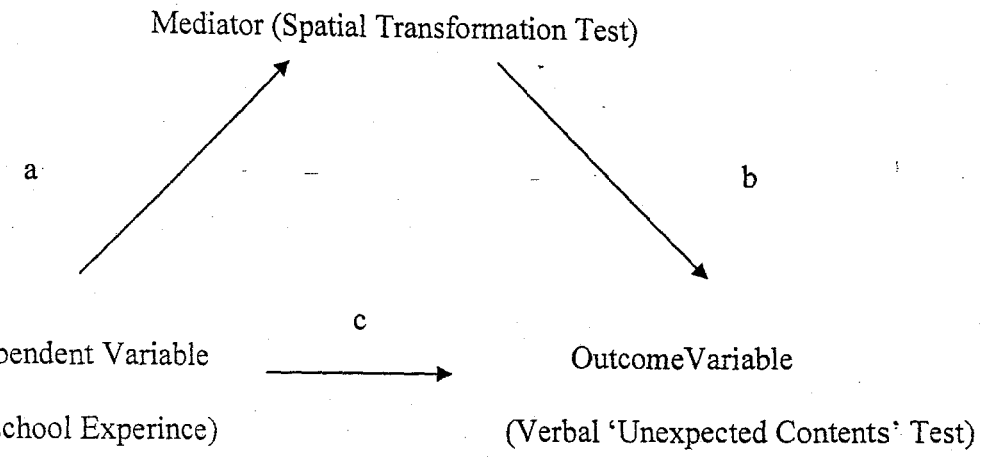
Predictor	Beta	t	*p*
Percentage of time spent in dialogical communication	-.236	-.890	.390
Number of elder siblings	.716	2.702	.018

The Relation between Spatial Transformation Test and Verbal 'Unexpected Contents' False Belief Test: The previous regression analyses with 'unexpected contents' test demonstrated that variations in both preschool experience and Spatial Transformation Test scores significantly accounted for the variations in performance on the verbal 'unexpected contents' false belief test in hearing children. This led us to analyze the nature of this relationship between the variables and to examine whether Spatial Transformation Test was a mediator variable. The mediational model is presented in figure 1.

The two basic assumptions of the regression analysis to test the mediational model were met, i.e. the dependent variable (false belief performance) did not cause

the mediator (spatial cognition performance) and it was assumed that there was no measurement error in the mediator (spatial cognition performance).

Figure 1- The Mediational Model



First, spatial cognition performance was taken as the dependent variable and preschool experience as the independent variable ('path a' in Figure 1). The result of the regression analysis revealed that preschool experience significantly predicted the variance in spatial cognition performance, $F(1, 30) = 6.336$, $p = .017$, with a beta weight of .418. Thus 'path a' was confirmed. The second analysis examined whether variations in spatial cognition significantly accounted for variations in the false belief performance ('path b' in Figure 1). The results of the second regression analysis showed that spatial cognition performance significantly predicted the variance in false belief test, $F(1,29) = 7.297$, $p = .011$. Thus 'path b' is also confirmed. Another regression analysis was conducted to test the predictive value of preschool experience on false belief understanding and it was found that preschool experience is a significant factor that predicts the variance in false belief performance, $F(1,29) = 4.509$, $p = .042$, with a beta weight of .367 ('path c' in figure 1) Then another regression was performed to test the effects of preschool and spatial cognition on

dependent variable verbal false belief performance and the results revealed that the only significant variable was spatial cognition with beta weight of .359 and preschool experience was no more a significant variable that predicts the variance in false belief performance with beta weight of .222. Thus spatial cognition is a mediator variable between preschool experience and false belief understanding.

3.6 Summary of Results

The testing of the hypotheses revealed that hearing status had a significant effect on performance in the nonverbal 'find the sticker' false belief test when the deaf children were compared with hearing children attending preschool with whom they are matched in terms of spatial cognitive skills. However on the same task the deaf children's performance did not differ from that of the hearing children without preschool experience with whom they were matched in terms of parental education but not level of spatial cognition. No significant difference was found between the three groups' performance on the nonverbal 'what face' test. Analyses comparing only hearing children revealed that preschool education experience had a significant effect on performance in the nonverbal 'find the sticker' and verbal 'unexpected contents' false belief tests.

Hypothesis two was confirmed since it was found that the level of dialogical responsiveness had an effect in the case of hearing children's performance on the verbal 'unexpected contents' test. Furthermore it was found that children's exposure to mental state terms did not have a significant effect on the performance on either nonverbal or verbal false belief tests. Thus hypothesis three was disconfirmed. On the other hand in accordance with hypothesis four, there was a significant correlation between children's exposure to mental state terms and production of mental state terms.

Further regression analyses concerning the verbal false belief test demonstrated that age, preschool experience, Spatial Transformation Test scores and number of elder siblings had significant predictive values in explaining the variance in performance on the unexpected contents test. Moreover the testing of the mediation model revealed that Spatial Transformation Test has a mediator function between preschool experience and verbal false belief understanding.

4. DISCUSSION

The present study aimed to investigate two fundamental questions about understanding of false beliefs in deaf and hearing children. Do deaf children perform worse than their hearing counterparts when the linguistic demands of the false belief tests were minimized? How do the communicative experiences of deaf and hearing children with their mothers affect their false belief performance?

In order to answer the first question deaf children were compared with two groups of hearing children, one attending preschool and the other not. In line with Hypothesis 1 which stated that deaf children would perform worse than hearing children on false belief tests, hearing status had an effect on false belief understanding when tested nonverbally with the 'find the sticker' false belief test. Deaf children performed worse than their hearing counterparts with preschool experience and with whom they were matched in terms of their nonverbal spatial cognition skills. On the other hand, on the same test deaf children did not differ from the hearing children without preschool experience with whom they were matched in terms of their parental education, but not level of spatial cognition skills. Furthermore, hearing children attending preschool performed better than those not attending preschool in spatial cognition competence and false belief understanding in both nonverbal 'find the sticker' and verbal 'unexpected contents' tests.

Our findings are in line with the previous research that has revealed significant delays in deaf children's acquisition of a theory of mind (Lundy, 2002; Courtin, 2000; Courtin & Melot, 1998; Jackson, 2001; Peterson & Siegal, 1998, 1999; Peterson, 2002, 2004). The main difference of this body of research from the current study is their use of standard false belief tests such as the change-in-location task, the appearance-reality task, and the unexpected contents task administered

through either sign language or speech depending on the child's preferred communication mode, i.e. the mode of communication the child has been educated in. Owing to the debate in the literature about the use of standard false belief tests for assessing development of theory of mind in both deaf and hearing children (Marschark, Green, Hindmarsh, Walker, 2000; Figuaras-Costa & Harris, 2001), the present study used two nonverbal tasks which aimed to minimize the possibility of poor performance caused by children's inability to understand the language used in the tests.

There is also another line of research highlighting the importance of gaining the cooperative efforts of preschool-age children to see their best performance on false belief tests. Thus criticizing the static, hypothetical procedure of standard false belief tests which have no immediate relevance or personal interest to the young subjects in the test, Chandler and Hala (1994) proposed that the procedures of the false belief tests should not give children the role of passive onlookers during the testing, but instead should engage them in an active role with concern on their own behalf. The results of the studies that tested whether active involvement made any difference in the ability of subjects to respond correctly to question about another's false belief showed that even young three-year olds perform much better on the interactive versions of the standard false belief tests (Chandler & Hala, 1994; Chandler, Fritz, & Hala, 1989; Freeman, Lewis, Doherty, 1991).

Our findings are in line with Chandler & Hala (1994), demonstrating that the nonverbal false belief test, 'find the sticker' (Call & Tomasello, 1999), which required the active participation of the child facilitated performance in deaf and hearing children compared to the other nonverbal false belief test, 'what face' (deVilliers & deVilliers, 2000). 'What face' test was also used by deVilliers and

deVilliers (2000) who found that deaf children were delayed even when they were tested with this nonverbal test. Another finding of that study was that the nonverbal test was harder than the standard verbal false belief tests for both deaf and hearing children, which is contrary to studies that show hearing children's performance improves when linguistic demands are reduced (Chandler, Fritz, & Hala, 1989; Freeman, Lewis, & Doherty, 1991). However 'what face' test does not engage the children actively; it consists of multi-picture sequences where the children are asked to find the appropriate face 'surprised or not' depending on the character's seeing or not seeing the contents of a container within the story. The results obtained from the present study by using this test also showed that both deaf and hearing groups perform poorly.

A plausible explanation for this finding is the complex nature of the 'what face' test; in addition to not assigning an active role for the child, this test entails one step further in the inferential chain and requires the child to identify the other's reaction to the violation of expectation, whereas in the typical false belief tests such as the unexpected contents test, the child is asked about the other's expectation only. The other nonverbal false belief test 'find the sticker' involved the children directly in a 'hiding-finding' game in which they could win a sticker as a reward if they could find it. Furthermore, children were not asked to imagine a hypothetical situation in the 'find the sticker' test as is typical of the verbal tasks cited above, but were tested in a situation where there was an actual participant whose mental states could be matched to his state of access to information from reality.

Thus considering the complex nature of the nonverbal 'what face' false belief test, the confirmation of hypothesis one was done on the basis of the nonverbal 'find the sticker' false belief test, which showed that deaf children were performing worse

than their cognitively matched hearing counterparts with preschool experience even when they are tested nonverbally. Furthermore, a comparison of the performance of the hearing children attending preschool in the present study (5 year olds) with the 5-years old hearing children in Call and Tomasello's study showed that the mean percentage of trials passed by two groups was the same (80%). When a similar comparison was done between deaf children (with a mean age of 5.6) in Figueras-Costa and Harris' study (2001) and the deaf children (with a mean age of 5.2) in the present study, it was found that the mean percentage of trials passed by deaf children in the present study was 50.3% and the mean percentage of trials passed in the Figueras-Costa and Harris' study employing the same procedure was 43.6%. The comparison of these three studies indicated that hearing children performed better than deaf children even when they are tested with the nonverbal 'find the sticker' test, which involves them actively and does not tax them further with hypothetical reasoning.

In Figueras-Costa & Harris' (2001) study two age groups of deaf children (one with a mean age of 5.6, other with a mean age of 9.7) were compared and it was found that older deaf children were performing better than the younger ones. It was pointed out that although the nonverbal 'find the sticker' test facilitated the performance of older deaf children, younger deaf children were still performing worse in comparison to hearing children of the same ages on standard false belief tests. The present study compared deaf children to hearing children on the same nonverbal false belief test ('find the sticker') and the effect of hearing status was evident when the deaf and hearing children were matched in terms of their nonverbal spatial cognition skills. Deaf children were not tested with the verbal standard false

belief tests in the present study since they neither knew sign language nor were they good at communicating verbally.

In the present study hearing children performed better on the verbal 'find the sticker' test compared to the verbal 'unexpected contents' test. This finding can be explained by the fact that all children received the nonverbal version of the 'find the sticker' test first, and had the opportunity to understand the rationale of the test, which enhanced their performance on the verbal version causing a ceiling effect. The reason for using this order of presentation of the tests was the primacy given to the children's performance on the nonverbal tests, since the nonverbal version was used to compare the performance of deaf and hearing children. Since the results obtained from the verbal 'find the sticker' test were confounded within the constraints of the procedure of the study, rejection and confirmation of the hypotheses were done on the basis of the verbal 'unexpected contents' test that is known to be a well-tried instrument for assessing false beliefs in the literature.

Effects of Socio-Educational Background of the Family and Preschool Education

Another interesting outcome of the present study is that the hearing children with preschool experience performed superior to hearing children without preschool experience on both the nonverbal 'find the sticker' and verbal 'unexpected contents' test. This finding is consistent with a line of research connecting family background with variations in linguistic and cognitive development. The demographical characteristics of the sample in the present study show that the children who are attending preschool are the ones with parents with higher education levels. Father's education level is an important indicator of the social economic status (SES) of the family and previous research has demonstrated that SES is significantly related to children's development of theory of mind, showing that the children form higher

socio-economic family backgrounds perform better than the children from lower socio-economic family backgrounds. (e.g. Cole & Mitchell, 1998; Shatz, Diesendruck, Martinez-Beck, Akar, 2003; Cutting & Dunn, 1999).

In a study comparing the vocabulary development of children from low and middle social class backgrounds, Hart and Risley (1995) found that less speech is directed to children in the lower-income homes. They underlined the connection between parental input and children's linguistic development highlighting the importance of the experiences children have with their parents. Similar findings are reported in studies conducted in Turkey (Kuşcul, 1993; Aksu-Koc, Örüng, & Cesur, 1999) showing that the children who grow up in middle class families are more exposed to linguistic interactions with their parents and in turn have higher levels of linguistic competence. It has also been stated that there are significant differences in the amount of parent-toddler linguistic interaction in different social classes and that frequent early interaction might be an important feature of middle class life, producing a long-term advantage for many facets of cognitive development, such as vocabulary, IQ and false belief reasoning (Hart & Risley, 1992).

It is well accepted that educational background is an index of the father's occupation and family's income, which might be related to the educational opportunities provided for children (Meadow, 1996). As it is clear in the demographical characteristics of the hearing children presented in the current study, the hearing children of more educated fathers are more likely to go to preschool. The present study showed that the hearing children with preschool experience performed better on both nonverbal and verbal false belief tests and also on the nonverbal cognitive competence test than the hearing children who never attended a preschool. Moreover a significant difference was found between the hearing children attending

preschool and deaf children attending special deaf education in terms of nonverbal false belief understanding, even though they were matched in their spatial cognition skills. However although deaf children performed better than the hearing children not attending preschool on the Spatial Transformation Test, there was no significant difference between hearing children not attending preschool and deaf children in terms of false belief understanding.

Thus it can be suggested that although attending an educational program in the preschool ages might provide for both deaf and hearing children an advantage in spatial cognition development, the deprivation from language and conversations cause deaf children to experience a delay in their development of theory of mind. Although educational experience is an advantage for development of theory of mind for hearing children, it does not provide the deaf children who attend special deaf education the opportunity to gain the understanding of other minds. From the other point of view hearing children without preschool experience and from similar family backgrounds with deaf children perform poorly on both spatial cognition test and false beliefs tests, indicating that these children are growing up in very disadvantaged conditions.

In sum, the findings of the present study points to the importance of communication children have in their homes in their developing a theory of mind. Deaf children who cannot access to the conversations within the family and the hearing children without preschool education who are from lower-income families and probably receive lower levels of linguistic interactions are found to be delayed in their understanding of false beliefs in comparison to the hearing children with preschool education and who are from higher socio-economic family background.

Communicative Experiences with Mother

Previous research has demonstrated that there is a difference between false belief performances of deaf children from deaf families and deaf children from hearing families (Peterson & Siegal, 1999; Courtin & Melot, 1998; Woolfe, Want, Siegal, 2002, Jackson, 2001; Courtin, 2000). This difference was suggested to indicate the importance of family conversation in the growth of a theory of mind (Peterson & Siegal, 2000). This conversational account of theory of mind proposed that deaf children's failure on false belief tests could reflect their deficient early conversational interaction in hearing families and their restricted discussion of beliefs and other mental states due to the absence of a shared language (Garfield, Peterson, & Perry, 2001).

An important contribution of this study is the assessment of amount of dialogical communication with the mother and the production of mental state terms by the mother in both deaf and hearing groups of children. The interesting finding of this assessment was that the level of responsiveness achieved through dialogical communication was not different in the hearing and deaf groups. However it is important to note that both deaf and hearing groups from whom this data was collected were from lower class families and the interaction between the mother and children could be at lower levels in comparison to upper-middle class as found in the previous studies (e.g. Hart, & Risley, 1995, 1992; Aksu-Koc, Örüng, & Cesur, 1999). Moreover deaf children did not differ from these hearing children without preschool education in terms of their nonverbal false belief understanding. These two groups were matched in terms of their parental education level, but not spatial cognition skills. Moreover deaf children performed better than these hearing children on the Spatial Transformation test. In light of these findings it can be suggested that the

hearing children from lower social class families were deprived of early linguistic interactions with their mothers that caused a disadvantage for their cognitive development in both spatial cognition skills and understanding of false beliefs. On the other hand the parents of deaf children who are also from lower social class families were involved more with their children's development due to their disability and deaf children were attending special deaf education. This involvement of the parents of deaf children seems to have provided an advantage for deaf children, that is evident in their spatial cognition development. Nevertheless due to deaf children's inability to access language and conversations, they were still delayed in their developing a theory of mind.

In line with the hypothesis two, which stated that the children who achieve higher levels of dialogical responsiveness with their mothers would perform better on false belief tests, dialogical responsiveness was found to be related to false belief understanding when assessed with the verbal 'unexpected contents' false belief test used with hearing children. However the effect of dialogical responsiveness was not found when assessed with the nonverbal false belief tests used with both hearing and deaf children. A plausible explanation for this finding is that both dialogical responsiveness assessment and verbal false belief test involve interaction through the use of verbal communication, i.e. language. Contrary to the situation in the nonverbal false belief test, the children were required to understand the language used in the test in order to pass the verbal 'unexpected contents' test. Thus it appears that dialogical responsiveness, which is achieved dominantly with the use of verbal mode of communication in hearing children and their mothers, is a factor that facilitates performance on verbal false belief tests. The failure to find the effect of dialogical responsiveness on nonverbal false belief tests, thus, seems to result from the

minimum linguistic requirements of the nonverbal test in which all the information needed to pass the test was presented in the visual modality and suggests that the capacity to pass this nonverbal test is associated with factors other than dialogical responsiveness with the mother. Yet it is hard and would be speculative to reach a firm conclusion on the basis of this study.

The present study also included a measure of the number of the mental state terms produced by the mother and the children in both speech and gesture during the play session. This is a different context for the measurement of mental state talk from the methodologies used in other studies. In previous studies this measurement was done with tasks that elicit talk about the mind (Ruffman, Slade, Crowe, 2002) or naturalistic observations in everyday communication (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Jenkins, Turrell, Kogushi, Lollis, Ross, 2003). Though the present study did not use a longitudinal methodology and tested older children, the results were in line with Jenkins, Turell, Kogushi, Lollis, Ross (2003) showing that in accordance with hypothesis four there is a correlation between the number of mental state terms produced by the mother and the child in both deaf and hearing groups. In contrast to Marschark (1993) this study showed that deaf children of hearing parents can achieve a comparable level of dialogical communication with their mothers and furthermore their mothers' amount of mental state talk affected their use of mental state terms, suggesting that deaf children are not entirely deprived of conversational opportunities about the mind as it is proposed in the literature (Courtin & Melot, 1998).

However, contrast to hypothesis three that stated the children who were exposed to more mental state terms would perform better on false belief tests, no relation was found between the level of children's exposure to mental state terms and

their false belief understanding although it has been pointed out in the literature that frequent conversations about mental processes within the family enable children to succeed in ToM tasks (Dunn, Brown, Slomkowski, Tesla, Youngblade, 1991). This finding could be a function of the fact that the testing in this study was not longitudinal (as in Dunn et al., 1991) and the engagement in mental state talk was tested in a short play session unlike the studies that measure the mental state talk in naturalistic observations in everyday communication (Dunn, et al., 1991; Jenkins, Turrell, Kogushi, Lollis, Ross, 2003).

Social and Cognitive Factors in False Belief Understanding of Hearing Children from a Developmental Perspective

Consistent with the previous research (Wellman, Cross, Watson, 2001; Astington, Gopnik, 1991) a developmental pattern in understanding of false beliefs was revealed in the present study in the hearing children's verbal standard false belief test performance, indicating that age has a significant effect in hearing children's development of theory of mind.

In addition, having older siblings also had a positive effect in hearing children's performance on verbal standard false belief test in line with Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, and Berridge (1996) and Youngblade and Dunn (1995) supporting the argument that children's interactions with their siblings are closely linked to developments in understanding 'other minds'. Thus the importance of the 'social landscape' the child is living in is highlighted suggesting that sibling interaction provided opportunities for building a theory of mind (Perner, Ruffman, Leekam, 1994).

The present study also found a relation between developments in the spatial cognitive domain and understanding of false beliefs in hearing children. It was found

that preschool experience influenced verbal false belief understanding with the mediating effect of spatial cognition skills. Thus this indicates that preschool experience does not directly influence false belief understanding, tested with the 'unexpected' contents test, but through the developments in the spatial cognition skills. This finding can be interpreted as an evidence for the fact that developments in theory of mind do not take place independent of the contribution of any other cognitive abilities as also suggested by Garfield, et al. (2001). A tentative causal link between the two developmental domains, that of spatial cognition and theory of mind can be drawn. It can be suggested that developments in the spatial domain are an outcome of a third variable that also affects the developments in theory of mind: 'perspective taking'. The Spatial Transformation Test used to measure spatial cognition requires the child to mentally integrate two separate parts of a shape to form a single complete figure and thus it entails the child to mentally rotate the parts and form a mental representation of the figure to choose the correct item on the test (Levine, et al., 1999). In a similar fashion, in false belief tests children have to take the perspective of the other and manipulate the mental representation of what that person might be thinking. Thus it can be suggested that both false belief and the spatial transformation tests require the child to manipulate mental representations, one in social and the other in the physical sphere, which in turn requires him to take a perspective other than his own despite the fact that it does not fit the reality in the perceptible world.

In sum, the results of the present study are in line with the previous research showing that the lack of exposure to language and conversations experienced by deaf children causes a delay in their understanding of other minds. This finding is obtained even when the children are tested nonverbally. The finding showing that

deaf children were not delayed in their spatial cognition skills, but in false belief understanding highlights the paramount importance of language for understanding what is happening in other people's minds. As stated in the conversational account of Peterson and Siegal (2000), normally intelligent and sociable deaf children lacking the opportunity to participate in conversations with peers and family members are severely delayed in their developing a theory of mind.

Another important finding of this study points to the socio-educational background of family and the communicative experiences of children that make important contributions to children's development of theory of mind. One of the main findings is that the experience of preschool education was found to be affecting hearing children's false belief understanding. Even more deaf children receiving a special education were performing at the same levels with their hearing counterparts who never attended preschool. This leads us to conclude that the deprived conditions the hearing children from lower social background experience may have led them to develop a false belief understanding at a level equivalent to their deaf peers who have no access to language. Their spatial cognition competence was also below that of both the deaf and hearing children who are attending preschool. The informal observations during the experiments and the interview with the mothers put forward the disadvantaged condition these hearing children live in with less opportunity for family interaction because of parent's lack of involvement with the children and living in overpopulated houses.

4.1. Limitations of the Study and Suggestions for Further Research

The main limitation of this study is the low sample size and the failure to find a group of deaf children with no educational experience to compare with the hearing children with no preschool experience, restricting us to draw firm conclusions on the

basis of our findings. An alternative path that can be taken by future research can be the inclusion of an SES matched hearing group that attend preschool to compare deaf and hearing children, which is drawback of this study. Moreover future research should make an assessment of 'dialogical responsiveness' taking the content of the dialogical communication into account in the context of comparing deaf and hearing children, since it is important to know what kind of information the dialogical communication contains as well as its duration.

The main contribution of this study is the nonverbal assessment of false belief understanding in deaf and hearing children, which yielded interesting results. However future research is recommended for the reliability of the current findings with a larger sample of deaf and hearing children from similar family and education backgrounds. Deaf children should also be given verbal false belief tests in order to achieve a full comparison with hearing children in both verbal and nonverbal tests. Furthermore the relation between spatial cognition and false belief understanding that is found in this study also deserves further research to reach firm conclusions.

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6. APPENDIX

6.1. The illustration of the materials used in the 'find the sticker' false belief test.

6.2. An example of the multi-picture stories used in the nonverbal 'what face' test.

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6.3. Questionnaire used for 'communicative experience' interview.

Name-Surname:

Birth Date: Gender:

Address:

Any Preschool Experience? Yes _____ No _____

If yes how long? _____ Between the ages of _____

Any school experience? Yes _____ No _____

If yes how long? _____ Between the ages of _____

Number of siblings (either hearing or deaf):

Age of the siblings: 1. _____ 2. _____ 3. _____ 4._____

Degree of hearing loss (for deaf children):

Education style at school (for deaf children):

Education level of mother:

Education level of father:

Does the mother work? Yes_____ If yes occupation: _____ No _____

Does the father work? Yes_____ If yes occupation: _____ No _____

How many people are living at home?

With whom does the child generally spend time at home?

How does the child spend time at home?

Communication style directed to child at home? (gesture, speech, sign) (for deaf children)

With whom does the child generally spend time outside the home?

How does the child spend time outside the home?

Communication style directed to child outside the home? (gesture, speech, sign) (for deaf children)

Additional questions for deaf children:

Would you prefer a primary school for deaf or a regular primary school for your child, when he/she begins preschool? (asked only to those who did not begin primary school education)

How well do you think your child can understand you, when you prefer speech as communication style?

How well do you think you can understand your child, when he/she uses signs or gestures in your communication?

Do you plan to learn sign language?

6.4. Example of a spatial transformation test item. Target figure is shown with choice array.