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Deaf Children Attending Different School Environments: Sign Language Abilities and Theory of Mind

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The present study examined whether full access to sign language as a medium for instruction could influence performance in Theory of Mind (ToM) tasks. Three groups of Italian participants (age range: 6–14 years) participated in the study: Two groups of deaf signing children and one group of hearing–speaking children. The two groups of deaf children differed only in their school environment: One group attended a school with a teaching assistant (TA; Sign Language is offered only by the TA to a single deaf child), and the other group attended a bilingual program (Italian Sign Language and Italian). Linguistic abilities and understanding of false belief were assessed using similar materials and procedures in spoken Italian with hearing children and in Italian Sign Language with deaf children. Deaf children attending the bilingual school performed significantly better than deaf children attending school with the TA in tasks assessing lexical comprehension and ToM, whereas the performance of hearing children was in between that of the two deaf groups. As for lexical production, deaf children attending the bilingual school performed significantly better than the two other groups. No significant differences were found between early and late signers or between children with deaf and hearing parents.

The primary goal of the study reported here was to assess the linguistic abilities and mentalizing skills of signing deaf children as compared with nonsigning hearing peers. Assessment was done with comparable tasks in sign language for the deaf children and spoken language tasks for the hearing children. Important for the design of this study was the inclusion of two different groups of signing deaf children from different school environments: Bilingual schools using Italian and Italian Sign Language (LIS) versus monolingual Italian schools with LIS-signing teaching assistants (TAs) in the classroom.

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The School Environment

In Italy, the great majority of deaf children attend mainstream public schools along with hearing children and instruction is provided according to three different models (see Caselli, Maragna, & Volterra, 2006; Meristo et al., 2007). Deaf children not exposed to sign language attend mainstream public schools where instruction is essentially "oral". Sign language is not used and not even mentioned inside the school. There are no interpreters, the support teacher of the classroom does not use sign language and teachers and students in the classroom communicate in spoken Italian.

Families of deaf children exposed to sign language have two possibilities: To request the presence in the

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classroom of a TA competent in LIS or to find a school with a bilingual curriculum: LIS and Italian for deaf and hearing children.

In the first case, a TA, competent in LIS, provides the deaf child with individual explanations in LIS, in Signed Italian (SI) or Sign Supported Italian (SSI), for 20 hr a week.[1] For the rest of the school curriculum, teaching is provided only through spoken Italian. In these situations, there is only one deaf child in a class of hearing schoolmates.

A very few public schools offer a bilingual curriculum that implies the use of Italian and LIS always within the classroom. In these schools, the teachers either use LIS, SI, or SSI or there is a LIS interpreter who simultaneously translates the teacher's and pupils' messages from Italian to LIS and vice versa. In such schools, LIS is also taught as a subject, from a minimum of 1 hr per week up to a maximum of 6 hr per week, as LIS is considered to be the children's first language (Ardito, Caselli, Vecchietti, & Volterra, 2008; Russo Cardona & Volterra, 2007). Usually two or more deaf children are in the classroom and hearing children are also enrolled in the SL courses. Conversations between deaf children and teachers in the schools are based on LIS, SI, or a combination of the two, and conversations among the deaf children are in LIS. In these bilingual schools, not only is there a greater possibility to receive school instruction in SL, but there is also increased opportunity for interactions in LIS or SI between deaf and hearing schoolmates as well as among hearing and deaf instructors, both within and outside of the classroom (for a description of a bilingual school, see Teruggi, 2003).

Given these important differences between the two types of school environments, which provide access to sign language, we wanted to determine in the present study the possible effects of different school programs on linguistic abilities and mentalizing skills of the deaf pupils.

For this reason, in the sample selection we started considering the age of all children attending a bilingual curriculum and we chose deaf signing children, matched for age, who attended schools with a TA. The two groups of deaf children were similar in hearing/deaf status of the parents and had a similar home language environment.

Assessing Mentalizing (Theory of Mind) Skills

Over the last three decades, relevant research in the area of developmental psychology has been conducted with regard to Theory of Mind (ToM) mentalizing skills. Mentalizing skills or ToM refers to children's understanding of people as mental beings who have beliefs, desires, emotions, and intentions, and whose actions and interactions can be interpreted and explained by taking into account these mental states (Astington & Baird, 2005; Baron-Cohen, Tager-Flusberg, & Cohen, 2000). Meta-analysis studies of ToM reasoning among typically developing children (Wellman, Cross, & Watson, 2001) have suggested that a fundamental conceptual change takes place during the preschool years, between the ages of 3 and 5 years (Naito & Koyama, 2006; Naito & Seki, 2009), resulting in 90% of the children at around the age of 6 and a half years, averaging across all conditions, passing the ToM task.

Studies on ToM conducted with deaf children were particularly interesting and significantly contributed to raising relevant issues in this area. Research conducted on deaf children with hearing families (often referred to as "late signers" or "non-native signers") showed a delay of up to several years in ToM development (Courtin, 2000; de Villiers & de Villiers, 2000; de Villers & Pyers, 2002; Jackson, 2001, Peterson & Siegal, 1995, 1997, 1999, 2002; Russell et al., 1998; Steeds, Rowe, & Dowker, 1997).

The picture became more complex when studies conducted with deaf children from deaf families showed that these children, who acquire their sign language from an early age (often referred to as "native signers") do not appear to be delayed in their ToM development (Courtin & Melot, 2005; Jackson, 2001; Peterson & Siegal, 1999, 2002; Woolfe, Want, & Siegal, 2002).

Research on mentalizing skills of deaf children coming from different backgrounds and having different linguistic experiences became crucial to understanding the role of language and its specific components in the development of ToM (de Villiers, 2005).

Language appears critical for the development of ToM in many ways: It provides a means for representing false belief in contrast to the evidence given in reality, and it provides the means by which children become aware of beliefs, both in terms of content and attitude.

Some researchers focused on the representational aspect by arguing, for example, that it is the acquisition of the "syntax of complementation" that provides the format needed for false belief understanding (de Villiers & de Villiers, 2000; de Villiers & Pyers, 2002). Other researchers also suggest that comprehension and production of mental state language supports reasoning about mental states (Hao, Su, & Chan, 2010). Other researchers focused on the communication aspects of language, arguing that stories and adult conversations bring mental states to children's attention (Harris, de Rosnay, & Pons, 2005; Nelson, 1996; Siegal & Peterson, 2008).

Deaf children's performance on ToM tasks as it relates to their language levels (Jackson, 2001; Woolfe et al., 2002) differs from their performance on ToM tasks as it relates to specific aspects of their linguistic competence. This is evidenced in the mastery of their mental lexicon and their mastery of embedded sentence structures (de Villiers & Pyers, 2002; Schick, de Villiers, de Villiers, & Hoffmeister, 2007). In particular, Schick et al. (2007) have reported that both vocabulary and understanding syntactic complements—a specific skill not examined in our investigation—were significant independent predictors of success in ToM tasks. But other evidence suggests that a link between understanding of sentence complements and mentalizing skills reasoning has not been completely established (Harris et al., 2005; Tardif, So, & Kaciroti, 2007).

Deaf children's delay in ToM reasoning does not appear to be the result of a general meta-representational problem. Deaf children do not show any problem in judging the contents of a "physical representation" (e.g., a photograph) that no longer reflects the scene that is in front of them: Their performance on the "false photographs" test (Zaitchik, 1990) matched that of their hearing peers (de Villiers & Pyers, 2002; Peterson & Siegal, 1998). Deaf children show comparable levels of performance on verbal standardized tests of false belief (e.g., change-in-location, unexpected contents) and less verbal or nonverbal tests of reasoning about mental states (de Villiers & de Villiers, 2000; Figueras-Costa & Harris, 2001; Woolfe et al., 2002). Their delayed performance on standarized tests of false belief, therefore, does not result from the language demands of the tasks themselves (e.g., linguistic complexity of the questions). Some studies had suggested that the ToM delays observed in deaf children are specific to false belief understanding.

The delay in the understanding of beliefs does not seem to be related to other mental states or abilities related to social cognition. According to several studies, deaf children and deaf adolescents do not differ from hearing peers in their general social cognition (Marschark, Green, Hindmarsh, & Walker, 2000; Rhys-Jones & Ellis, 2000; Steeds et al., 1997). In sharp contrast to autistic children, reasoning about desires and intentions is less delayed or not delayed at all in both signing and oral deaf children (Marschark et al., 2000; Rhys-Jones & Ellis, 2000; Steeds et al., 1997). The specific delay in the understanding of beliefs, and not that of other mental states or of other abilities related to social cognition, indicates a potentially different effect of some specific linguistic components. Preschoolers' proficiency in ToM reasoning has often been linked to exposure to mothers' speech about the mental states of others (Dunn & Brophy, 2005; Hughes & Leekam, 2004; Slaughter, Peterson, & Macintosh, 2007). An early conversational input that conveys the notion that others have beliefs that differ from reality and a pragmatic development that occurs during preschool and school years as well as the possibility to participate in conversation, both at home and school, could affect performance of children's understanding of false beliefs (Meristo et al., 2007). Recent research (Wellman, Fang, & Peterson, 2011; Peterson, Wellman, & Liu, 2005; Peterson & Wellman, 2009) has suggested that the delays in ToM reasoning appear also in earlier aspects of ToM, including understanding of diverse desires, diverse beliefs, and knowledge access.

Assessing Linguistic Skills in LIS

LIS, like other signed languages investigated to date, is a full-fledged human language, with its own lexical, morphological, and morphosyntactic structure (Russo Cardona & Volterra, 2007). Assessment of linguistic development should ideally be based on available knowledge about natural acquisition of the particular language assessed. But in Italy, as well as in other countries, research on the acquisition of sign language has not been conducted on large samples of children.

Limited data on the acquisition of sign vocabulary have been collected on a small number of preschool signing children (Pizzuto, Ardito, Caselli, & Volterra, 2001) and educators and clinicians lack appropriate assessment methods and tools for evaluating children's lexical and/or grammatical competence in LIS. Also as far as other sign languages are concerned assessments of sign language knowledge have been developed relatively recently (Haug & Mann, 2008; Haug, 2011a, 2011b; Singleton & Morgan, 2005; for a comprehensive review of available sign language tests see Plaza-Pust & Morales-Lopez, 2008 and visit the following web site: http://www.signlang-assessment.info).

Some test developers have used existing tests of other sign languages as templates to measure the sign language used by deaf people in their country. For example, the Test for American Sign Language and the British Sign Language (BSL) Receptive Skills Test are two tests that have been adapted for other sign languages. However, as pointed out by Haug and Mann (2008), these attempts have often resulted in complications due to differences in linguistic structures and cultural influences. In other cases, researchers have attempted to translate and adapt tests already developed and widely used for spoken language assessment. This strategy can be adopted to evaluate lexical skills and narrative abilities although it could be much more difficult in the case of the assesmet of grammar, given the differences between spoken and signed languages in this respect. As reported by Miller (2008), "There are still few if any sign-based tests for deaf children whose validity has been established to any acceptable degree" (p. 441). Following his suggestion, in the present study we adapted to LIS tests originally developed for spoken language and widely used with hearing children. In this way, we could evaluate deaf children's lexical and narrative abilities adopting tests similar to those used for hearing children in order to establish a reliable comparison between the two groups.

In earlier studies on deaf children mentalizing abilities, SL language skills of deaf signing children were only evaluated by teachers ratings "on scales of expressive language skills, comprehension and vocabulary size" (Peterson & Siegal, 1999). Only in one study (Meristo et al., 2007), children were also given a test for proficiency in LIS based on the BSL Receptive Skills Test (Herman, Holmes, & Woll, 1999). In the present study, we wanted to evaluate directly not only the comprehension but also the expressive language of Italian deaf signing children. We directly assessed vocabulary comprehension and production, and production of narratives using the same tasks for evaluating both the linguistic abilities of deaf children in LIS and of hearing children in spoken Italian. We did not evaluate grammatical competence for which we did not have reliable LIS assessment tasks that were comparable to those used for Italian hearing–speaking children.

The Goal of the Present Study

The aim of the present study is twofold. The first goal is to to assess linguistic skills (receptive, productive lexicon, and narrative abilities) and mentalizing skills of deaf children and to compare their performance with that of nonsigning hearing peers using comparable tasks for deaf (in sign language) and hearing participants (in spoken language) as well as a comparable assessment procedures. As reported in the "Method" section, particular attention was paid to the adaption of the tests for signers and the procedure for assessing the children in order to explore the relationship between linguistic and mentalizing skills both in hearing and deaf participants.

A second goal is to compare ToM measures and linguistic abilities of the subgroups of deaf signing children who clearly differ in their language environment at school. A recent study of deaf children in Estonia, Italy, and Sweden (Meristo et al., 2007) suggests that the expression of ToM, as well as related aspects of mentalizing, may depend on signing deaf children's continuous exposure to a sign language. The study found that bilingually instructed native signers who have access to both sign and spoken language as the medium of instruction outperformed native signers instructed in oral schools where access to signing in the school was absent. In the research reported here, we propose going beyond the factor of whether sign language is used in the school curriculum, and in addition to look at how sign language is provided as a medium of instruction within the two school environments.

One purpose of this study is therefore to compare the performance on linguistic and on ToM measures of deaf signing children who differ in their signing

environment at school. Specifically, we sought to determine whether a complete access to sign language as a medium of instruction and the possibility of interaction through sign language with school peers influence the performance on both linguistic and ToM tasks. Given the contrast between the two types of school curriculum in providing access to a sign language during school instruction, we sought to determine whether deaf children in a bilingual curriculum would on various measures outperform children with a reduced sign language access. In a bilingual instructional environment, deaf children, whether native or late signers, are constantly exposed to a LIS language community and they can often communicate spontaneously in a linguistic environment in which they would be constantly alerted to the possibility that beliefs can differ from one's own and from reality.

Method

Participants

Deaf participants. Thirty deaf children and adolescents (14 females and 16 males), ranging from 6 years and 1 month to 14 years and 6 months (mean = 11.3 years, *SD* = 2.3 years), participated in this study. All deaf children attended mainstream schools with hearing children from primary school to secondary school. However, 15 of these children (age range 6.1–13.9 years; mean = 10.8, *SD* = 2.4) were enrolled in a bilingual program (Italian and LIS) while the other 15 children (age range 8.1–14.6 years; mean = 11.7, *SD* = 2.1) were enrolled in a school program with the support of a TA for approximately 20 hr per week. The TA provided translations or explanations in LIS. All children attending the bilingual school received a bilingual education; interpretations or explanations in LIS were continuously provided in the classes where usually two or more deaf children were included.

Information about deaf participants was collected through a parental questionnaire (Arfè, 2006; Fabbretti, 1997; Fabbretti & Tomasuolo, 2006). The children's linguistic competencies, in terms of comprehension and production in both LIS and Italian, was provided by their teachers. Deaf participants were chosen according to the following criteria:

1. severe or profound bilateral deafness;
2. lack of other deficits;
3. daily use of LIS.

None of the children presented cognitive impairments as evaluated by clinical services. However, as these services had used differing testing materials, we preferred to evaluate nonverbal cognitive intelligence of all participants through the same task. We used the nonverbal Visual Motor Integration test (VMI) and all participants, deaf and hearing, performed in the normal range (for more details on VMI and deaf children, see Horn et al., 2007).

All relevant information about participants is reported in Table 1 and includes gender (F = female; M = male), chronological age, degree of deafness (severe or profound), parental hearing status (D = at least one deaf parent; H = both parents are hearing), environments where the children were first exposed to LIS (within the family from 0 to 3 years, preschool from 3 to 5 years, or elementary school from 6 or older), and the use of LIS in the family (Y = yes; N = not used). In the last column, information about the school environment is reported; for example, whether the school offers a bilingual program or provides an individual TA. The participants from both groups were enrolled in the one of the two types of programs from the beginning of their schooling (3 years of age), and none had changed from bilingual to TA schools or the reverse.

The deaf children were all congenitally or prelingually deaf and, as in previous studies, these two groups were considered together. The majority of the children were severely deaf; five children were profoundly deaf. Only 22 children made regular use of hearing aids, and none of them had a cochlear implant. Among the eight deaf children in the study who did not make regular use of hearing aids, five were attending the school with a TA, and three were attending the bilingual school. All children were enrolled in a speech intervention program, which used spoken Italian accompanied by Signed Italian (bimodal communication).

Twenty-three children had hearing parents. Of those, 11 were attending the school with a TA and 12 were attending the bilingual school. Seven children had deaf parents. Of these, four were attending the school

Table 1 Characteristics of the deaf participants

	Gender	Age (year; month)	Degree of deafness	Parents' hearing status	First exposure to LIS	Use of LIS at home	School attended
1	F	6; 1	Severe	D	Family	Y	Bilingual
2	M	7; 5	Severe	H	Preschool	N	Bilingual
3	M	8; 0	Severe	H	Preschool	Y	Bilingual
4	M	8; 9	Profound	D	Family	Y	School with TA
5	F	8; 11	Profound	H	Preschool	Y	School with TA
6	M	9; 1	Severe	H	Elementary	Y	School with TA
7	F	9; 4	Severe	D	Family	Y	Bilingual
8	F	9; 5	Severe	H	Elementary	N	School with TA
9	M	9; 7	Severe	D	Preschool	N	Bilingual
10	M	9; 11	Severe	H	Preschool	Y	Bilingual
11	F	10; 7	Severe	H	Preschool	Y	Bilingual
12	M	11; 0	Severe	H	Preschool	Y	School with TA
13	F	11; 2	Severe	H	Preschool	Y	Bilingual
14	M	11; 3	Profound	D	Family	Y	School with TA
15	M	11; 4	Severe	D	Family	Y	School with TA
16	M	11; 8	Severe	H	Elementary	N	School with TA
17	F	11; 9	Severe	H	Preschool	N	Bilingual
18	M	11; 11	Severe	H	Elementary	Y	School with TA
19	M	12; 7	Severe	H	Preschool	Y	Bilingual
20	M	12; 7	Severe	H	Elementary	N	School with TA
21	F	12; 9	Profound	D	Family	Y	School with TA
22	M	12; 10	Severe	H	Preschool	N	Bilingual
23	F	13; 3	Profound	H	Preschool	Y	Bilingual
24	F	13; 4	Severe	H	Preschool	Y	Bilingual
25	F	13; 6	Severe	H	Preschool	N	Bilingual
26	F	13; 9	Severe	H	Preschool	N	Bilingual
27	M	13; 9	Severe	H	Preschool	Y	School with TA
28	M	14; 0	Severe	H	Elementary	Y	School with TA
29	F	14; 6	Severe	H	Elementary	Y	School with TA
30	F	14; 6	Severe	H	Elementary	Y	School with TA

with a TA, and three were attending the bilingual school. Many families used LIS even when the parents were hearing. One child (number 9) had deaf parents, but the parents did not use LIS at home after the child was born. The sociocultural level of all families was medium–low.

Concerning the age of first exposure to LIS, six children had been exposed since birth (native signers), 16 children were exposed during their preschool years (early signers), and eight children were exposed after the age of 6 (late signers). All children attending the bilingual school were exposed to LIS either from birth (two children) or during their preschool years (13 children). Among the children attending school with a TA, four had been exposed to LIS from birth, three from preschool age, and eight in elementary school. Late signers were only found among children attending the school with a TA; therefore, a comparison between early and late signers was feasible only within this group. Using Grosjean's (1998, 2004) definition of bilingualism as the regular use of more than one language in everyday life, all deaf children in the present study would be considered bilingual LIS /Italian (for more details on similarities as well as differences with hearing bilinguals, see Grosjean, 2010).

Hearing participants. Fifteen hearing participants (age in years: mean = 10.9, SD = 2.4, range 6.6–13. 9) were chosen based on comparability by age to both deaf groups ($F(2,42) = .643$, $p = .531$). Nonverbal intelligence (VMI), which was assessed also in hearing participants, showed all the hearing participants to be within the typical range. The hearing children were sampled from schools in working-class districts to roughly match the socioeconomic background of the deaf children.

Language Assessment

Lexical comprehension: Peabody Vocabulary Test-Revised. The Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1981) is a widely used test, selected to provide a reliable measure of lexical comprehension (from 2 year olds to adults). It consists of 175 items; for each signed or spoken item the child has to point to the correct corresponding picture chosen from a set of four possible answers.

The Italian version of the revised test (PPVT-R by Stella, Pizzoli, & Tressoldi, 2000) was translated and adapted to LIS and this adaptation lasted several months. Four adult native LIS signers chose the best LIS translation for each Italian item, selecting signs that were not totally transparent and hence could be not too easily recognizable from among the four proposed choices. For example, for item "cage", the sign chosen was a sign which could designate not exclusively the specific square cage represented in the picture.

For some of the more advanced items in the PPVT, it resulted very useful having a group of deaf native signers working together in finding the correct LIS translation and in some cases the translation resulted into a signed description of the target picture. For items indicating a semantic category such as "vehicle" the LIS translation implied the use of more than one sign: car, moto, bus, group. In order to avoid a possible effect of iconicity all 175 item of the PPVT-R in LIS have been administered to 10 nonsigning hearing adolescents. Percentage of correct responses above the chance value was 89/175 (50.9%) in nonsigning hearing adolescents whereas it was 169/175 (96.6%) in signing children, indicating that for this receptive task most of the signs presented were not sufficiently transparent to make their meaning known to nonsigning participants.

Two deaf native LIS signers produced the final version of 175 items, and all items were shown on a television screen to each deaf child of our sample. For a few items, regional variations have been provided (for further details on the LIS version, see Tomasuolo, 2006).

Lexical production: Boston Naming Test. The Boston Naming Test (BNT; Kaplan, Goodglass, & Weintraub, 1983) is a lexical production task specifically devised to study patients with linguistic disorders (aphasia) in clinical settings, and it has also been used with Italian children with typical and atypical development (Bello, Capirci, & Volterra, 2004; Riva, Nichelli, & Devoti, 2000). The BNT consists of 60 line drawings representing nouns.

In order to ascertain whether all items of the BNT could be labeled in LIS, we asked an expert deaf native signer to perform the task, and we video-recorded his performance. The signs he produced were considered to be the correct "conventional" signs. All children productions that differed from his signs were shown to four deaf native signers from different regions who judged whether the children's signs could be considered acceptable variants. We codified as correct only those signs that were recognized as acceptable LIS variations by the four deaf signers. Another deaf native signer watched the "standardized" signs and wrote the corresponding Italian words. The labels he provided corresponded to those considered correct for the Italian spoken version of the same test. This was further confirmation that the Italian and the LIS versions of the same naming task corresponded to one another (for further details on the coding procedure of this task performed in LIS, see Tomasuolo, 2006; Tomasuolo, Fellini, Di Renzo, & Volterra, 2010).

Narrative skills: Frog, where are you? The narrative task consisted of telling the story of the wordless picture book "Frog, Where Are You?" (Mayer, 1969). This 24-page story is about a boy, his dog, and a frog. It begins with the boy and the dog in the bedroom looking at a frog in a jar. In the morning, they wake to find the frog gone. The rest of the story centers around their search for the frog. The boy and the dog encounter various obstacles throughout their search and eventually find the frog with a mate and a clutch of baby frogs. The boy and the dog depart, taking one of the babies home with them. Testing for all children began with the presentation of the book and the instruction to first look through the pictures and then tell the story. Each child was free to narrate the story from memory or by looking at the pages of the book. Several studies have previously used the same book to elicit narratives in many languages with typically or atypically developing children (Bamberg & Reilly, 1996; Berman & Slobin, 1994; Capps, Kehres, & Sigman, 1998; Capps, Losh, & Thurber, 2000; Reilly, 1992; Reilly, Bates, & Marchman, 1998; Reilly, Losh, Bellugi, & Wulfeck, 2004; Tager-Flusberg & Sullivan, 1995). A few studies

have used the frog story (FROG) also for eliciting narratives in Sign Language (Emmorey & Reilly, 1998; Morgan, 2006).

The narratives produced by children were analyzed according to a coding scheme proposed by Reilly (1992) and revised by Bello, Capirci, and Volterra (2004). According to a rating scale from 0 to 5 points, the following criteria were established.

- 1 point for the story setting. This includes identifying the characters in the story and the place and time in which the story occurs. For example, "There is a boy, a dog, a frog". The mention of two characters out of three is acceptable. For the place where the events occur, "A boy was in his little room with his dog" is an acceptable response. For the timing of the event, "One night, while the little boy was sleeping the frog escaped" would be an acceptable response.
- 1 point for the onset of the plot. This means correctly identifying the event that set the plot in motion. Mentioning that the frog escaped, the jar was empty, the boy discovered that the frog was missing the next morning would all be considered correct responses. For example, "When the boy woke up he realized that the frog escaped" is a possible response.
- 1 point for the unfolding of the plot. This requires the participant to develop the action in terms of the protagonist's attempt to solve the problem: The attempt to find the frog in various situations (e.g., the encounter with the bee; the encounter with the mole; the encounter with the owl; the encounter with the deer; the fall in the water) An acceptable response would mention at least two out of the five events.
- 1 point for controlling the temporal and causal sequence between episodes.
- 1 point for the resolution of the plot. This requires identifying the correct ending to the story, the final rediscovery of the frog.

The interrater reliability for the raters was found to be $\kappa = .89$ ($p < .001$). A more detailed analysis was conducted on the signed narratives, taking into account other linguistic aspects (for further details on the coding procedure of LIS narratives, see Tomasuolo, Di Renzo, & Pinto, 2008).

Mentalizing Skills Assessment

False belief tasks administered to all participants were:

- two "unexpected change" tasks using the "Sally – Ann tasks 1 and 2" (Baron-Cohen, Leslie, & Frith, 1985; Baron-Cohen, 1995; Peterson & Siegal, 1995, 1998; Russell et al., 1998);
- one "unexpected content" using "the Smarties task" (Perner, Frith, Leslie, & Leekman, 1989).

The false-belief tests chosen are the most commonly used tests within the literature. The original or most widely used variations of the tasks were employed. The Sally-Ann tasks 1 and 2 (Baron-Cohen et al., 1985, adapted from Wimmer & Perner, 1983) involved two dolls, a marble, and two different containers.

Both tasks followed the original format in which Sally hides a marble, and while she is out of the room, Ann moves the marble to a new location. The child is then asked the test question, "Where will Sally look for the marble?" The two control questions are: The reality question, "Where is the marble really?" and the memory question, "Where did Sally put the marble in the beginning?" In the Sally-Ann 2 task, the choice was among three locations.

The Smarties task (Perner et al., 1989) required a tube of Smarties and a pencil. Participants were shown a tube of Smarties and asked what they thought was inside. All children replied Smarties, chocolates, or sweets. They were then shown that the tube really contained a pencil. They were asked two test questions: "What do you think was originally in the tube?" (own false belief) and "What will X say is in here?" (other's false belief) as well as a control question, "What is really in the tube?".

A team of expert native signers worked with the authors of this study in order to find how to ask most appropriately the test questions in LIS. A pilot study has been conducted with deaf pupils who did not participated in the study in order to ensure that the test and the control questions in LIS were clear (for more details see Tomasuolo, 2006). For coding ToM tasks, the following criteria were considered:

– According to Peterson and Siegal (1995) and Russell et al. (1998), the child was credited with possessing an understanding of false beliefs if he/she had passed both the Sally-Ann 1 and Sally-Ann 2 tasks. The age range of Peterson and Siegal's 26 deaf participants was 8.1–13 years. The age range of Russell et al. (1998) 32 deaf participants was 4.9–16.11 years.
– According to Courtin (2000), the child was credited with possessing an understanding of false beliefs if he/she had passed two out of three (Sally-Ann 1, Sally-Ann 2, Smarties) tasks. The age range of Courtin's 155 deaf participants was 5–8 years while the age range of 39 hearing participants was 4–6 years.

In the study conducted by Peterson and Siegal (1995), if the child failed either of the two control questions he or she was dropped from further analysis, whereas in the Courtin's study, only one control question was asked with few changes in the procedure. The data analysis was conducted taking into account all of the criteria, those proposed by Peterson and Siegal (1995) and those proposed by Courtin (2000), and then comparing the results.

Procedure

All tests were administered to each child individually in a quiet room; responses were video-recorded. Each task was administered by a deaf LIS teacher to the deaf children attending the bilingual school and by a hearing TA to the deaf children attending the public school. Both administrators are skilled LIS signers, have a degree in Psychology and several years of experience in testing deaf children. Neither of the administrators of the tasks were familiar with the children before the assessment, but in both cases they spent some time with each participant before testing. We used the same procedure for deaf children and hearing children; the only difference was that deaf participants were requested to perform the task in LIS and hearing participants in spoken Italian. Very few adjustments were made with respect to the original procedures for administrating these tests.

In the PPVT-R a single sign was presented to the participants, and they were asked to select the one of four pictures on a test plate that corresponded to the item indicated by the sign. All 175 items were proposed to all hearing children in the spoken version and to all deaf children in the LIS version. The original administration of this task consists of a reduced number of items depending on age and/or performance of children but we preferred to administer all items (despite the length of the testing session) as we did not have standardized data from the signed version.

In the BNT, the hearing children were requested to name all 60 drawings in spoken Italian and the deaf children were requested to name all 60 drawings in LIS and they had no time limit for performing the task. This is in contrast to the original administration of the BNT, which is interrupted after six consecutive errors. The ToM tasks were presented to the hearing children in spoken Italian and to the deaf children in LIS following the "standard procedure," with no imposed time limits for answering.

The present study has been conducted in agreement with schools and families. Written informed consent was obtained from the school directors and parents of the children before testing was begun.

Results

Language Assessment

Lexical comprehension. Significant differences were found in the number of correct responses provided by the two deaf groups and the hearing group on the signed and spoken versions of the PPVT [$F(2,42) = 6.759$, $p = .003$]. Post-hoc analysis, adjusted for multiple comparisons, revealed that the only significant pair-wise difference was between the two deaf groups (Sidak's $p = .001$) as the deaf children attending the bilingual school performed better (148.9, 95% confidence interval [*CI*] = 141.6–156.2) than the deaf children attending the regular school with the TA (130.1, 95% *CI* = 122.8–137.4). The performance of hearing children (139.5, 95% *CI* = 132.2–146.8) was in between those of the two deaf groups, with no significant difference in either case, $p > .20$.

When VMI was entered as a covariate to separate out the partial confounding effect of an indirect

measure of nonverbal intelligence, the above findings were confirmed with only slight differences within estimated marginal means.

Early (n = 7) and late (n = 8) signers within the deaf group attending the school with a TA obtained similar scores on the PPVT (129.7 and 130.3, respectively; $t(13) = .082$, $p = .936$). The children of deaf and hearing parents obtained similar scores on the PPVT (140.6 and 139.1, respectively; $t(28) = .207$, $p = .838$; for a more detailed analysis on responses to individual items in the signed and spoken versions of the task, see Tomasuolo, 2006).

Lexical production. Significant differences were found in the number of correct responses provided by the two deaf groups and the hearing group on the signed and spoken versions of the BNT [$F(2,42) = 13.217$, $p < .001$]. Post-hoc analysis revealed that two pair-wise differences were significant: The children attending the bilingual school performed better (48.9, 95% CI = 45.1–52.7) than both the deaf children attending the regular school with the TA (38.1, 95% CI = 34.3–41.9, $p = .001$) and the hearing children (36.1, 95% CI = 32.3–39.9, $p < .001$).

Even for the BNT, no relevant differences were found when VMI was entered as a covariate in the above analysis of variance (ANOVA). The children of deaf and of hearing parents obtained similar scores on the BNT (40.3 and 44.4, respectively; $t(28) = 1.063$, $p = .297$).

Early (n = 7) and late (n = 8) signers within the deaf group attending the school with a TA obtained similar scores on the BNT (38.0 and 38.1, respectively; $t(13) = .029$, $p = .978$); (for a more detailed analysis on responses to individual items in the signed and in the spoken version of the task, see Tomasuolo et al., 2010).

Narrative abilities: Frog, where are you? All narrative productions have been analyzed and scored (from 0 to 5) according to the coding system described in the "Method" section: number of characters of the story introduced, number of episodes mentioned, links between episodes expressed, the resolution and unfolding of the plot correctly identified.

Nonparametric Kruskal–Wallis ANOVA did not indicate clear significant differences between the three groups ($p = .072$). However, the Mann–Whitney pair-wise comparison suggested higher scores in deaf children attending the bilingual rather than the regular school (uncorrected $p = .021$), whereas no difference appeared for the other possible contrasts (consistently, $p > .20$). In addition, because the majority of participants obtained 4 or 5 points for total scores of 36 out of 45, these two scores have been collapsed to indicate a "good performance," while 2 and 3 points were collapsed as "poor performance." No participant scored less than 2. According to this classification, we observed that the number of children who performed poorly totaled only one (7%) in the bilingual group, three (20%) in the hearing group and five (33%) in the TA group.

A more careful analysis of the data revealed that older participants, both in the deaf group attending the bilingual school and in the hearing group, obtained the maximum score (beginning at 11; 6 years) but this did not happen in the deaf group attending the regular school with a TA. A similar proportion of children of deaf and hearing parents obtained a good performance on the FROG (6 out 7 = 86% and 18 out 23 = 78%, respectively; Fisher's exact test, $p = .567$).

Early and late signers within the deaf group attending the school with a TA obtained similar scores on the FROG (5 out of 7 early signers and 5 out of 8 late signers obtained a good performance, as defined above; Fisher's exact test, $p = 1.0$).

A more detailed analysis was conducted of LIS productions looking at the number of signs produced. Also in this case, a significantly better performance was found in the deaf children attending the bilingual school versus those attending the TA school (median = 192, min–max = 56–293 vs. median = 92, min–max = 60–203, Mann–Whitney, $p = .013$).

Mentalizing Skills

Comparison between deaf and hearing participants. In Table 2, we report the percentages of deaf and hearing children, respectively, who passed the three ToM tasks: Sally-Ann 1 and 2 and Smarties, according to the criteria proposed by Peterson and Siegal (1995) and Russell et al. (1998). In the last column, the percentages of children who passed two out of the three tasks are reported. This last criterion was proposed by Courtin (2000).

Table 2 Percentage of hearing and deaf children attending two different types of school who passed false belief tasks

	Sally Ann 1 and 2 (%)	Smarties (%)	Two out of three (%)
Hearing	73	93	73
School with TA	25	53	50
Bilingual school	100	91	100

According to the classifications in the three groups (hearing and deaf attending two different types of school), there was a significant overall difference ($\chi^2 = 6.916$, $df = 2$, $p = .031$), mainly attributable to a significantly higher percentage of success (uncorrected Fisher's exact test, $p = .015$) for children attending the bilingual school (100%) versus the TA school (50%). The performance of hearing children (73%) was in between the performances of the two deaf groups but without a significant difference ($p > .10$).

Results obtained by deaf children in the present study are better than those reported by other studies conducted with the same methodology but testing younger children. Apparently, a much higher percentage of deaf children passed the Sally-Ann tasks (59%) with respect to the findings of the classical studies. In Peterson and Siegal (1995), only 17% of the children passed Sally-Ann 1 and 2 and in Russell et al. (1998) 28% of the children passed Sally-Ann 1 and 2. However, by distinguishing the two groups of deaf children, we found that 25% of children attending the school with a TA passed the task (95% *CI* = 9–53%), while 100% of those attending the bilingual school (95% *CI* = 72–100%) passed the task. Interestingly, the performance of deaf participants in the Russell et al. (1998) study was very similar to that of children attending school with a TA from our sample.

In the above table, only children who provided correct answers to control questions of ToM tasks are included: 21 out of 30 deaf children and all hearing children. This occurred because an important difference between the two groups was found: All hearing children provided correct answers to control questions, whereas many deaf children failed on the same questions (eight children in Sally-Ann 1 and 2 and four children in Smarties); a total of nine deaf participants were excluded. As shown in Table 3, this happened with children attending both types of school. Three of the children attending the bilingual school who were excluded were also among the younger children assessed (6–8 years).

Table 3 Number of deaf children attending two different types of school who failed answering control questions

	Sally Ann 1 and 2	Smarties	2 out of 3
School with TA	3/15	2/15	3/15
Bilingual school	5/15	4/15	6/15

More detailed characteristics of deaf children passing the ToM tasks, including age and school attended, are reported in Table 4.

Within the deaf group, a significant difference emerged between deaf children attending the two types of schools: All children aged 9 years or older who attended the bilingual school passed all ToM tasks according for all criteria proposed by Peterson and Siegal (1995), Russell et al. (1998), and also Courtin (2000), whereas some older children attending the school with a TA failed. In the hearing group, two children failed in the ToM tasks, but they were in the youngest group.

The association between type of school and success on ToM was found to be significant (Fisher's, $p = .046$) only in younger children (9–11 years). For the older group (12–14 years) this association was nonsignificant (Fisher's, $p = .500$).

A similar proportion of children of deaf and of hearing parents obtained a good performance on the mentalizing tasks (4 out 5 = 80% and 11 out 16 = 69%, respectively; Fisher's exact test, $p = .550$).

Early and late signers within the deaf group attending the school with a TA obtained similar scores on the mentalizing tasks (three out of five early signers and three out of seven late signers obtained a good performance, as defined above; Fisher's exact test, $p = .500$).

With regard to hearing loss of deaf participants, we found that, even if the sample size was too small to give a reliable assessment, there was no evidence of difference between profound ($n = 5$) and severe ($n = 25$) deaf children in terms of ToM scores. In the attempt to limit the low power of such statistical comparison, we performed exact and Monte Carlo tests (more suitable for small samples), consistently indicating a lack of statistical significance ($p > .2$).

Table 4 Numbers and percentages of children passing the ToM tasks according to chronological age and school attended

Age range (years)	Children who passed two out of three ToM tasks (*n*)	Children who correctly answered control questions (*n*)	Percentage of children understanding false beliefs
9–11			
School with T.A	2	6	33.3
Bilingual school	5	5	100
12–14			
School with T.A	4	6	66.7
Bilingual school	4	4	100

Relationships between mentalizing skills and language abilities. Kendall's τ correlations were computed to explore the association between language measures and children's ability to pass the ToM tasks (Table 5). The analysis was conducted separately for hearing and deaf children.

In hearing children, only lexical comprehension (PPVT) and lexical production (BNT) were significantly related to children's ability to pass the ToM tasks. On the other hand, no association was found between narrative skills (FROG) and ToM tasks.

In deaf children, the ability to pass ToM tasks was slightly associated with lexical measures, particularly to lexical production, but the effect did not reach statistical significance. The stronger association was between mentalizing skills and narrative abilities. None of the four deaf children with "poor performance" on FROG passed the ToM tasks, whereas 15 out of 17 deaf children with "good performance" on FROG passed the ToM tasks ($p < .001$). In contrast, two out of three hearing children with "poor performance" on FROG passed the ToM tasks (see Table 6), whereas 9 out of 12 hearing children with "good performance" on FROG passed the ToM tasks ($p = 1.00$).

Despite the relatively small sample size and the consequent lack of statistical precision, these data give a preliminary suggestion that in deaf children narrative skills could have a high Positive Predictive Value of passing ToM tasks (15 out 17), as well as a strong Negative Predictive Value of failing ToM tasks (four out of four). In hearing children, the Positive Predictive Value is maintained (9 out 12), but the Negative Predictive Value was lowered (one out of three).

Table 5 Correlation (Kendall's τ) between language measures and ToM tasks for hearing and deaf children

	Hearing ($n = 15$)	Deaf ($n = 21$)
PPVT°	.59 ($p = .010$)	.44 ($p = .019$)
BNT*	.59 ($p = .015$)	.35 ($p = .067$)
FROG^	.13 ($p = .604$)	.59 ($p = .006$)

Notes: ° = Peabody Vocabulary Test (Dunn & Dunn, 1981); * = Boston Naming Test (Kaplan, Goodglass & Weintraub, 1983); ^ = Frog, where are you? (Mayer, 1969).

Table 6 Deaf children's performance on FROG and performance on ToM

	Performance on FROG	Ability to pass ToM tasks		
		No	Yes	Total
Hearing	Poor	1	2	3
	Good	3	9	12
	Total	4	11	15
Deaf	Poor	4	0	4
	Good	2	15	17
	Total	6	15	21

After adjusting for both lexical measures computing residuals of the logistic regression model, the correlation between narrative skills and ToM tasks was confirmed nonsignificant in hearing children (Kendall's $\tau = -.163$; $p = .470$) and clearly significant in deaf children ($\tau = .502$; $p = .007$). Even if a differential effect of linguistic measures on ToM tasks in the two deaf groups would have been interesting to investigate, these correlations could not be compared according to type of school because all deaf children attending the bilingual school passed the ToM tasks.

Conclusion and Discussion

In the present study, we compared three groups of participants (two groups of deaf signing children and one group of hearing) matched for sample size ($n = 15$) and chronological age (6–14 years) on linguistic abilities (lexical comprehension, lexical production, narrative abilities) and mentalizing skills (false beliefs tasks). The two groups of deaf signing children differed in their

school environments: One attended a school with a TA, and the other attended a bilingual school.

Linguistic abilities of all participants were directly evaluated by two of the authors of this article (one hearing and one deaf), both skilled LIS signers, using similar tasks in spoken Italian with hearing children and in LIS with deaf children.

As for lexical comprehension (PPVT), deaf signing children attending the bilingual school performed significantly better than the deaf children attending the regular school with a TA. The performance of hearing children was in between those of the two deaf groups. In lexical production (BNT), deaf children attending the bilingual school performed significantly better than the other two groups. In narrative abilities (FROG), deaf children attending the bilingual school scored higher than deaf children attending school with a TA and hearing children, but the difference was not significant. In the mentalizing tasks, deaf children attending the bilingual school performed significantly better than deaf children attending school with a TA, whereas the performance of hearing children was, again, in between those of the two deaf groups.

As reported by previous studies the perfomance of deaf signing children look similar to that of hearing speaking children but school environment appears to be a critical factor in the comparison between deaf and hearing groups. Our results confirm the hypothesis described in the "Introduction": Deaf children in a bilingual curriculum outperformed deaf children attending the school with a TA in all tasks and the performance of hearing was in between those of the two deaf groups. Earlier studies reported important differences between native-signing children (those who have had access from birth to a sign language used by deaf family members) and late-signing deaf children (those who have hearing parents and have gained access to a sign language later in school; Courtin & Melot, 2005; Jackson, 2001; Peterson & Siegal, 1999; Schick et al., 2007; Woolfe et al., 2002). In our sample, all deaf children were signing at the age of assessment, but it was not always the case that children with deaf parents had learned sign language early in life or that deaf children of hearing parents had learned sign language late in life, as we explained in detail in the "Method" section (see Table 1 reporting hearing status of parents, first exposure to LIS and use of LIS at home). We did not choose parent hearing status as a significant variable, but we preferred to distinguish between children's exposure to sign language before or after entrance into elementary school. Nevertheless, no significant differences were found in any of the skills examined between deaf children with hearing families and those with deaf families. These results indicate that the nature of the instructive environment is sometimes more influential than the hearing status of the parents in the acquisition of linguistic and mentalizing skills.

It was often taken for granted that the presence of deaf parents implied good sign language competence of their deaf children, which is not always the case (Pizzuto et al., 2002; Van Den Bogaerde, 2000). On the other hand, there are also deaf children with hearing parents who acquire sign language early, before entering school. A survey by De Houwer (2007) on bilingual hearing families has shown that successfully raising children to speak two languages very much depends on the parental language input patterns.

As reported in the "Method" section, all children attending the bilingual school were exposed to LIS since birth or in their preschool years (3–5 years of age), whereas within the group attending school with a TA, we could distinguish between native and early signers (seven children) versus late signers (eight children). The presence of late signers only in the group of deaf children attending the school with a TA could have influenced the results, but a further comparison conducted within the signing deaf group attending the schools with a TA between children exposed to LIS at an early age versus children exposed to LIS after 6 years of age did not show a significant difference in any task considered for the present study. Since only vocabulary and narrative skills, but not grammar, were measured it is not so surprising that age of exposure is not sensitive. In other studies reporting differences between native or late signers, the first exposure to LS for late signers occurred in high school (Russell et al., 1998), much later than for our late signers. A recent study by Thordardottir (2011) on 5-year-old Montreal children acquiring French and English, found that children with early and late onset (before 6 months and after 20 months) of exposure did not differ significantly on any vocabulary measures.

In the present study, we directly assessed vocabulary comprehension and production, and production of narratives adopting the same tasks for evaluating linguistic abilities of deaf children in LIS and of hearing children in spoken Italian. As reported in the "Method" section, particular attention was paid to the adaption of the tests for signers and the procedure for assessing the children in order to compare the hearing and the two deaf groups with comparable tasks and procedure.

Previous studies on deaf children's mentalizing skills have confirmed a relationship between ToM reasoning and specific linguistic components such as comprehension of vocabulary, general syntax (Schick et al., 2007; Meristo et al., 2007) complementation (de Villiers & Pyers, 2002; Gale, de Villiers, de Villiers, & Pyers, 1996), mental state vocabulary (Hao et al., 2010), and pragmatic and conversational abilities (Meristo et al., 2007).

Our results further confirm a strong relationship between linguistic and mentalizing skills both in hearing and deaf participants. However, although in hearing children only lexical comprehension and lexical production were significantly related to children's ability to pass the ToM tasks, in deaf children, a stronger association between narrative abilities and mentalizing skills was found.

Although a general level of linguistic competence may be necessary for children to succeed in ToM tasks, our results indicate that specific linguistic abilities, in particular the ability to construct and narrate a story, show a relation more significant than others with ToM performance. This result points to a substantial dependence between specific components of language development and ToM performance that deserves further investigation, particularly regarding the relationship between narrative abilities and mentalizing skills in deaf children (Rathmann, Mann, & Morgan, 2007).

We are aware that any definitive conclusion is a bit premature, but the main results of our study strongly support and reinforce results reported by previous studies. According to Meristo et al. (2007), access to sign language in a bilingual environment may facilitate conversational exchanges that promote the expression of ToM by enabling children to monitor other's mental states effectively: In our study, the school environment appears to be a critical factor for the acquisition of LIS linguistic abilities and mentalizing skills. Our results strongly support the hypothesis that intensive input from learning environments in which sign language is a medium for instruction leads to better SL competencies and to the overcoming of early ToM false-belief difficulties. The evidence that quantity of input influences the progress of bilingual development is robust and well researched (Hart & Risley, 1995) but also "quality factors" of bilingual input could make a difference (Paradis, 2011; Sorace, 2011; Van Den Bogaerde, 2000). Sign language, even learned early in life, is not enough for the acquisition of mentalizing skills. Ample opportunity for linguistic exchanges with deaf and hearing peers at school appears to be another relevant resource to access others' mental states and to facilitate ToM reasoning. This approach has been deepened by the work of Nelson (2007) who argues that children can be seen not as scientists but as members of a community of minds, striving not only to make sense, but also to share meanings with others.

One of the crucial differences between bilingual schools and regular schools with a TA seems to be the amount of opportunity to sign with deaf and hearing peers. In bilingual schools, as opposed to classes with signing TAs, there was always more than one deaf child attending the same class (and school), and hearing peers were learning and using SL as foreign language for about 2 hr a week. Sign language in this environment was not just a device to support the learning of the spoken language, but was one of the schools languages, actively used by children and teachers, inside and outside of the classroom.

Our study thus indicates that research on deaf children should include, among other variables such as hearing parents' status or daily use of LIS, the type of school attended.

The results of our study differ from those of other studies in several respects. In some previous studies, various tasks and different procedures have been used, which could have influenced the results. For example, it is not clear in many studies if and how control questions were proposed and what happened if the child failed to correctly answer the control questions. As discussed in the previous section, results may dramatically change if children who fail to correctly answer control questions are dropped from further analysis. Wellman

et al. (2001) showed that the use of different procedures in the administration of ToM tasks with typically developing children did not influence the results, but such evidence is not reported for studies with atypically developing children. All hearing children in our sample responded correctly to control questions, whereas many deaf children did not correctly answer the same questions. The difficulty exhibited by deaf children in our sample with control questions of ToM tasks was not reported by previous studies. Our results could indicate that the ToM tasks chosen, as well as the procedure adopted to assess mentalizing skills in the present study (in sign as well as in spoken language), were more difficult for this age range compared with those employed by other studies. In the present research, younger children, deaf and hearing, have difficulties performing the tasks as in some of the previous studies (Courtin, 2000).

In closing, we would like to point out some limitations of the present study and to highlight relevant issues for further investigation. Our deaf sample was not well balanced for age subgroups (few children below the 8 years of age participated in the study), so there is a pressing need to further investigate mentalizing skills in young deaf children. Only in the case of the younger deaf children did the type of school attended not appear to impact success on ToM tasks. In the present study, SL abilities were evaluated with tests originally developed for spoken language and adapted to LIS. Despite the caution used in the adaptation procedures, this could have potentially influenced the comparison between hearing and deaf groups: The difficulty of items in the spoken version often did not correspond to the difficulty of items in the LIS version (Tomasuolo et al., 2010). In addition, the age range of participants was extremely wide, particularly with a small sample size per group.

Only large effects could be documented as significant with such a small sample, and a limitation of the present study is the inability to detect fine-grain differences and, more generally, the lack of a priori sample size calculation. However, many expected differences among groups and correlations among variables were found significant, indicating that in such cases the sample size can be considered adequate a posteriori.

Additional research is also needed on the quality of the conversational context offered in deaf and hearing families by parents and siblings (Slaughter et al., 2007; Woolfe, Want, & Siegal, 2003) and on how the school linguistic environment may affect the ability to understand and produce narratives.

Notes

1. SI and SSI, both rely on spoken Italian words simultaneously accompanied by the corresponding LIS signs. In addition, SSI uses fingerspelling for Italian function words.

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Conflicts of Interest

No conflicts of interest were reported.

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