

Deaf Children's Understanding of Emotions: Desires Take Precedence

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Deaf children frequently have trouble understanding other people's emotions. It has been suggested that an impaired theory of mind can account for this. This research focused on the spontaneous use of mental states in explaining other people's emotions by 6- and 10-year-old deaf children as compared to their hearing peers. Within both age-groups deaf children referred to others' beliefs as often as their hearing peers and their references to desires even exceeded those of hearing children. This relative priority for the expression of desires is discussed in terms of possible communicative patterns of deaf children. The specific problems that deaf children meet in their daily communication might explain their abundance of desire-references: plausibly, they give a high priority to stress their own desires and needs unambiguously.

Keywords: Child development, emotion recognition, hearing loss, theory of mind.

Abbreviations: SSD: Sign-Supported Dutch; ToM: theory of mind.

Introduction

The expression and understanding of emotions are major factors in everyday communication (Frijda, 1986). Socially inadequate expression or impoverished understanding of other people's emotions can easily create a climate of interpersonal misunderstandings. In deaf children, some authors (e.g. Montanini Manfredi, 1993; van Eldik, 1994; Vostanis, Hayes, Du Feu, & Warren, 1997) claim to detect a relatively large amount of distrust, stubbornness, and other behavioural problems. Deaf children's alleged difficulties with the expression (Odom, Blanton, & Laukhuf, 1973) and understanding of emotions may have been instrumental to this phenomenon. As far as the understanding of emotions is concerned, it is suggested that their problems might be quite fundamental: deaf children suffer from a delayed or impaired theory of mind (Peterson & Siegel, 1995, 1998). A functional theory of mind (ToM) implies that children acknowledge (1) that people make their own subjective mental representation of the objective reality, (2) that these representations depend on people's own set of beliefs and desires, and (3) that people's actions and their emotional reactions to what happens to them are to be understood in terms of, or predicted from, these subjective beliefs and desires.

Most hearing children understand when they are aged 3 that other people's *actions* are governed by their desires and beliefs. The understanding that *emotions* also depend on subjective desires and beliefs appears somewhat later, when they are aged 5. At this age, children accurately predict a happy emotion when the protagonist receives what she desired, and an unhappy emotion when the protagonist is frustrated in fulfilling her desire (Wellman, 1990). These young children also accurately predict others' emotions when protagonists' preferences for one

item over the other (e.g. milk vs. coke) are alternated (P. L. Harris, Johnson, Hutton, Andrews, & Cooke, 1989). In other words, they appreciate the fact that different people can have different desires or that others' desires can differ from their own. Additionally, these young children also show the capacity to attribute beliefs to the protagonist that differ from their own. In this respect, *false beliefs* are frequently used (Wimmer & Perner, 1983). A false belief refers to another's mental representation of reality that does not correspond with reality, nor with what the protagonist knows to be the case. P. L. Harris et al. (1989) provided children aged 4–6 years with situations in which the protagonist falsely believed that a Smartie box contained Smarties, whereas (as participants knew) the Smartie box actually contained pencils. Participants were asked to predict how Bertie the bear would feel when he was given the box, but had not yet discovered its actual contents. Most emotion predictions by the 4-year-olds (75%) were based on their own belief and stated that Bertie the bear would be unhappy, as if he could know that the box did not contain Smarties. Yet, 75% of the emotion predictions by the 6-year-olds were based on the bear's false belief and stated that he would be happy receiving the box.

A replication of the Smartie experiment among deaf children seemed to indicate a delay (Steeds, Rowe, & Dowker, 1997): 70% of the participants (aged 5–12 years, mean 9 years) accurately predicted that Bertie would be happy receiving the Smartie box. Although this result is compatible to that of hearing 6-year-olds, it can be expected to lag behind the performances of a hearing group with a mean age of 9 years. Also other false belief tasks showed the impaired results of deaf children: 65% to 90% of deaf children with normal intelligence (mean age 10 years) failed simple false belief tasks that were accurately responded to by hearing 5-year-olds (Peterson & Siegel, 1995, 1998; Russell et al., 1998).

Less is known about deaf children's understanding of the relationship between desires and emotions. The only study that addresses this topic (Steeds et al., 1997)

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suggests little impairment of deaf children in this area. Note, however, that hearing children also perform better on desire tasks (“Bertie likes Smarties. How does Bertie feel when he receives Smarties?”) than on belief tasks, due to a less complex task structure (Rieffe, 1998). A key difference between beliefs and desires is that beliefs can misrepresent reality, whereas desires can only be more or less desirable. Different people can have different desires, and they can each be more or less acceptable in the eyes of the participant. Yet, different people can have different beliefs, but only one is true. Until now, ToM difficulties among deaf children have mainly been demonstrated in relation to beliefs and little is known about their understanding of desires. More complex desire tasks that also cause more difficulties for hearing children, for example when the protagonist’s desire conflicts with the participant’s beliefs about desirability, such as a desire for Brussels sprouts (Rieffe, 1998), have not yet been administered with deaf participants.

There has also been attention to the development of a ToM among children with autism (e.g. Baron-Cohen, Leslie, & Frith, 1985; Perner, Frith, Leslie, & Leekam, 1989). The impaired ToM performances of children with autism are frequently explained in terms of a pathological deficit that results in *mindblindness* (Baron-Cohen, 1995; Carruthers, 1996). Mindblindness implies that children live in a world in which mental activities are not recognised. Consequently, children with autism are said to also lack the capacity to attribute mental states to others. It is argued that the specific characteristics of children with autism, such as impaired communication, impaired social relating, and lack of pretend play (Kanner, 1943; Wing & Gould, 1979) can be traced back to this fundamental deficit. In deaf children, however, there is no reason to assume neurological deficits other than the ones directly related to their handicap. ToM difficulties, therefore, have to be attributed to learning factors.

Although it is not exactly comparable, deaf children seem to have problems in areas that are also frequently mentioned with respect to autistic children. First, we already mentioned their social problems. Second, pretend play—an activity that is often mentioned as an important prerequisite of ToM development (Leslie, 1987; P. L. Harris, 1989)—also seems to be less imaginative in deaf children than in hearing children (Brown, Prescott, Rickards, & Paterson, 1997), and third, it needs no discussion that their communication is impaired due to their handicap. Also in the case of autism, it has been argued that communication problems could be the *result*, but also the *cause*, of ToM impairment (Boucher, 1996). In deaf children, where we have no reason to expect innate ToM deficiencies, the latter clearly seems to be the more plausible point of view. The lack of exposure to daily conversation (A. E. Harris, 1978; Marschark, 1993; Peterson & Siegel, 1995) could be an important condition for the acquisition of ToM understanding. Information exchange through daily conversation confronts children with the fact that different people can have different beliefs about reality. Evidence for this argument stems from research of Peterson and Siegel (1997, in press), who showed that deaf children with at least one family member fluent in sign language were less impaired on ToM tasks than deaf children who lacked such a family member.

The present research focused on deaf children’s understanding that emotions are governed by subjective mental states in a way that differs from the usual ToM tasks.

More strongly than in the usual setup, this research called upon children’s spontaneous use of conversational means: instead of asking children to *predict* others’ emotions, we asked children to *explain* them. As P. L. Harris (1996) points out, in the context of emotion predictions, one could concentrate primarily on the protagonist’s goal, thereby overlooking the protagonist’s mental states (e.g. beliefs about reality). By contrast, in the context of daily interactions, one might try to focus more on mental states, because both interaction partners, generally speaking, intend to understand one another. In this research, we compared the extent to which deaf and hearing children refer to mental states rather than to situational factors as the causes of other people’s emotions. Due to their shortage of spontaneous conversations with knowledgeable others referred to earlier, deaf children’s responses are expected to be impaired compared to those of hearing children.

Additionally, we added a factor that was expected to appeal more strongly to children’s possible tendency to suggest the causal relationship between mental states and emotions. Besides the explanation of typical emotions, children were also asked to explain the protagonist’s atypical emotions. Typical emotions—a delighted face when a birthday cake is carried in, or a grumpy face when a penalty is inflicted—do not require much elaboration about specific desires and/or beliefs of the person in question. These kinds of typical emotions can be easily explained in terms of situational factors. However, a situational explanation would be unsatisfactory in the case of an unexpected emotional reaction (a grumpy face when the birthday cake is carried in). This reaction asks for an additional explanation, preferably in terms of the protagonist’s experience of the situation, for example, the assumption that the protagonist has an atypical desire (“She doesn’t like cake”) or a different belief (“She is angry, because she *thinks* that they won’t allow her to eat cake”). Therefore, *if* children have an understanding of the fact that other’s emotions are caused by mental states, the explanation of others’ atypical emotions should most strongly encourage both deaf and hearing children to mention this subjective element.

Method

Participants

Twenty-three severely and profoundly deaf children and 85 hearing children participated in this study. The group of deaf children consisted of ten 6-year-olds (mean age 6–11, *SD* 6 months) and thirteen 10-year-olds (mean age 10–11, *SD* 5 months) who came from a primary school for the deaf. There were 13 boys and 10 girls, all of whom had a prelingual hearing loss. All children were audiologically diagnosed as being profoundly deaf: the mean hearing loss of 17 children was 104.42dB (*SD* 8.82) in the better ear; the remaining children had no measurable hearing. All but one had hearing parents. The communication with their teachers was in Sign-Supported Dutch (SSD). Apart from their deafness, they had no other handicaps. The deaf children were in a standard educational programme. To confirm that the deaf children were of average IQ, assessments by the school psychologist were used (these were available for all but one of the children). Seven children were tested with the SON (a standard Dutch nonverbal intelligence test, mean score 102, *SD* 6.8), but most children were tested with subtests from the WISC-R. Based on their WISC-R scores, children’s intelligence was rated by the school psychologist as “below average”, “average”, or “above average” for intelligence. Most children (nine) were within the

Table 1
Content of the Six Stories, with Typical and Atypical Emotions

Story content	Typical emotion	Atypical emotion
1. Joris receives a present from his mother, and he doesn't know what is in it	Happy	Angry
2. Sheila goes outside to play hide and seek with other children	Happy	Afraid
3. Linda was promised a trip to the zoo, but she has to stay at home now	Angry/Sad	Happy
4. Walter's dog is a bit ill today	Sad	Afraid
5. Petra sees a person in a dark living room, who she cannot identify	Afraid	Happy
6. Madelain lies in bed, trying to sleep, when she hears a strange noise	Afraid	Angry

"average" category and six were considered to be "above average".

An additional 42 hearing 6-year-olds (mean age 6:3, range 5:9 to 7: 2) and 43 hearing 10-year-olds (mean age 10:4, range 9:8 to 10:11) participated. Half of the participants in each age group were male. These children came from primary schools located around Amsterdam, the Netherlands. In terms of SES (middle to higher class children) these groups were comparable to the SES of the deaf children. No intelligence measures were collected, but according to the teachers of one school the intelligence of their pupils could be described as average, whereas teachers of the second school judged their school population as average and slightly above average, respectively.

Material

The material consisted of six stories that described emotion-eliciting situations. Two stories were designed to provoke happiness, two to provoke sadness or anger, and two to provoke fear. A content indication of each of the stories is provided in Table 1. After hearing each story, participants were asked how the protagonist would feel and why (question 1 and 2). If participants failed to identify an emotion, they were asked "Do you think [name protagonist] feels happy, sad, angry or afraid?" The order of the suggested emotions was randomised to avoid biased responses. Once participants had predicted and explained an emotion, the experimenter said that the protagonist felt differently and named an atypical emotion. The atypical emotions (happiness, anger, or fear) were fixed. The experimenter asked participants to explain this atypical emotion (question 3).

Female protagonists were used for stories that involved fear as a typical emotion in order to avoid "macho" responses. We had noticed in previous studies that few boys (of all age-groups) had suggested fear during introductory conversations. An example of a story (anger/sadness) is:

This is Linda. Linda's father and mother had said that they would go to the zoo. But now Linda's mother says that they cannot go and that they will have to stay at home. How does Linda feel now she hears that she will not be going to the zoo, but has to stay at home? (1) And why does Linda feel ... ? (2)

Yes, I would have thought so too. But Linda does not feel [emotion given by the participant]. Linda feels *happy* now she isn't going to the zoo and is staying at home. How come Linda feels happy? (3)

Procedure

All participants were tested individually. The deaf children were tested using SSD by a hearing female staff member who they were not familiar with. The instructions given to the hearing children were accurately translated into SSD and no

child gave any indication that they did not understand the instructions. It should be noted that some practitioners suggest that deaf children have conceptual problems with "why" questions. However, the deaf children's responses revealed no conceptual problems with these questions.

In order to make participants familiar with the emotional concepts that would be used in the stories, they were asked if they sometimes experienced happiness, sadness, anger, and fear, and if they could give an example of such an occasion. The experimenter helped children who found it difficult to provide examples. For example: "When is your birthday? Do you feel happy then? Okay, and could you think of something else now?" The order of the six presented stories was randomised.

The sessions with hearing children were tape recorded, and the sessions with deaf children were also recorded by video. The deaf children's experimenter verbalised children's responses. Transcriptions were derived from the tapes after the sessions. A deaf person compared the written text with the video recordings. No inaccuracies were found.

Scoring

In order to ascertain the extent to which children attributed mental states to the protagonist in their emotion-explanations, responses were assigned to one of the following categories.

- (1) *Fact beliefs*: This category was applied when the participant referred to the protagonist's beliefs about the situation. For example: "She is happy, because she thinks that her friend will come over to play now she isn't going to the zoo".
- (2) *Desires & preferences*: This category was applied to answers that referred to the protagonist's desires. For example: "She wants to stay at home and play with her friend". Value beliefs, that is, beliefs that do not refer to reality but to someone's preferences, also fell into this category.
- (3) *Situational*: Answers that only elaborated on the situation or referred to another situation without reference to a protagonist's mental state fell into this category. For example: "She is happy because she is going to play with her friend".
- (4) *Missing*: Responses fell into this category if (a) the participant had not predicted the typical emotion; or (b) the answer was missing on the tape. The responses of five participants (three 6-year-olds and two deaf children) were excluded from further analyses, because they had two missing values on one emotion-cluster (two happiness, anger/sadness, or fear stories). When participants had one missing value per emotion cluster, the remaining score was included in the analysis.

Note that the categories for fact beliefs and desires are not exclusive, because the response: "He *thinks* it is a car and he really *wants* a car" refers to a desire and a fact belief. Responses were then assigned to both categories. This was the case for 25 and 69 responses by deaf and hearing children respectively. All responses were coded by two raters. The inter-rater agreement was 96% and disagreements were resolved by discussion.

Results

Typical Emotion Predictions

Children were presented with six stories in which they were asked to predict the protagonist's emotion. The expected or typical emotion was frequently predicted, although deaf 6-year-olds (82% correct) and hearing 6-year-olds (90% correct) made fewer correct predictions than 10-year-olds (both deaf and hearing: 96% correct). Collapsed over age and group, correct emotion-predictions ranged from 92% to 97%, except for one story in which a girl goes outside to play with other children. The expected emotion-prediction was happy, but 18 hearing and 5 deaf children predicted that the girl was sad, angry, or scared.

One striking difference between deaf and hearing children was the fact that only 9/13 of the 10-year-old deaf children immediately predicted the protagonists' emotions when they were asked to in all six stories (question 1), whereas all hearing children responded correctly (except for one 6-year-old once). All deaf 6-year-olds and four deaf 10-year-olds started to explain the protagonist's emotion, but they failed to tell how the protagonist actually felt at least once. This occurred irrespective of story-type or emotion. Children who did not predict an emotion were asked again by the experimenter. Most deaf children who did not predict an emotion immediately, corrected this when the experimenter then asked again "Okay, but how does [s]he feel?".

Emotion Explanations

Our first consideration was the extent to which deaf children would refer to mental states (desires or beliefs) in their explanations of others' emotions, when compared to hearing children. Table 2 shows the mean scores for mental state attributions (corrected for missing values). Children were given a score of 0.5 for each story in which they referred to a mental state (a desire, a belief, or both). As there were two stories in each group children could receive scores of 0, 0.5, or 1.

A 2(Group: deaf and hearing children) \times 2(Age: 6- and 10-year-olds) \times 2((A)typical) analysis of variance with

Table 2
Mean Score of Mental State Attributions as a Function of Group \times Age \times (A)typical Emotions

	Prototypical emotion	Atypical emotion
Deaf children		
6-year-olds	.60	.46
10-year-olds	.74	.72
Hearing children		
6-year-olds	.37	.45
10-year-olds	.48	.55

repeated measures on the last factor revealed main effects for Group, $F(1,104) = 8.74$, $p = .004$, and Age, $F(1,104) = 7.23$, $p = .008$, and an interaction for Group and (A)typical, $F(1,104) = 4.10$, $p = .046$. It can be seen in Table 2, as expected, that 10-year-olds referred more often to mental states than 6-year-olds. Unexpectedly, however, Table 2 also shows that deaf children referred *more often* to mental states than hearing children and this is especially the case for typical emotions. Note, however, that these results may be delusive, because this analysis—based on mental state references—is insensitive concerning possible distinctive desire- and belief-response patterns. In order to obtain more specific information, we decided to analyse the results separately for beliefs and desires.

Beliefs. Table 3 shows the mean score of belief-attributions as a function of Age, Emotion (happiness, anger/sadness, fear) and (A)typical. Children were given a score of 0.5 for each story in which they referred to a belief. Thus, for the two stories given in each group, children who failed to refer to beliefs scored 0, children who referred to beliefs in only one of the stories scored 0.5, and children who referred to beliefs in both stories scored 1. The scores in Table 3 are collapsed over group, since there was no difference between the two. Overall, only a few belief references were made. However, it can be seen that 10-year-olds referred more often to beliefs than 6-year-olds. As one would expect, atypical happiness and atypical anger/sadness evoked more belief references than typical happiness and anger/sadness. Yet, the response pattern for fear is quite distinct. Clearly, fear evoked more belief attributions than the other emotions and this is especially the case for typical fear. A 2(Age) \times 3(Emotion) \times 2((A)typical) analysis of variance with repeated measures on the last two factors confirmed a main effect for Age, $F(1,101) = 5.65$, $p = .019$, and Emotion, $F(2,202) = 59.70$, $p = .000$, and an interaction for Emotion \times (A)typical, $F(2,202) = 12.49$, $p = .001$. The differences between typical and atypical happiness, $T(105) = 2.46$, $p = .008$, and fear, $T(105) = 3.18$, $p = .000$, showed significance when tested post hoc. The difference between typical and atypical anger/sadness was in the expected direction, but did not reach significance.

Desires. Children were given a score of 0.5 for each story in which they referred to a desire. Thus, for the two stories given in each group, children who failed to refer to desires scored 0, children who referred to desires in only one of the stories scored 0.5, and children who referred to desires in both stories scored 1. Overall, all children referred more frequently to desires than to beliefs. Because the factor Age had no influence on the desire scores, the results are collapsed over Age. A 2(Group) \times 3(Emotion) \times 2(A)typical analysis of variances with repeated measures on the last two factors revealed two main differences between deaf and hearing children, which we will discuss separately.

Table 3
Mean Score of Belief Attributions as a Function of Age \times Emotion \times (A)typical

	Happiness		Anger/Sadness		Fear	
	I	II	I	II	I	II
6-year-olds	.07	.14	.02	.11	.42	.23
10-year-olds	.15	.23	.12	.13	.48	.32

I = Prototypical emotions; II = Atypical emotions.

Table 4
Mean Score of Desire Attributions as a Function of Group \times Emotion

	Happiness	Anger/Sadness	Fear
Deaf children	.58	.73	.13
Hearing children	.27	.37	.10

Table 5
Mean Score of Desire Attributions as a Function of Group \times (A)typical Emotions

	Prototypical emotion	Atypical emotion
Deaf children	.51	.45
Hearing children ^a	.19	.30

^aPost hoc *t*-test between typical and atypical conditions shows significance with Bonferroni correction.

The first difference concerns the different emotions and can be seen in Table 4. In this table, the scores are collapsed over (A)typical for deaf and hearing children. A main effect for Group, $F(1,101) = 27.61$, $p = .000$, and Emotion, $F(2,202) = 78.12$, $p = .000$, and an interaction for Group \times Emotion, $F(2,202) = 11.81$, $p = .000$, was revealed. Obviously, deaf children made more desire references than hearing children. This is especially true when they were asked to explain happiness, $T(106) = 4.18$, $p = .000$, and anger or sadness, $T(106) = 5.07$, $p = .000$. Fear, by contrast, showed no group differences and evoked few desire references for both deaf and hearing children.

The second difference in results between deaf and hearing children, Group \times (A)typical, $F(1,101) = 8.30$, $p = .005$, can be seen in Table 5. Collapsed over Emotion, this table shows that hearing children attributed more desires to explain atypical emotions than to explain typical emotions, $T(84) = 4.36$, $p = .000$. This pattern was absent among deaf children's responses: deaf children's desire-attributions did not differ significantly for typical or atypical emotions. Post hoc *t*-tests confirmed this pattern.

Finally, we want to mention an unanticipated, yet surprising result: the responses of the deaf children were nearly twice as long as for the hearing children (mean response length is 290 and 159 words respectively).

Discussion

Our results showed that both deaf and hearing children were capable of correctly predicting typical emotions. Former studies demonstrated hearing children's capacity to predict basic emotions at a much earlier age (Barden, Zelko, Duncan, & Masters, 1980; P. L. Harris, Olthof, Meerum Terwogt, & Hardman, 1987), but Odom et al. (1973) found that 7- and 8-year-old deaf children still had trouble identifying and interpreting emotional situations. Yet, in this research, most deaf children did not always come up with accurate emotion predictions immediately, although this decreased with age. All deaf 6-year-olds had to be asked again by the experimenter to name an emotion at least once. The fact that the older deaf children performed as well as their hearing peers might have to do with the PATH programme ("Promoting Alternative Thinking Strategies": Greenberg & Kusché, 1993) that is part of the curriculum at the institute for deaf children and which starts with 6-year-old children.

Emotional awareness and labelling emotions are important aspects of this programme (this curriculum aims to develop self-control and interpersonal problem-solving skills). Additionally, when they enter the institute for the deaf, children will have more possibilities to communicate with mature conversation partners.

The main focus of this research, however, was on the extent to which deaf and hearing children would refer to mental states rather than to situational factors as the causes of other people's emotions. For this reason, we asked deaf and hearing children to *explain* the emotions they had predicted, whereas most research on deaf children asked them to *predict* others' emotions or behaviour. We expected deaf children to have less understanding of the causal relationship between mental states and emotions than hearing children (Steeds et al., 1997). However, the different mental states, desires, and beliefs precluded a general pattern: whereas there were no differences between deaf and hearing children's belief attributions, the deaf children's desire attributions exceeded those of the hearing children.

Beliefs ("Because he *thinks* it is only a fake package") were mentioned less than desires, but belief references increased with age for both deaf and hearing children. Consistently, other findings also showed that (hearing) children understand the causal relationship between a situation and an emotion before they are 6 years old (Stein & Trabasso, 1989), but they rarely make belief references to explain others' emotions. Ten-year-olds, on the other hand, refer increasingly to beliefs as causes of visible emotional reactions (P. L. Harris, Olthof, & Meerum Terwogt, 1981). Obviously, the causal relationship between beliefs and emotions is more complicated, since this requires appreciation of the fact that it is not objective reality but one's mental representations of reality that causes one's emotional reaction. This age-related pattern was evident in our research for both deaf and hearing children.

However, the different emotions moderate this general pattern. Moreover, the kind of emotion influences the extent to which children attribute desires or beliefs. Fear evoked fewer desire attributions, but more belief attributions, than happiness, anger, and sadness. Fear is experienced in anticipation of possible harm (Izard, 1991). Consequently, the protagonist's lack of knowledge about the situation was frequently suggested as a cause for fear "She doesn't know who it is", which explains the relatively frequent use of belief attributions. Probably, participants considered it pointless to express the universal desire for physical safety in fearful situations, which explains the lack of desire statements in the case of fear.

The fact that the results of deaf children were not inferior to those of hearing children with respect to belief references, whereas deaf children showed impaired results on other belief tasks (Peterson & Siegel, 1995, 1998; Russell et al., 1998; Steeds et al., 1997), might have to do with the difference in task: explaining versus predicting emotions. Especially for deaf children, this might be an important factor. Deaf children participate less in daily conversations that concentrate around mental states. Their limited access to everyday conversations might cause deaf children to react more briefly and to the point when they are asked for a prediction of others' emotions. They might head directly for the final outcome of the story—the fulfilment of the protagonist's desire—without regard to the protagonist's beliefs (P. L. Harris, 1996). In

other words, emotion prediction tasks might elicit a pragmatic line of reasoning in deaf children: the actual content of the Smartie box will eventually result in the emotional reaction of the protagonist.

The *explanation* of emotions, on the other hand, does not ask children to choose between two possible responses, as is the case for the emotion prediction tasks (i.e. happy or unhappy). Instead, children are required to invent and talk about possible scenarios that could explain protagonists' emotions. The fact that deaf children's responses were twice as long as those of hearing children indicates that deaf children were particularly engaged by this task. This outcome strengthens our point in the next paragraph, that deaf children's limited interaction time in their daily lives influences their communication: they might not have the possibility to communicate at length very often. Moreover, emotion explanations do not ask for a correct prediction, because the protagonist's emotion is already known. Whereas desires and beliefs are given in the emotion prediction tasks, children have to work these out for themselves in the case of emotion explanations. Thus, unlike emotion predictions, emotion explanations appeal more to imaginative and creative problem solving capacities, which will also have encouraged children to reason more extensively about the topic. And as it turns out, by doing so, deaf children included mental representations of reality as often as hearing children. The fact that the response pattern of deaf and hearing children was compatible with respect to belief references is consistent with the work of Clark, Schwanenflugel, Everhart, and Bartini (1996). They concentrated on deaf adults' organisation of cognitive verbs (knowing, thinking, etc.) and concluded that deaf adults' ToM is similar to that of hearing adults.

Furthermore, deaf children's references to desires largely *exceeded* those of hearing children when they were asked to explain the protagonist's happiness, anger, or sadness. These desire references among deaf children even increased with age. More surprisingly, however, deaf children's references to desires occurred for both typical and atypical emotions. This pattern differed from that of the hearing group, because hearing children referred more frequently to desires in the case of atypical than typical emotions. A first question is why deaf children used so many desire references. It could be argued that understanding the subjectivity of desires can be learned nonverbally as well, but that leaves unexplained why deaf children referred *more frequently* to desires than hearing children. Maybe we should consider the functionality of expressing desires to explain this result. Vaccari and Marschark (1997) argued that hearing parents are not fully responsive to their deaf children's needs, due to their lack of communication skills. Moreover, hearing caretakers show less patience with their deaf child than do deaf caretakers (Wood, 1991). In other words, deaf children who grow up in a hearing world have limited interaction time and interaction means when compared to their hearing siblings. The deaf children in this research—with one exception—all had hearing parents. Probably, deaf children with hearing parents are likely to concentrate on an effective use of their interaction time and they may primarily use this time to ensure that others unambiguously understand what they want: their desires. Any other approach might be misunderstood. Note that the consequences for deaf children are harder to overcome than for hearing children

if an implicit desire is misunderstood. Hearing children can quite easily correct such a misunderstanding (Meerum Terwogt, Rieffe, Tuijn, Harris, & Mant, 1999). Maybe deaf children are as capable as hearing children in this respect, but they might simply lack the interaction time to do so. Thus, deaf children's desire references might very well be a part of their standard way of communicating.

A second question is why deaf children, as opposed to hearing children, did not distinguish between typical and atypical emotions. Deaf children might be concentrating on the expression of their own desires in their daily life, to the extent that they—by default—also talk about desires in cases where hearing children would leave the desire implicit. Hearing children might reserve desire explanations only for when they think that the situation asks for them (see Introduction), as for example in the case of atypical anger: "He might have wanted something else". The content of children's responses, however, shows a difference between deaf and hearing children that goes one step further: not a fundamental lack of understanding, but a somewhat different perspective on the situation by deaf children brings about their frequent desire references. We will use the story about Linda, whose trip to the zoo is cancelled by her mother (see Methods), as an example.

In contrast with hearing children, one third of the deaf children concentrated on how Linda is frustrated in her desire by her mother to explain her typical anger: "Linda is angry, she wants to go to the zoo, but mum says no, mum is angry with Linda". Another third of the deaf children concentrated on what Linda (still) wants and they even elaborate on what she will be missing: "She is angry, because she wants to go to the zoo, she wants to see the monkeys", or "... she wants to pet the animals". Hearing children did not give these kinds of answers. It seems as if deaf children—more strongly than hearing children—identify themselves with Linda, instead of judging the situation as an observer. Hearing children mostly explained typical anger in terms of situational factors. One third referred to the broken promise: "She is angry, because they were going to the zoo at first and now they aren't going any more". In contrast, deaf children never mentioned the broken promise. Their focus seems somewhat limited. They get stuck in Linda's initial desire, without much consideration for external factors that might have caused this situation. This explanation is supported by the work of Gregory (1976), who showed that in interactions between deaf and hearing conversation partners, explanations of actions or emotional reactions from both parties are less frequent and less competent. Presumably, this tenacious attitude is an influential factor in the frequently noted externalising behavioural problems of deaf children (van Eldik, 1994; Vostanis et al., 1997).

In conclusion, in our research deaf children appreciated the fact that desires and beliefs govern emotions as well as their hearing peer-group, but the manifestation of this appreciation appeared to depend on the kind of relationship that children want to establish with other people. Deaf children grow up in a mainly hearing society and, as such, their time and their means of communicating with others is frequently restricted. Therefore, an economic use of this time seems wise and their frequent references to desires are defensible. Whereas hearing children learn that desires can be left implicit, because "it goes without saying", it appears that deaf children have

learned to explicitly refer to desires by default (in order to avoid a possible misunderstanding). Deaf children explain other people's emotions by means of desires regardless of the typicality of that emotion.

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