

Belief-attribution in deaf and hearing infants: Evidence for the importance of conversational input

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INTRODUCTION

Here we report the preliminary results of three experiments where we compare deaf and hearing children from Italy, Sweden and UK on non-verbal tasks of belief attribution and measures of communication. The aim is to determine the effects of access to language on children's early mentalizing abilities.

EXPERIMENT 1

Participants

Forty-two typically developing hearing Italian infants

- 19 eleven-month-olds (range 8m – 13m)
- 23 sixteen-month-olds (range 14m – 18m)

Procedure

The infants were seated on their parent's lap and viewed a Tobii T120 Eye Tracker screen. After a 5-point calibration, all children were shown two familiarization trials and two test trials (see Figure 1). In the familiarization trials, they viewed a cat (Tom) who followed a mouse (Jerry) through a Y-shaped tube. Tom was shown witnessing Jerry traveling through the tube, then exiting and hiding in one of the two boxes located outside the exit points. Tom followed Jerry to look for him in the appropriate box.

Then half the infants in each group received the true belief (TB) task. Here Jerry was shown moving through the tube and hiding in one location and then the opposite location in full view of Tom. Once Jerry disappeared in the second box, Tom entered the tube. The infants' eye movements were recorded during the 2.75 seconds in which Tom was travelling through the tube to determine whether he or she would anticipate the Tom's exit point and preference for the place in which Jerry was hidden. The dependent measure was the time elapsed during which infant's gaze was focused on either the location where Jerry had hidden or the opposite location.

The other half of the infants in each group received the false-belief (FB) task. The procedure was the same except that Tom was illustrated as not having witnessed Jerry's second hiding place. After an interval of 1-7 days, the infants who had received the TB task first, now received the FB task in a second session and those who had seen the FB task first, now received the TB task.

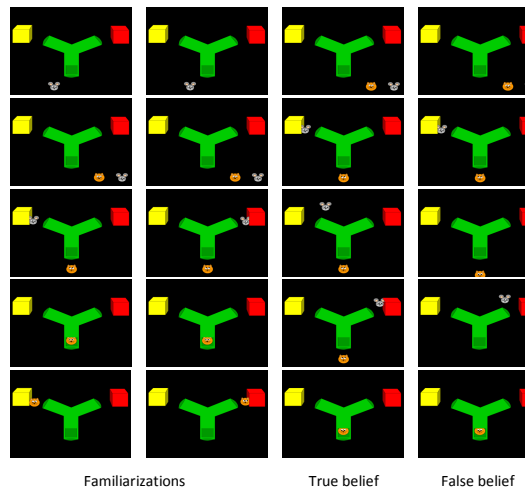
Results

We coded the location of the first saccade after Tom disappeared into the tube chasing Jerry. On the TB test trial, 8 of the 19 eleven-month-olds gazed toward the correct location ($p = .647$, two-choice binomial test, two-tailed), and 16 of the 21 sixteen-month-olds gazed toward the correct location ($p = .026$).

On the FB test trial, 6 of the 19 eleven-month-old infants gazed toward the correct location ($p = .167$), whereas 17 of the 23 sixteen-month-olds gazed toward the correct location ($p = .034$).

The results suggest that 16-months-old but not 11-months-old typically developing infants show patterns of anticipatory looking which indicate an understanding of other's behaviour in mental terms, i.e. false beliefs.

Figure 1. Example of "Tom & Jerry" ToM task



EXPERIMENT 2

Participants

These were ten congenitally deaf 23-months-old Swedish children of hearing parents (age range 17m–26m; hearing loss of 50–120 dB unaided). Five children used cochlear implants (1 to 11 months of implant use) and five children used hearing aids (12 to 21 months of use).

Procedure

All children were shown the "Tom & Jerry" ToM task following the procedure from Experiment 1. The children were also given measures of executive functions and language comprehension, both spoken and signed language.

Results

A 2 (condition: true belief vs. false belief) X 2 (looking location: correct vs. incorrect) ANOVA on the total looking times yielded no significant main effects of the condition or looking location. There was however a significant interaction effect $F(1, 36) = 21.55, p < .001, \eta^2 = .37$, indicating that the children showed different looking patterns in different test conditions. Specifically, the children looked significantly longer at the correct location in the true belief condition compared to the incorrect location; and significantly longer at the incorrect location in the false belief condition.

Although it is known from earlier research that deaf late signing children do not pass the verbal ToM-tasks until their teenage years (Meristo et al., 2007; Peterson & Siegal, 2000), our study is the first one to demonstrate that these children are delayed even in the non-verbal spontaneous false-belief attribution at the age of 2 years.

EXPERIMENT 3

Participants

Twenty-nine families of toddlers with severe to profound hearing losses (>80dB) from UK, aged between 24-35 months participated in the study.

Procedure

Parents were given 10 pictures portraying emotionally charged or mentalistic situations (e.g. a girl showing signs of shyness, a father scolding his son) taken from Ruffman, Slade, and Crowe (2002). The parents were asked to look at the pictures together with their child. Parents' language use was video recorded and analyzed in respect to mental and non-mental state categories. The mental state terms included all references to emotions, desires, cognitive terms (e.g. "think", "know"), modulations of assertions (e.g. "might", "must", "maybe"), and other mental state terms (e.g. "remember", "understand", "forget"). The non-mental state utterances include descriptions, links to the child's life and physical states (e.g. "hungry").

Results

Deaf toddlers of hearing mothers experience less good interaction, less abstract talk, slower vocabulary growth, less emotional state talk, far less modulations of assertion talk, far less think and know talk, and less descriptions, elaborations and contingent talk than hearing children or deaf children of deaf parents. At the same time they experience more orienting, repetition and more physical state talk.

CONCLUSIONS

Our results show that even at a very early stage of language development, deaf children of hearing parents do worse on ToM measures than do hearing children. Hearing mothers also use far less mental state language than their signing deaf counterparts when communicating with their deaf children. These findings support the position that the access to a theory-of-mind mechanism seems to be dependent on early access to language. Since children in our studies are still just in the beginning of their language acquisition, it would be expected that the role of language in this case seems to be coordination of minds in a conversational context (e.g. joint attention or early pragmatic understanding) rather than specific structural parts of language (e.g. complement clauses).