



## Confronting the language barrier: Theory of mind in deaf children



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### ABSTRACT

The current study addressed deaf children's Theory of Mind (ToM) development as measured by a battery of first- and second-order belief tasks. Both a chronological age-matched control group and a younger group of pre-school aged hearing children were compared to a group of deaf children born to hearing parents. A hearing native signer enacted each of the tasks, which were pre-recorded in video clips in English (SSE), British Sign Language (BSL) and spoken English, in order to consider all communication preferences of the deaf children. Results revealed no differences in performance between the deaf and the young hearing children. However, despite the inclusion of ToM tasks based on their preferred mode of communication, the deaf children performed significantly worse at the unexpected-content and second-order belief task compared with their age-matched controls. These findings imply a delay rather than a deficit in ToM in deaf children that could be attributed to limited opportunities to converse and overhear conversations about mental states.

**Learning outcomes:** None.

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## 1. Introduction

An essential element to successful communication is the ability to make inferences about the psychological states of others and to predict or explain their behaviour with reference to their mental states, feelings, beliefs and desires (Premack & Woodruff, 1978; Wellman, 1990). The ability to attribute mental states to others is known as “mind-reading” or having a Theory of Mind (ToM; Povinelli & Giambrone, 2001). Some evidence indicates that deaf children, in particular, late-signing or oral deaf children, have a delay or a deficit in ToM compared to hearing pre-schoolers (Peterson & Siegal, 1995) due to difficulties in language acquisition and opportunity to talk about mental states. However, some more recent studies have shown comparable performance between oral deaf and hearing children (e.g., Ziv, Most, & Cohen, 2013). Language skill appears crucial to be able to pass ToM tasks, but whether difficulty in passing tasks assessing ToM is due to difference in language development (Harris, de Rosnay, & Pons, 2005), or as a result of the language and/or processing demands of the tasks measuring ToM (e.g., using an interpreter) remains to be clarified (Bloom & German, 2000).

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### 1.1. False belief and language

Central to the development of a ToM is the capacity to understand false beliefs: mistaken beliefs about situations held by another person. Typically developing children acquire this understanding between 4 and 5 years of age (Wellman, Cross, & Watson, 2001). In the standard false belief task a child is told a story in which the central character holds a mistaken belief, for example the location of an object (e.g., “The Sally Ann marble task”; Baron-Cohen, Leslie, & Frith, 1985), or the content of a container (e.g., “the Smarties task”; Perner, Leekham, & Wimmer, 1987). As the story unfolds, the child being tested becomes aware of events that the main character does not witness. While most 5-year-olds can easily differentiate their own view from that of the main protagonist in the story, typically developing children aged 3 and younger do not understand that the character will act upon his/her mistaken belief rather than according to the child’s own knowledge (Wellman & Liu, 2004). Beyond this age, children begin to extend their understanding to grasp the concept of multiple perspectives and appreciate that two people can interpret the same situation differently (Selman, 1980). By around age 7, a second-order false belief task is passed by most typically developing children, requiring the attribution of a first-order belief (Person A thinks X) to another person (Person B thinks “Person A thinks X”; Baron-Cohen, 1989). The original version of this task, the so called “ice cream-task” (Perner & Wimmer, 1985), involves a situation in which a boy (“John”) knows that an ice-cream van has left the park to go to the school, but he believes that a girl (“Mary”) does not know this. In order to pass this task the child must differentiate between factual reality and the knowledge of each character in the story.

There are differences in the age at which ToM develops, but a child’s language ability appears to account for such variation. Evidence comes from studies showing language often develops in conjunction with ToM (Tager-Flusberg, 2000) and a deficit in ToM is commonly observed in children with difficulties in language; for example autism (Tager-Flusberg & Joseph, 2005), specific language impairment (Miller, 2001) and oral or late-signing deaf children (Woolfe, Want, & Siegal, 2002). Controversy circulates the debate on how exactly language relates to children’s ToM development. One interpretation is lexical enrichment, whereby a well-developed vocabulary of mental-state terms (e.g., *think*, *know*) scaffolds conversations about mental states (Ruffman, Slade, & Crowe, 2002). Alternatively, it has been proposed that the verbal nature of false belief tasks accounts for the relationship between ToM performance and language (Bloom & German, 2000). It can be reasoned that failing the false belief task indicates a lack of understanding of what is being asked.

### 1.2. Theory of mind in deaf children

A population that consistently shows problems in ToM is deaf children (de Villiers & de Villiers, 2000; Peterson, 2002, 2004; Peterson & Siegal, 1995, 2000; Schick, de Villiers, de Villiers, & Hoffmeister, 2007). The vast majority of deaf children are born to hearing parents (more than 90%), and have typically demonstrated a delay and/or a deficit in ToM (Peterson & Siegal, 1995). More specifically, research has shown that language is a key component in the development of ToM in deaf children. For example, Peterson and Siegal (1999) found that the performance of “late-signing” deaf children (deaf children born into families in which no-one uses a sign language) was impaired relative to hearing controls, native-signing and oral deaf children, and paralleled that of a group of autistic children. In contrast, deaf signing children of deaf parents can perform similarly or better than hearing children on some ToM tasks (Courtin, 2000; Courtin & Melot, 2005).

It has been suggested that the difference in performance of deaf children with hearing parents is the opportunity to converse about mental states. For example, Peterson and Siegal (1995) proposed “the conversational hypothesis”, positing that it is the lack of experience of conversing about mental states that leads to difficulty in acquiring ToM for late-signing deaf children. In addition, Courtin (2000) proposed that the grammatical structure of sign language usage promotes the visual perspective-taking and structure necessary to represent a point-of-view that is necessary to acquire ToM. Many late-signing children’s hearing families have limited or no skills in sign language, so it is plausible that this reduced opportunity to converse about mental states leads to such mind-reading difficulties (Vaccari & Marschark, 1997).

More recent studies comparing deaf children with different types of hearing amplification have yielded inconsistent results. While Peterson’s (2004) study revealed a delay of between 3 and 5 years in ToM acquisition of deaf children with cochlear implants (CIs), studies by Peters and colleagues found only marginal delays in children with CIs between 3 and 12 years (Peters, Rimmel, & Richards, 2009; Rimmel & Peters, 2008). In a more recent study, Ziv et al. (2013) found that younger deaf Israeli children (aged 5–7) with CIs performed as well as hearing children. Although it is possible that the increased auditory input from CIs benefits ToM acquisition, there is much variability in false belief performance among children with CIs. Peters et al.’s (2009) study revealed positive correlations between false belief scores and duration of implantation. In addition, Ziv et al. (2013) noted that a number of children with CIs who performed poorly also had low verbal ability. The heterogeneity of deaf oral children’s communication and linguistic background warrants caution in directly linking levels of performance with CIs.

### 1.3. Assessment of ToM and language

Given the relationship between ToM and language development it may seem surprising that only a handful of studies of ToM development in deaf children have considered language or signing ability of their participants. However, there are several linguistic factors that can potentially affect the performance of deaf children. For example, many deaf children use a combination of sign language (e.g., American Sign Language (ASL) or British Sign Language (BSL)) and oral communication,

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