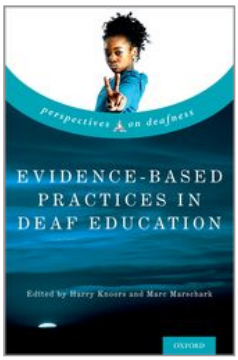

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Social-Emotional Problems in Deaf and Hard-of-Hearing Children from an Executive and Theory-of-Mind Perspective

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Abstract and Keywords

The implications of a hearing loss can go far beyond the linguistic domain. Several studies have revealed that deaf and hard-of-hearing children are at risk in their social-emotional development. This chapter argues that executive functions and theory of mind are two central underlying cognitive factors in people's social-emotional functioning. We briefly review what is currently known about executive functioning and theory-of-mind development in deaf and hard-of-hearing children and adolescents and then present a cognitive model with a central role for inner speech in relation to executive functioning and theory of mind. We hypothesize that inner speech both enables and urges the regulation of oneself (executive function) and also the mentalization of one's own and others' inner worlds (theory of mind). We discuss the implications for assessing and

treating social-emotional problems in deaf and hard-of-hearing children and adolescents.

Keywords: social-emotional functioning, deaf, hard-of-hearing, executive functions, theory of mind, inner speech, neuropsychology

Although the major impact of deafness from birth is the difficulty in learning (sign or spoken) language, impoverished or insufficient access to language for deaf and hard-of-hearing (DHH) children has implications that go far beyond the linguistic domain. To illustrate, many studies have revealed that DHH children are also at risk in their social-emotional development (Dammeyer, 2010; Fellinger, Holzinger, Sattel, & Laucht, 2008; Hintermair, 2007, 2014; van Eldik, Treffers, Veerman, & Verhulst; 2004; van Gent, Goedhart, Hindley & Philip, 2007). Hintermair (2014) pointed out that the prevalence rate of social-emotional problems in DHH children and adolescents is about two to three times higher than the prevalence rate in hearing children and adolescents. Dammeyer (2010) administered the Strengths and Difficulties Questionnaire to the parents of a group of 334 DHH children and adolescents in Denmark and found a 3.7-fold increase in the prevalence of social-emotional problems in this group. Slightly lower prevalence rates have been reported by Van Gent et al. (2007), who administered the Child Behavior Checklist (CBCL) and Teacher's Report Form (TRF) to the parents and teachers of a group of seventy DHH adolescents in the Netherlands and found that the prevalence of social-emotional problems was 1.7 to 1.9 times higher in this group in comparison to hearing peers. In other words, it has become clear that DHH children's social-emotional development is at risk.

Neuropsychology provides a framework for differentiating social-emotional problems in terms of the interactions among the brain, cognition, experiences, and context. From a neuropsychological perspective, social-emotional problems can be cognitively differentiated in terms of mentalization (theory of mind [ToM], e.g., Lalonde & Chandler, 1995) and self-regulation (executive functioning, e.g., Morgan Lilienfeld, 2000; Nigg, Quamma, Greenberg, & Kusche, 1999). **(p.456)** Insight into disordered mentalization and self-regulation is highly valuable because it will enable individualized treatment and assessment of social-emotional problems in DHH children (cf. Hintermair, 2013; Castellanos, Pisoni, Kronenberger, &

Beer, 2015; Vissers & Koolen, 2016). Given that mentalization and self-regulation are the central underlying cognitive factors in social-emotional functioning, this chapter elaborates theoretical insights into executive functioning and ToM and presents state-of-the-art evidence on executive functions and ToM in DHH children. We then present a cognitive model of social-emotional problems in DHH children and end this chapter with implications for assessing and treating these problems.

Executive Functioning

Each executive function is “a form of self-directed actions aimed at modifying one’s behavior so as to make a future goal, end or outcome more or less likely to occur” (Barkley, 2012, page 60). In other words, they allow people to control and change their behavior in order to achieve (long-term) goals in life as well as controlling ongoing behavior in daily living. They are especially important in situations in which relying upon automatisms or impulses is unwise or even impossible, as in non-routine situations (Diamond, 2013). There is controversy over the specific components of executive functioning and the way they relate to each other (Barkley, 1997, 2012; Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000). This chapter focuses on three executive functions that are generally considered to be the core executive functions: inhibitory control, updating the contents of working memory (which we will refer to as working memory), and cognitive flexibility (Miyake et al., 2000).

Inhibitory control allows people to refrain from impulsive actions and automatic responses (self-control). It also helps people to stay focused on specific stimuli in the environment while ignoring distracting and irrelevant ones (selective attention/attentional inhibition). Inhibitory control (especially self-control) is important for social functioning because resisting impulses and temptations (e.g., waiting for your turn, not grabbing another child’s toy) is essential for establishing and maintaining social relationships (Tangney, Baumeister, & Boone, 2004). Consistent with this assumption, inhibitory control has been found to be related to social functioning in hearing children (Eisenberg, Fabes, Shepard, Murphy, Guthrie, Jones, et al., 1997; Nigg et al., 1999) and in DHH children and adolescents (Hintermair, 2013).

Working memory is the ability to temporarily store and process information that is perceptually no longer present. People need their working memory system to process sensory information from their environment that unfolds and changes over time. For instance, verbal **(p.457)** working memory is required to process and acquire spoken (and sign) languages (Waters & Caplan, 2006) and visual-spatial working memory is, among other things, needed to safely navigate through our environment (Garden, Cornoldi, & Logie, 2001). Most models of executive functioning also stress the role of working memory in goal-directed behavior (Barkley, 1997; Barrett, Tugade, & Engle, 2004; Hofmann, Schmeichel, & Baddeley, 2012). Barrett et al. (2004) proposed that working memory enables the activation of an individual's goals, the means by which these goals can be attained (retrieved from long term memory), and the selection or computation of a response on the basis of the available information (see for a similar claim Hofmann et al., 2012). Diamond (2013) has therefore argued that working memory is also essential for higher-order cognitive functions such as problem-solving, reasoning, and creativity.

With respect to social functioning, working memory may subserve temporal processing of social information during interactions, keeping social goals actively in mind, retrieving social information from long-term memory, and computing or selecting an appropriate social response. In line with this hypothesis, McQuade, Murray-Close, Shoulberg, and Hoza (2013) reported a correlation between hearing children's working memory capacity and various measures of social functioning (peer rejection, social competence, aggression, and conflict-resolution skills). For evidence for a similar relationship for DHH children and adolescents, see Hintermair (2013).

Cognitive flexibility allows people to quickly adjust their thoughts and behavior in response to changed circumstances (Diamond, 2013). Cognitive flexibility is necessary when one way of problem-solving turns out to be unsuccessful and one needs a new approach to attain one's goal. It is also required when there are sudden changes in priorities (an unexpected opportunity or threat) or sudden changes in the environment (un unexpected event or behavior from someone else). Cognitive flexibility is essential to social-emotional functioning as people bring their own goals, impulses, desires, and

emotions into social situations, which makes every social situation unique and often very complicated and unpredictable (Parsons & Mitchell, 2002). Consequently, cognitive flexibility has been found to be related to social functioning in hearing children and adolescents (Berger, van Spaendonck, Horstink, Buytenhuijs, Lammers, & Cools, 1993; Bonino & Cattelino, 1999) and in DHH children and adolescents (Hintermair, 2013).

Emotion regulation or emotional control is an executive function that is intimately related to cognitive flexibility (Gioia, Isquith, Retzlaff, & Epsy, 2002). Emotional control allows people to modulate or control their emotional responses, which is vital for social functioning (Barkley, 2012). Unsurprisingly, the ability to regulate one's emotions has been found to be related to social status and the number of friendships **(p.458)** in hearing children (Lopes, Salovey, Côté, & Beers, 2005). Similarly, Hintermair (2013) found a relation between DHH children's emotion regulation abilities and their social functioning.

In sum, the three core executive functions—inhibition, working memory, and flexibility—are important for social functioning, as is emotional control. The next section briefly discusses what is currently known about DHH children's abilities in these domains of executive functioning.

Executive Functioning in DHH Children

Executive functioning of DHH children has been addressed extensively in research over the past decade. Deficits or delays of DHH children have been found (although not always consistently) in all domains of executive functioning that were discussed in the previous section: inhibition, (verbal and visual-spatial) working memory, flexibility, and emotion regulation (e.g., Botting, Jones, Marschall, Denmark, Atkinson, & Morgan, 2017; Castellanos et al., 2016; Figueras, Edwards, & Langdon, 2008; Hintermair, 2013; Kronenberger, Colson, Henning, & Pisoni, 2014; Marschark, Kronenberger, Rosica, Borgna, Convertino, Durkin, et al., 2017; Pisoni, Conway, Kronenberger, Henning, & Anaya, 2010; Pisoni, Kronenberger, Roman, & Geers, 2011; but see Hall, Eigsti, Bortfeld, & Lillo-Martin, 2017).

An extensive study on executive functioning in DHH children was conducted by Hintermair (2013), who administered the Behavior Rating Inventory of Executive Function (BRIEF) to the teachers of 214 DHH children (ages five to eighteen years). Differences were observed between the average scores of DHH children and a hearing control group on most subscales of the questionnaire. Furthermore, Hintermair (2013) found that 22% of the DHH children had elevated scores (T-score ≥ 65) on the Inhibition subscale, 31% on the Working Memory subscale, 29% on the Shift (cognitive flexibility) subscale, and 26% on the Emotion Regulation subscale. Across these four domains, the number of DHH children with elevated scores (in the clinical range) was three to five times larger than the number of hearing children with elevated scores.

Botting et al. (2017) administered a battery of nonverbal executive function tasks to a group of 108 DHH children between five and twelve years old and a group of 125 hearing children matched on age, gender, and socioeconomic status and found that, on average, DHH children performed significantly worse in comparison to hearing children on inhibition, visual-spatial working memory, and flexibility. Thirteen percent of the DHH children scored more than two standard deviations below the hearing children's average scores on the inhibition task, respectively 2% and 10% on the two visual-spatial working memory tasks, and 12% on the cognitive flexibility task.

(p.459) Kronenberger, Colson, Henning, and Pisoni (2014) administered a battery of executive function tests to a group of sixty-four deaf children, all of whom were early implanted long-term cochlear implant users, and a group of seventy-four hearing children matched on age and nonverbal intelligence and found that deaf children performed significantly worse on the tests that assessed verbal working memory and inhibition in comparison to hearing children, but not on the tests that assessed visual-spatial working memory.

In sum, studies in the past two decades have consistently revealed that DHH children are delayed or have deficits in the three core components of executive functioning. It seems safe to conclude that DHH children are at risk in the domain of regulating their own behavior. As executive functions are

essential to social functioning, delays or deficits in executive functioning are likely to put children's social-emotional development at risk as well.

Theory of Mind

In 1978, Premack and Woodruff coined the term “theory of mind” in a paper in which they investigated whether chimpanzees have mental states such as knowledge and desires, and whether they can relate to others’ thoughts and intentions. They concluded that monkeys are able to infer others’ states of will (goals and desires). The ToM concept, which was developed in primate research, was adopted by developmental psychologists and still has a large influence on research into cognitive development and psychiatric disorders such as autism.

In short, ToM refers to our ability to build mental representations of our own and others’ inner worlds. ToM allows us to draw connections between observed external situations and internal mental states, and thereby predict behavior. Distinctive dimensions or types of human ToM, each with a different neuroanatomic underpinning, can be discerned: cognitive ToM, affective ToM, interpersonal ToM, and intrapersonal ToM (Vissers & Koolen, 2016; Westby & Robinson, 2014). Cognitive ToM refers to thinking about thoughts, knowledge, beliefs, and intentions, and affective ToM involves thinking about and experiencing emotions (e.g., Dvash & Shamay-Tsoory, 2014). Intrapersonal ToM refers to representing one’s own mental states, and interpersonal ToM concerns representing the thoughts and emotions of others (e.g., Tine & Lucariello, 2012). Interestingly, research has shown that affective and cognitive aspects of ToM are mediated by dissociated brain regions. While cognitive ToM seems to be mediated by the dorsomedial prefrontal cortex, the dorsal anterior cingulate cortex, and the dorsal striatum, affective ToM appear to be mediated by the ventromedial and orbitofrontal cortices, the ventral anterior cingulate cortex, the amygdala, and the ventral striatum (Abu-Akel & Shamay-Tsoory, 2011).

(p.460) Although children’s ToM abilities develop considerably with maturation between the ages of three and eleven years, development of ToM starts in the first six months with reciprocal interaction and emotional sharing (e.g., Gallagher & Hutto, 2008). During the second year of life, joint attention, imitation, and pretend play develop (e.g., Lewis, 2014), which indicate an understanding of others as intentional agents, an ability to form representations of self and others, and the capacity to form meta-representations

(Leslie, 1987; Rogers & Pennington, 1991; Tomasello, 1995). At this stage, emotional recognition and mental state vocabulary also start to develop (Astington & Baird, 2005). With a sense of self, children begin to realize that they are separate from others and can have different emotions from others, and they start to show empathy by intentionally comforting or helping another person (Thompson & Newton, 2013). Between four and five years of age, first-order ToM (the ability to think about what someone else is thinking or feeling) develops (Wellman, Fuxi, & Peterson, 2011). Around five years of age, children come to realize that convictions have probabilities—that is, convictions may be false (false-belief understanding). In other words, children learn that behavior is determined by mental states (e.g., desires, emotions, convictions, and memories) and not always by objective truth (Wellman, 1990). Initially, ToM is restricted to desires, whereas in later stages conceptions and convictions are also part of children's ToM. These convictions concern first-order convictions (related to other's thoughts and feelings) and from six to eight years second-order convictions (related to others' thoughts and feelings about a third person). From ages eight to eleven years children develop higher-order ToM, indicated by an ability to understand and/or express figurative language, cognitive lies, (affective) sarcasm, and social faux pas (see for an overview of ToM development Westby & Robinson, 2014).

Ample reports exist that delayed ToM development is typical in DHH children (Peterson, Wellman, & Liu, 2005). Before focusing on ToM performance in DHH children, we first present different perspectives on the cognitive architecture of ToM.

Cognitive Models of ToM

There are three cognitive perspectives of ToM: (1) the theory-theory perspective, (2) the simulation perspective, and (3) the modular cognitive perspective.

The *theory-theory perspective* claims that there is a general underlying learning mechanism that determines the innate ability to acquire a ToM (Gopnik & Wellman, 1992; Perner, 1993; Wellman, 1990). According to this perspective, children deduce others' thoughts and desires from fixed starting points (axiomas) and according to their judgments **(p.461)** (inferences). The mental states of others are understood on the basis of the theory held by the observer, comparable to the psychology of the day. For example, when a four-year-old has acquired false-belief understanding, Gopnik and Wellman (1992) consider this a modification of the child's current theory, because empirical evidence is no longer in line with this theory.

Against the background of the theory-theory, Perner (1993) claimed that the general cognitive ability to form meta-representations (also including the understanding of misrepresentations) is crucial for acquiring ToM. After all, meta-representations allow a person to theorize about the misrepresentations of others. In this context, Hughes and Russell (1993) stated that an executive system, in which attention is flexibly and rapidly adjusted and plans are formulated, is required for establishing a ToM. Hence, they claimed, it is not so much ToM but the experience of being actively involved with the environment that is fundamental. The theory-theory claimed that a deficient learning mechanism (i.e., the inability to establish meta-representations or a malfunctioning executive system) is underlying a deficient ToM.

From a *simulation perspective*, the development of ToM takes place due to the internal processing of others' thoughts and feelings, using our own mental state as a reference model (Gallese & Goldman, 1998; Gordon, 1986, 1996; Harris, 1992). In other words, observers carry out internal simulations of observed actions and apply their own knowledge of their own actions and intentions to deduce those of others. In this regard, empathizing with others (i.e., recognizing, perceiving, and feeling others' emotions) plays a vital role. The simulation perspective further claims that our own actions, sensations,

and emotions and those of others are governed by shared neural circuitry. As an example, Keysers and Gazzola (2007) mentioned that when we see someone who is disgusted by drinking a glass of milk, the premotor and parietal areas are activated for action (Keysers & Gazzola, 2006), the insula for emotion (Jabbi, Swart, & Keysers, 2007), and the primary somatosensory cortex for sensation (Keysers, Wicker, Gazzola, Anton, Fogassi, & Gallese, 2004). By simulating parts of this neural circuitry while perceiving others, observers can translate the physical states of others into their own body language. The simulation perspective on ToM has been supported by evidence showing that mirror neurons are activated, both in apes and humans, when specific hand and mouth movements are perceived in others. Gallese and Goldman (1998) claimed that the system of mirror neurons plays a crucial role in predicting and explaining the mental states of others by simulating others' mental states. According to this simulation perspective, a developmental disorder in terms of functional simulators and, more specifically, mirror neurons, may be underlying ToM deficits.

(p.462) In line with the modular organization of the human brain, as proposed by Fodor (1983), the *modular perspective* claims that ToM is an isolated cognitive skill with a specific innate basis, which emerges as a result of child maturation. ToM is perceived as a domain-specific module, and therefore this perspective assumes that ToM is restricted to social inferencing. From this modular perspective, Baron-Cohen (1995) stated that four different mechanisms may be underlying ToM or, as he calls it, "the human mindreading system" (1995, p. 31):

1. The first mechanism that humans use to assign mental states to behavior is the *Intentionality Detector* (ID), a perception device that interprets moving stimuli in terms of primitive states of mind, such as aims and desires. The ID is required to understand others' approach and avoidance behavior.
2. The second mechanism that, according to Baron-Cohen, allows us to read minds, is the *Eye-Direction Detector* (EDD), which interprets stimuli on the basis of a person's vision. The EDD detects eyes, or stimuli that

are similar to eyes; tries to determine the current focus of attention; and interprets looking as “seeing.”
3. The function of the third mechanism, the *Shared-Attention Mechanism* (SAM), is to build triadic representations, which specify the relations between a given person, the self, and an object (or a person). For example, two persons know, because of eye contact, that they are looking at the same object. Subsequently (from nine to eighteen months), the child develops the ability (through SAM) to analyze whether different people experience specific mental states in relation to a given object or event.
4. *Theory-of-Mind Mechanism* (ToMM), according to Baron-Cohen (1975), is one additional mechanism that is required to truly read minds. The development of the ToMM starts between eighteen and forty-eight months with performing pretend play. The function of the ToMM is to represent all mental states (pretend play, thinking, knowing, believing, imagining, dreaming, guessing, and misguiding) and to process this mentalistic knowledge in a usable theory.

According to this modular perspective on ToM, disorders in these four mechanisms underlying ToM and their related brain regions can lead to mind-blindness.

In the various paradigms presented above, ToM is operationalized from different theoretical perspectives. At this point none of the three theoretical perspectives can explain ToM development on its own. This is also acknowledged by Keysers and Gazzola (2007), who tried to bridge the gap between the theory-theory (the “cold” cognitive approach) and the simulation theory (the “hot” affective approach).

(p.463) ToM in DHH Children

Various studies have examined ToM understanding in DHH children with so-called false-belief tasks, in which the child is asked to infer the behavior or thoughts of an agent with false beliefs. While typically developing children pass these false-belief tasks by the age of five, DHH children are often delayed, continuing to fail on these tasks until middle childhood (see, for a review, Siegal & Peterson, 2008). Interestingly, Meristo et al. (2012) showed within an anticipatory looking paradigm that hearing infants (aged seventeen to twenty-six months) are better than deaf infants in anticipating the search actions of a cartoon character that held a false belief about the location of a target object. These findings suggest that early ToM development in DHH children is already delayed from infancy. Empirical results on false-belief performance suggest that the developmental trajectory of cognitive ToM in late-signing DHH children parallels that of hearing children. DHH children thus seem to be delayed in timing but do not demonstrate a different developmental path or pattern (e.g., Jones, Gutierrez, Ludlow, 2015; Peterson et al., 2005; Russell et al., 1998).

Mixed results have been observed with respect to DHH children's ability to understand desire (an aspect of affective ToM). Steeds, Rowe, and Dowker (1997) reported that DHH children are not impaired in understanding the relationship between desires and emotions: they are able to predict emotions on the basis of desires ("Constance loves chocolate. How does she feel when she receives chocolate?"). In line with this finding, Rieffe and Meerum-Terwogt (2000) observed that late-signing DHH children (aged six to eleven years) are able to use desire to explain characters' emotional reactions in a story task. In contrast with these findings, Scott, Russell, Gray, Hosie, and Hunter (1999) reported impaired desire understanding in late-signing DHH children on a task that required attribution of feelings of desire and desire-based behavior. Likewise, Peterson et al. (2005) concluded that DHH children from hearing families have a delayed appreciation of the diversity of desires and emotions (i.e., the ability to predict behavior and emotions based on preferences). Holmer, Heimann, and Rudner (2016) asked children to distinguish between the desires of different actors and then predict choosing behavior based on these preferences. They also

observed deficits in predicting desire-based behavior and attributing emotions based on desire in DHH children.

Interestingly, when ToM is examined within a narrative paradigm, DHH children (aged nine to fifteen years) were shown to be capable of attributing mental states to themselves and others (Marschark, Green, Hindmarsh, & Walker, 2000). When telling stories, there was no difference between DHH and hearing children in referring to their own and others' false and true beliefs. Apparently, these DHH children were **(p. 464)** aware of mental states and were able to attribute them to themselves and others. So, in contrast to the conclusion based on impaired false-belief understanding, these storytelling data indicate that DHH children do possess a full representation of mental states.

The mixed results on ToM performance in DHH children urges further research. Up to now, most research has focused on false-belief understanding in DHH children. To gain more insight into ToM development in DHH children, it is necessary to differentiate all aspects of ToM, examining their interpersonal/intrapersonal cognitive and affective ToM abilities (Westby & Robinson, 2014).

Most empirical evidence so far has suggested cognitive and affective ToM delays in DHH children and adolescents who have hearing parents (Marschark, 1993; see Peterson & Siegal, 2000, for a review; Meristo, Falkman, Hjelmquist, Tedoldi, Surian, & Siegal, 2007). DHH children from DHH families who are exposed to a signed language from birth did not appear to have ToM deficits (Schick, de Villiers, de Villiers, & Hoffmeister, 2007). Delay in ToM development can be taken as an explanatory factor for the high prevalence of social-emotional problems in DHH children. This association between ToM and social-emotional functioning is bolstered by empirical research showing significant relations between ToM performance and DHH children's status as popular members of the peer group or as socially isolated outsiders (Peterson, O'Reilly, & Wellman, 2016). Important theoretical questions remain, though, with respect to the nature and consequences of the ToM deficits.

As noted earlier, the *modular perspective* on ToM assumes that it is an isolated cognitive skill with a specific innate basis. Following this perspective, disorders in one of the four

mechanisms underlying ToM (e.g., detecting intentionality and sharing attention) and their related brain regions can lead to ToM deficits (Baron-Cohen, 1995). Within the modular perspective, it may be hypothesized that the acquisition of ToM is constrained by a critical period, after which it may not be possible to acquire ToM normally (Peterson et al., 2016). This explanation would be in line with the finding that DHH children of hearing parents had ToM deficits, whereas those from DHH families performed identically to age-matched hearing controls on ToM tasks (e.g., Schick et al., 2007). DHH children with DHH parents share a sign language and may thus be exposed to a rich communicative context in a critical (early life) period for establishing ToM (cf. Vaccari & Marschark, 1997). Since most DHH children of hearing parents cannot use spoken language and most hearing parents cannot use sign language in daily interchanges, the ability to communicate in daily life is limited in these families. The lack of communicative feedback and hence the limited opportunity to learn about mental states might underlie the ToM deficits found in DHH children with hearing parents (Marschark, 1993).

(p.465) The *simulation perspective* states that a system of mirror neurons plays a crucial role in predicting and explaining the mental states of others by supporting the simulation of others' mental states. In line with this hypothesis, the development of the mirror neuron system may not be initiated in DHH children, for example due to a lack of communicative language experience. This could lead to a malfunctioning mirror neuron system and hence delayed ToM development. In contrast to this hypothesis, evidence from sign language and animal research pointed out that the mirror neuron system may not (fully) mediate the understanding, observations, and production of language and nonlinguistic actions (e.g., Hauser & Wood, 2010; Knapp & Corina, 2010).

Following the *theory-theory perspective*, a general underlying cognitive ability underlies ToM development. Hence, ToM deficits are explained in terms of a general cognitive defect. According to this hypothesis, children with autism are not able to form meta-representations, which leads to an inability to form theories on mental states (Leslie, 1987). It is unlikely that all ToM deficits in DHH children can be explained in terms of a general cognitive defect, but it is highly plausible that language deficits and executive disorders contribute to an

inability to form meta-representations. Language and executive deficits could, in other words, contribute to a decreased ability to theorize about mental states.

To summarize, cognitive and affective ToM deficits in DHH children could be explained in terms of an interplay between poor communicative language context during a critical early life period and (related) language deficits and executive disorders. In the next section, we further this analysis, elaborating an interactionistic perspective on social-emotional functioning in DHH with communicative context, language, executive function, and ToM as central players.

The Interplay Between Executive Functioning, ToM, and Language

It is not coincidental that DHH children are at risk in the domains of language, ToM, and executive functioning: many empirical studies have revealed close relationships between children's skills in these three domains (Botting et al., 2017; Carlson, Davis, & Leach, 2005; Gooch, Thompson, Nash, Snowling, & Hulme, 2016; Kapa & Plante, 2015; Kronenberger et al., 2014; Kuhn, Willoughby, Wilbourn, Vernon-Feagans, & Blair, 2014; Milligan, Astington, & Dack, 2007; Pisoni et al., 2011; Roebers & Schneider, 2005; Schick et al., 2007; Vissers & Koolen, 2016; Vissers, Koolen, Hermans, Scheper & Knoors, 2015).

Gooch et al. (2015) administered a battery of executive function tasks to a group of 243 hearing children using a three-year longitudinal design. The average age of the children was 4;8 years at T1, 5;8 years at **(p.466)** T2, and 6;7 years at T3 respectively. At each point in time, their analyses revealed that executive functioning and language are separate but highly correlated constructs. A similar relationship has been observed for DHH children and adults. For instance, Kronenberger et al. (2014) administered a battery of executive function tests and language tests to a group of sixty-four DHH participants and a group of seventy-four hearing participants. They found that, for both groups, participants' executive function skills were related to their language skills, although there were some subtle and interesting differences in the precise relationship observed for both groups. Similar results have been reported by Hintermair (2013), Marschark et al. (2015), and Pisoni et al. (2011).

Milligan, Astington, and Dack (2007) conducted a meta-analysis on the data from 104 studies investigating the relation between language skills and ToM skills. They concluded that children's language abilities and their ToM skills are related, and that the strength of this relationship is moderate to large. A similar relationship has been observed for DHH children (Schick et al., 2007), who found that DHH children's vocabulary skills and their ability to comprehend sentence complements predicted their false-belief reasoning scores, regardless of what their most dominant language (American Sign Language or spoken English) was. In other words, these studies demonstrate that language skills are intimately linked to executive function and ToM abilities.

Connecting Language, Executive Functioning, and ToM: The Role of Inner Speech

Although further research is needed to disentangle the nature of the interplay among executive functioning, ToM, and social-emotional functioning in DHH children, we will now attempt to relate these state-of-the-art empirical findings on executive function development, ToM development, and social-emotional functioning in DHH children. We propose a model in which inner speech plays a central role in this interaction (Figure 20.1).

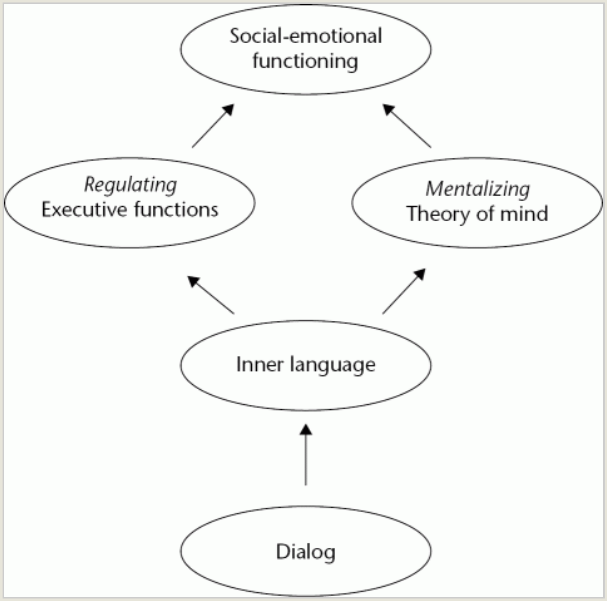

Figure 20.1 Schematic representation of the interplay between sharing a dialog, inner speech, ToM, executive functioning, and social-emotional functioning. According to our hypothesis, inner speech (internalization of the social dialog) is necessary for the development of executive functioning (regulation) and ToM (mentalization) and underlies social-emotional functioning.

Inner speech can be defined as the subjective experience of language in the absence of overt articulation (Alderson-Day & Fernyhough, 2015). Inner speech exists regardless of the modality (i.e., spoken language or sign language). According to Vygotsky (1987), inner speech is the outcome of a developmental process in which linguistically mediated social exchanges are transformed into an internalized dialog with the self. With the emergence of inner speech, children become able to use language to regulate and reflect on their behavior. Like language, inner speech has been hypothesized to serve various different functions (Alderson-Day & Fernyhough, 2015; Brinthaupt, Hein, & Kramer, 2009). Inner speech enhances

executive functioning (Cragg & Nation, 2010) and supports ToM development (Fernyhough & Meins, 2009), but **(p.467)** it has also been hypothesized to be important for practicing and planning communicative and social interactions, for self-awareness and self-monitoring, for self-reinforcement and self-motivation, and for creativity (Alderson-Day & Fernyhough, 2015; Barkley, 2012; Brinthaupt et al., 2012).

Consistent with these hypotheses, inner speech has been found to enhance the three core executive functions: inhibition (Müller, Zelazo, Hood, Leone & Rohrer, 2004; Tullett & Inzlicht, 2010; but see Fatzer & Roebers, 2012, 2013), verbal working memory (Fatzer & Roebers, 2012; 2013; Hitch & Halliday, 1983), and flexibility (Cragg & Nation, 2010). Most of the studies we have mentioned brought to light the impact of inner speech on executive functioning by eliminating or reducing its impact under conditions of articulatory suppression (repeatedly saying nonsense words during executive function tasks). Tullett and Inzlicht (2010) found a significantly higher percentage of commission errors in a go/no-go task in an articulatory suppression condition in comparison to a control condition (circle drawing) in a group of hearing university students, suggesting that inner speech enhances inhibitory control. **(p.468)** Fatzer and Roebers (2012) found detrimental effects of articulatory suppression on a verbal working memory task in comparison to a foot-tapping task, especially for older children (age nine years). Cragg and Nation (2010) reviewed the literature on inner speech and flexibility in adults and children and concluded that although inner speech is not essential for flexibility, it clearly enhances performance on switching tasks. Day and Smith (2013) examined the relation between children's private speech (the overt precursor of inner speech), emotions children experienced (anger and sadness), and applied emotion-regulation strategies (self-comforting and distraction) during a locked-box frustration task. Day and Smith (2003) found that hearing children's private speech not only was related to experiencing anger and sadness and the use of emotion-regulation strategies, but also moderated the relation between the use of emotion-regulation strategies and their experience of anger and sadness. This suggests that inner speech can play a central role in emotion regulation. In sum, these studies

demonstrate that inner speech enhances executive functioning (including emotion regulation).

With respect to inner speech and ToM, there has been considerably less research. Fernyhough and Meins (2009) studied the associations between private speech and ToM performance in four- to six-year-old hearing children and found associations between the amount of private speech and ToM performance. For instance, for four-year-old children, the amount of private speech children produced was positively correlated with their ToM performance.

Given these empirical findings, we can hypothesize that inner speech both enables and urges the regulation of oneself (executive functioning) and also the mentalization of one's own and others' inner worlds (ToM). Inner speech plausibly plays a necessary role in developing adaptive social-emotional behavior. Following Vygotsky (1987), we see inner speech or inner signing as the result of the internalization of the social dialog (see Figure 20.1). From here, language and inner speech can be taken as a gateway to consciousness (see also Kolk, 2012). Because of its sensory nature, language enhances the interpretation and control of brain processes (Kolk, 2012). In fact, two communication streams exist between brain and inner speech. The first stream flows from brain to inner speech, enabling us to interpret our brain processes (mentalizing ToM). Thanks to this stream we are able to think that we want something and form a ToM. The second stream connects inner speech to our brain processes and enables the regulation of these processes (regulating EF).

Inner speech thus develops as a result of holding dialogs and sharing language with the child. Holding a dialog and sharing language with a deaf child can be a challenge, especially for hearing parents and hearing teachers. This is where the observed delay in executive function development and ToM development in DHH children might originate, at **(p.469)** least in part. When the social dialog with a DHH child is impaired, the quality of inner speech (or its internalization) will also be hampered and this will in turn impede the development of executive function and ToM. We can thus understand the observed deficits in social-emotional functioning.

Consistent with these assumptions are the results of studies that showed unimpaired development of executive functioning and ToM in deaf children of deaf parents, who communicate in sign language with each other from birth and hence have less difficulty constructing adequate social dialogs. For instance, Hall et al. (2017) had deaf parents of deaf children, who had exposed their child to a natural sign language from birth, complete the parent-report BRIEF about their children and found that the children, on average, received age-appropriate scores on all of the executive function domains assessed by the BRIEF (Inhibitory Control, Flexibility, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor). With respect to ToM development, similar results have been reported. Schick et al. (2007) administered a battery of verbal and nonverbal ToM tasks to four groups of young children: hearing children of hearing parents, deaf children of deaf (signing) parents, and deaf children of hearing parents who were either in a signing environment or in an oral environment. They found that the performance of deaf children of deaf parents was very similar to that of hearing children of hearing parents, and both groups outperformed deaf children of hearing parents.

Thus, our argument here is that executive function and ToM development are affected by inner speech, which in turn depends upon the quality of the social dialog. If the social dialog is not impaired, as is often the case in deaf children of deaf parents, the internalization of the social dialog (inner speech) will not be delayed and inner speech will enhance executive functioning and ToM development. However, an impaired social dialog will hinder this internalization, thus having a negative impact on executive functioning and ToM development.

Implications for Research and Intervention

Future research is needed to further investigate the interplay among executive functioning, ToM, and inner speech. First, the role of inner speech and inner signing in the development of executive functioning and ToM should be explored in DHH children to provide more and direct evidence for this model of social-emotional functioning in DHH children. Second, the relationship between the quality of the social dialog and the internalization of inner speech should be investigated through intervention studies focusing on the quality of parent–child interaction and the internalization of language. Deepened theoretical **(p.470)** and empirical insight will also contribute to early detection of problems in the development of executive functioning, ToM, and inner speech/inner signing through neuropsychological assessment.

Further insight in this neuropsychological interplay may fuel the choice for an intervention program to stimulate a DHH child's social-emotional development, ToM development, and executive functioning. According to our model, strengthening inner speech/inner signing, either directly (Abdul Aziz, Fletcher & Bayliss, 2016; Bodrova & Leong, 2007) or indirectly by strengthening the social dialog with the child (Bodrova & Leong, 2007), is likely to stimulate the development of executive function and ToM. In the end, enhancing executive function or stimulating ToM development will have a positive influence on the child's social-emotional functioning. Interestingly, for children with a specific language impairment, it has already been demonstrated that a program that directly stimulates children's use of private speech can enhance their executive functioning (Abdul Aziz et al., 2016).

There are currently many types of interventions to enhance children's executive functioning (Diamond & Lee, 2011). When seeking such a program, we should seriously consider the possibility that DHH children's executive function deficits may be due, at least in part, to delayed or hampered inner speech. Therefore, interventions that ascribe a central role to enhancing the social dialog and/or the internalization of inner speech may be more promising than interventions in which these roles are limited or even absent. In our view, programs such as Tools of the Mind (Bodrova & Leong, 2007) are

therefore among the more promising candidates to enhance DHH children's executive functioning.

With respect to ToM, we recently developed a treatment program for DHH adolescents in which the social dialog is strengthened within a group context. Consciousness of one's own inner world and others' inner worlds is strengthened through group conversations and appointments in which the participants can experience emotions. We are running a pilot project on the effectiveness of this treatment for executive functioning, ToM, and social-emotional functioning.

Summary

The prevalence rate of social-emotional problems in DHH children and adolescents is about two to four times higher than the rate in hearing children and adolescents. In this chapter we argued that executive function and ToM are the central underlying cognitive factors in social-emotional functioning and explained that many DHH children show deficits or delays in their executive function and ToM development. We presented a cognitive model of social-emotional problems in DHH children with a central role for inner speech in relation to executive **(p.471)** function and ToM and discussed the implications for assessing and treating these problems. We believe that tailor-made neuropsychological interventions are vital in enhancing DHH children's development and that the cognitive model outlined here may be useful in selecting or developing appropriate intervention programs for this population.

References

Bibliography references:

Abdul Aziz, S., Fletcher, J., & Bayliss, D. M. (2016). The effectiveness of self-regulatory speech training for planning and problem solving in children with specific language impairment. *Journal of Abnormal Child Psychology*, *44*, 1045–1059.

Abu-Akel, A., & Shamay-Tsoory, S. (2011). Neuroanatomical and neurochemical bases of theory of mind. *Neuropsychologia*, *49*, 2971–2984.

Alderson-Day, B., & Fernyhough, C. (2015). Inner speech: Development, cognitive functions, phenomenology, and neurobiology. *Psychological Bulletin*, *141*, 931–965.

Astington, J. W., & Baird, J. A. (2005). *Why language matters for theory of mind*. New York: Oxford University Press.

Barkley, R. A. (1997). *ADHD and the nature of self-control*. New York: Guilford Press.

Barkley, R. A. (2012). *Executive functions: What they are, how they work, and why they evolved*. New York: Guilford Press.

Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. London: MIT Press.

Barrett, L. F., Tugade, M. M., & Engle, R. W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychological Bulletin*, *130*, 553–573.

Berger, H. J., van Spaendonck, K. P., Horstink, M. W., Buytenhuijs, E. L., Lammers, P. W., & Cools, A. R. (1993). Cognitive shifting as a predictor of progress in social understanding in high-functioning adolescents with autism: A prospective study. *Journal of Autism & Developmental Disorders*, *23*, 341–359.

Bodrova, E., & Leong, D. J. (2007). *Tools of the mind: The Vygotskian approach to early childhood education*. Upper Saddle River, NJ: Pearson Education, Inc.

Bonino, S., & Cattelino, E. (1999). The relationship between cognitive abilities and social abilities in childhood. *International Journal of Behavioral Development*, *23*, 19–36.

Botting, N., Jones, A., Marshall, C., Denmark, T., Atkinson, J., & Morgan, G. (2017). Nonverbal executive function is mediated by language: A study of deaf and hearing children. *Child Development*, *88*(5), 1689–1700.

Brinthaupt, T. M., Hein, M. B., & Kramer, T. E. (2009). The Self-Talk Scale: Development, factor analysis, and validation. *Journal of Personality Assessment*, *91*, 82–92.

Carlson, S., Davis, A., & Leach, J. (2005). Less is more. *Psychological Science*, *16*, 609–616.

Castellanos, I., Pisoni, D. B., Kronenberger, W. G., & Beer, J. (2015). Neurocognitive function in deaf children with cochlear implants: Early development and long-term outcomes. In M. Marschark & P. Spencer (Eds.), **(p.472)** *The Oxford handbook of deaf studies, language, and education* (pp. 264–275). New York: Oxford University Press.

Cragg, L., & Nation, K. (2010). Language and the development of cognitive control. *Topics in Cognitive Science*, *2*, 631–642.

Dammeyer, J. (2010). Psychosocial development in a Danish population of children with cochlear implants and deaf and hard-of-hearing children. *Journal of Deaf Studies and Deaf Education, 15*, 50–58.

Day, K. L., & Smith, C. L. (2013). Understanding the role of private speech in children's emotion regulation. *Early Childhood Research Quarterly*, *28*, 405–414.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168.

Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4–12 years old. *Science*, *333*, 959–964.

Dvash, J., & Shamay-Tsoory, S. B. (2014). Theory of mind and empathy as multidimensional constructs: Neurological foundations. *Topics in Language Disorders*, *34*, 282–295.

Eisenberg, N., Fabes, R. A., Shepard, S. A., Murphy, B. C., Guthrie, I. K., Jones, S., . . . Masek, P. (1997). Contemporaneous and longitudinal prediction of children's social functioning from regulation and emotionality. *Child Development*, *68*, 642–664.

Fatzer, S. T., & Roebers, C. M. (2012). Language and executive functions: The effect of articulatory suppression on executive functioning in children. *Journal of Cognition and Development*, *13*, 454–472.

Fatzer, S. T., & Roebers, C. M. (2013). Language and executive functioning: Children's benefit from induced verbal strategies in different tasks. *Journal of Educational and Developmental Psychology*, *3*, 1–9.

Fellinger, J., Holzinger, D., Sattel, H., & Laucht, M. (2008). Mental health and quality of life in deaf pupils. *European Child & Adolescent Psychiatry*, *17*, 414–423.

Fernyhough, C., & Meins, E. (2009). Private speech and theory of mind: Evidence for developing interfunctional relations. In A. Winsler, C. Fernyhough, & I. Montero (Eds.), *Private speech, executive functioning, and the development of verbal self-regulation* (pp. 95–104). New York: Cambridge University Press.

Figueras, B., Edwards, L., & Langdon, D. (2008). Executive function and language in deaf children. *Journal of Deaf Studies and Deaf Education*, *13*, 362–377.

Fodor, J. A. (1983). *The modularity of mind*. Cambridge, UK: Bradford Books.

Gallagher, S., & Hutto, D. D. (2008). Understanding others through primary interaction and narrative practice. In J. Zlatev, T.P. Racine, C. Sinha, & E. Itkonen (Eds.), *The shared mind: Perspectives on intersubjectivity* (pp. 17–38). Amsterdam: John Benjamins.

Gallese, V., & Goldman, A. (1998). Mirror neurons and the simulation theory of mind- reading. *Trends in Cognitive Sciences*, 3, 493–501.

Garden, S., Cornoldi, C., & Logie, R. H. (2001). Visuo-spatial working memory in navigation. *Applied Cognitive Psychology*, *16*, 35–50.

Gioia, G., Isquith, P.K., Retzlaff, P., & Espy, K. (2002). Confirmatory factor analysis of the Behavior Rating Inventory of Executive Function (BRIEF) in a clinical sample. *Child Neuropsychology*, *4*, 249–257.

(p.473) Gooch, D., Thompson, P., Nash, H. M., Snowling, M. J., & Hulme, C. (2016). The development of executive function and language skills in the early school years. *Journal of Child Psychology and Psychiatry*, *57*, 180–187.

Gopnik, A., & Wellman, H. (1992). Why the child's theory of mind really is a theory. *Mind and Language*, 7, 145–171.

Gordon, R. (1986). Folk psychology as simulation. *Mind and Language*, *1*,158–171.

Gordon, R. M. (1996). “Radical” simulationism. In P. Carruthers & P. K. Smith (Eds.), *Theories of theories of mind* (pp. 11–21). Cambridge, UK: Cambridge University Press.

Hall, M. L., Eigsti, I. M., Bortfeld, H., & Lillo-Martin, D. (2017). Auditory deprivation does not impair executive function, but language deprivation might: Evidence from a parent-report measure in deaf native signing children. *Journal of Deaf Studies and Deaf Education*, *22*, 9–21.

Harris, P. L. (1992). From simulation to folk psychology: The case for development. *Mind and Language*, *7*, 120–144.

Hauser, M., & Wood, J. (2010). Evolving the capacity to understand actions, intentions, and goals. *Annual Review of Psychology*, *61*, 303–324.

Hintermair, M. (2007). Prevalence of socio-emotional problems of deaf and hard of hearing children in Germany. *American Annals of the Deaf*, *152*, 320–330.

Hintermair, M. (2013). Executive functions and behavioral problems in deaf and hard-of-hearing students at general and special schools. *Journal of Deaf Studies and Deaf Education*, *18*, 344–359.

Hintermair, M. (2014). Psychosocial development in deaf and hard-of-hearing children in the twenty-first-century. In M. Marschark, G. Tang, & H. Knoors (Eds.), *Bilingualism and bilingual deaf education* (pp. 152–186). New York: Oxford University Press.

Hitch, G. J., & Halliday, M. S. (1983). Working memory in children. *Philosophical Transactions of the Royal Society, Series B*, *302*, 324–340.

Hofmann, W., Schmeichel, B. J., & Baddeley, A. D. (2012). Executive functions and selfregulation. *Trends in Cognitive Sciences*, *16*, 174–180

Holmer, E., Heimann, M., & Rudner, M. (2016). Theory of mind and reading comprehension in deaf and hard-of-hearing signing children. *Frontiers in Psychology*, *7*, 854.

Hughes, C., & Russell, J. (1993). Autistic children's difficulty with mental disengagement from an object: Its implications for theories of autism. *Developmental Psychology*, *29*, 498–510.

Jabbi, M., Swart, M., & Keysers, C. (2007). Empathy for positive and negative emotions in the gustatory cortex. *NeuroImage*, *34*, 1744–1753.

Jones, A. C., Gutierrez, R., & Ludlow, A. K. (2015). Confronting the language barrier: Theory of mind in deaf children. *Journal of Communication Disorders*, *5*, 47–58.

Kapa, L. L., & Plante, E. (2015). Executive function in SLI: Recent advances and future directions. *Current Developmental Disorders Reports*, *3*, 245–252.

Keysers, C., & Gazzola, V. (2006). Towards a unifying neural theory of social cognition. *Progress in Brain Research*, *156,* 379–401.

Keysers, C., & Gazzola, V. (2007). Integrating simulation and theory of mind: From self to social cognition. *Trends in Cognitive Sciences*, *11,* 194–196.

(p.474) Keysers, C., Wicker, B., Gazzola, V., Anton, J.L., Fogassi, L., & Gallese, V. (2004). A touching sight: SII/PV activation during the observation and experience of touch. *Neuron*, *42*, 335–346.

Knapp, H. P., & Corina, D. P. (2010). A human mirror neuron system for language: Perspectives from signed languages of the deaf. *Brain & Language*, *112*, 36–43.

Kolk, H. H. J. (2012) *Free will is no illusion. How the brain procures freedom. [Vrije wil is geen illusie. Hoe de hersenen ons vrijheid verschaffen.]* Amsterdam: Uitgeverij Bert Bakker.

Kronenberger, W. G., Colson, B. G., Henning, S. C., & Pisoni, D. B. (2014). Executive functioning and speech-language skills following long-term use of cochlear implants. *Journal of Deaf Studies and Deaf Education*, *19*, 456–470.

Kuhn, L. J., Willoughby, M. T., Wilbourn, M. P., Vernon-Feagans, L., & Blair, C. B. (2014). Early communicative gestures prospectively predict language development and executive

function in early childhood. *Child Development*, *85*, 1898–1914.

Lalonde, C. E., & Chandler, M. J. (1995). False belief understanding goes to school: On the social-emotional consequences of coming early or late to a first theory of mind. *Cognition and Emotion*, 9:2-3, 167–185.

Leslie, A. (1987). Pretense and representation: The origins of "theory of mind." *Psychological Review*, *94*, 412–426.

Lewis, M. (2014). *The rise of consciousness and the development of emotional life*. New York: Guilford.

Lopes, P. N., Salovey, P., Côté, S., & Beers, M. (2005). Emotion regulation abilities and the quality of social interaction. *Emotion*, *5*, 113–118.

Marschark, M. (1993). *Psychological development of deaf children*. New York: Oxford University Press.

Marschark, M., Green, V., Hindmarsh, G., & Walker, S. (2000). Understanding theory of mind in children who are deaf. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *41*, 1067–1073.

Marschark, M., Kronenberger, W. G., Rosica, M., Borgna, G., Convertino, C., Durkin, . . . Schmitz, K. L. (2017). Social maturity and executive function among deaf learners. *Journal of Deaf Studies and Deaf Education*, *22*, 22–34

Marschark, M., Spencer, L., Durkin, A., Borgna, G., Convertino, C., Machmer, E., . . . Trani, A. (2015). Understanding language, hearing status, and visual-spatial skills. *Journal of Deaf Studies and Deaf Education*, *20*, 310–330.

McQuade, J. D., Murray-Close, D., Shoulberg, E. K., & Hoza, B. (2013). Working memory and social functioning in children. *Journal of Experimental Child Psychology*, *115*, 422–435.

Meristo, M., Falkman, K. W., Hjelmquist, E., Tedoldi, M.,Surian, L., & Siegal, M. (2007). Language access and theory of mind reasoning: Evidence from deaf children in bilingual and oralist environments. *Developmental Psychology*, *43*, 1156–1169.

Meristo, M., Morgan, G., Geraci, A., Iozzi, L., Hjelmquist, E., Surian, L., & Siegal, M. (2012). Belief attribution in deaf and hearing infants. *Developmental Science*, 15, 633–640.

Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding. *Child Development*, *78*, 622–646.

(p.475) Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, *41*, 49–100.

Morgan, A. B., & Lilienfeld, S. O. (2000). A meta-analytic review of the relation between antisocial behavior and neuropsychological measures of executive function. *Clinical Psychology Review*, *20*, 113–136.

Müller, U., Zelazo, P. D., Hood, S., Leone, T., & Rohrer, L. (2004). Interference control in a new rule use task: Age-related changes, labelling, and attention. *Child Development*, *75*, 1594–1609.

Nigg, J. T., Quamma, J. P., Greenberg, M. T., & Kusche, C. A. (1999). A two-year longitudinal study of neuropsychological and cognitive performance in relation to behavioral problems and competencies in elementary school children. *Journal of Abnormal Child Psychology*, *27*, 51–63.

Parsons, S., & Mitchell, P. (2002). The potential of virtual reality in social skills training for people with autistic spectrum disorders. *Journal of Intellectual Disabilities Research*, *46*, 430–443.

Perner, J. (1993). The theory of mind deficit in autism: Rethinking the metarepresentation theory. In S. Baron-Cohen, H. Tager-Flusberg, & D. Cohen (Eds.), *Understanding others’ minds: Perspectives from autism*. New York: Oxford University Press.

Peterson, C. C., O’Reilly, K., & Wellman, H. M. (2016). Deaf and hearing children’s development of theory of mind, peer

popularity, and leadership during middle childhood. *Journal of Experimental Child Psychology*, *149*, 146–158.

Peterson, C. C., & Siegal, M. (2000). Insights into a theory of mind from deafness and autism. *Mind & Language*, *15*, 123–145.

Peterson, C. C., Wellman, H. M., & Liu, D. (2005). Steps in theory-of-mind development for children with deafness or autism. *Child Development*, *76*, 502–517.

Pisoni, D. B., Conway, C. M., Kronenberger, W. G., Henning, S., & Anaya, E. (2010). Executive function, cognitive control and sequence learning in deaf children with cochlear implants. In M. S. Marschark & P. E. Spencer (Eds.), *Oxford handbook of deaf studies, language, and education* (Vol. 1, 2nd ed., pp. 439–457). New York: Oxford University Press.

Pisoni, D. B., Kronenberger, W. G., Roman, A. S., & Geers, A. E. (2011) Measures of digit span and verbal rehearsal speed in deaf children after more than 10 years of cochlear implantation. *Ear and Hearing*, *32*, 60–74.

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a “theory of mind”? *Behavior & Brain Sciences*, *4,* 515–526.

Rieffe, C., & Meerum-Terwogt, M. (2000). Deaf children’s understanding of emotion: Desires take precedence. *Journal of Child Psychology and Psychiatry*, *42*, 601–608.

Roebers, C. M., & Schneider, W. (2005). Individual differences in young children’s suggestibility: Relations to event memory, language abilities, working memory, and executive functioning. *Cognitive Development*, *20*, 427–447.

Rogers, S. J., & Pennington, B. F. (1991). A theoretical approach to the deficits in infantile autism. *Development and Psychopathology*, *35*, 137–162.

Russell, P. A., Hosie, J. A., Gray, C. D., Scott, C., Hunter, N., Barks, J. S., & Macauly, M.C. (1998). The development of theory of mind and deaf children. *Journal of Child Psychology and Psychiatry*, *39*, 903–910.

(p.476) Schick, B., de Villiers, P., de Villiers, J., & Hoffmeister, R. (2007). Language and theory of mind: A study of deaf children. *Child Development*, *78*(2), 376–396.

Scott, C., Russell, P., Gray, C., Hosie, J., & Hunter, N. (1999). The interpretation of line of regard by prelingually deaf children. *Social Development*, *8*, 421–425.

Siegal, M., & Peterson, C. C. (2008). Language and theory of mind in atypically developing children: Evidence from studies of deafness, blindness, and autism. In C. Sharp, P. Fonagy, & I. M. Goodyer (Eds.), *Social cognition and developmental psychopathology* (pp. 81–112). New York: Oxford University Press.

Steeds, L., Rowe, K., & Dowker, A. (1997). Deaf children's understandings of belief and desires. *Journal of Deaf Studies and Deaf Education*, *2*, 185–195.

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, *72*, 271–322.

Thompson, R. A., & Newton, E. K. (2013). Baby altruists? Examining the complexity of prosocial motivation in young children. *Infancy*, *18*, 120–133.

Tine, M., & Lucariello, J. (2012). Unique theory of mind differentiation in children with autism and Asperger syndrome. *Autism Research and Treatment*, *2012*, 1–11.

Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 103–130). Hillsdale, NJ: Lawrence Erlbaum.

Tullett, A. M., & Inzlicht, M. (2010). The voice of self-control: Blocking the inner voice increases impulsive responding. *Acta Psychologica*, *135*, 252–256.

Vaccari, C., & Marschark, M. (1997). Communication between parents and deaf children: Implications for social-emotional development. *Journal of Child Psychology and Psychiatry*, *38*, 793–801.

van Eldik, T., Treffers, P., Veerman, J., & Verhulst, C. (2004). Mental health problems of Dutch children as indicated by parents' responses to the child behavior checklist. *American Annals of the Deaf, 148*, 390–395.

van Gent, T., Goedhart, A., Hindley, P., Treffers, A., & Philip, D. A. (2007). Prevalence and correlates of psychopathology in a sample of deaf adolescents. *Journal of Child Psychology and Psychiatry*, *48*, 950–958.

Vissers, C. T. W. M., & Koolen, S. (2016). Theory of mind deficits and social and emotional functioning in preschoolers with specific language impairment. *Frontiers in Psychology*, *7*, 1734.

Vissers, C. T. W. M., Koolen, S., Hermans, D., Scheper, A., & Knoors, H. (2015). Executive functioning in preschoolers with specific language impairment. *Frontiers in Psychology*, 6, 1574.

Vygotsky, L. (1987). *The collected works of L. S. Vygotsky, Vol. 1: Problems of general psychology*, ed. R. Reiber & A. Carton. New York: Plenum Press.

Waters, G. S., & Caplan, D. (2006). Language comprehension and verbal working memory. *Encyclopedia of Cognitive Science* [online].

Wellman, H. (1990). *The child's theory of mind. Cambridge*, MA: Bradford/MIT Press.

Wellman, H. M., Fuxi, F., & Peterson, C. C. (2011). Sequential progressions in a theory of mind scale: Longitudinal perspectives. *Child Development*, *82*, 780–792.

Westby, C., & Robinson, L. (2014). A developmental perspective for promoting theory of mind. *Topics in Language Disorders*, *34*, 362–382.