Social-cognition for learning as a deaf student

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RUNNING HEAD: Social cognition for learning

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Social-Cognition for Learning as a Deaf Student

Abstract

Success at capturing academic information in the classroom and assimilating this into existing knowledge relies on an intertwined set of cognitive and social skills. These are both basic: audition, vision, attention, and more complex: language development, social-cognition (Theory of Mind) and conversational pragmatics (how we use language in interaction). All of these skills are typically well developed in hearing children's psychology when they arrive for the first time in the classroom. One of the ways young children first develop social-cognitive abilities is through rich interaction involving language and communication with their caregivers. While some social-cognitive abilities may appear very early in development,, for example, joint attention and non-verbal interactions, communication and language allow these abilities to flourish and fully mature. This higher level of complexity is important for children to reach, as through language children can appreciate more complex social-cognitive concepts uttered by others around them and also express their own developing ideas. Most deaf children do not have language impairment but find natural language acquisition effortful, and this includes pragmatics which enable an understanding of the conversational needs of your interaction partner, that is, 'what do they know, what do they not know and how specific or general do I need to be when I speak to them'? Perhaps not coincidentally, young deaf children with hearing parents find tests of social-cognition difficult. This chapter reviews the research on how deafness influences early interaction and language development, what deafness means for picking up ambient knowledge about others' mental states and what social-cognitive delays might mean for academic learning. The take home message is for professionals to devote time in the school to social-cognitive as well as speech and language interventions and with this aim the chapter concludes with several ideas for future interventions in this important area.

Key words: Theory of mind, language, deafness, false belief, intervention, learning

Social-Cognition for Learning as a Deaf Student

This chapter describes research findings on deaf children's understanding of others - an ability termed 'social-cognition' with one important component called Theory of Mind. The chapter attempts to link up what we know about social-cognitive development and its function for deaf students in a school classroom. With this in mind, it is aimed at teachers, Communication Support Workers (CSWs) and parents of deaf children. The title is purposefully about how social-cognition enables or facilitates academic learning and for this reason will highlight research findings that might be relevant for deaf children's future and current academic progression. In this chapter 'learning' refers to the mastery of academic concepts: numeracy, encyclopaedic knowledge and the epistemological skills to appreciate different points of view in science etc.

In the UK 1 in 1000 children are born each year with a significant hearing loss which affects their language and educational achievement (Davis et al., 1997). The recent survey by the Consortium for Research in Deaf Education (CRIDE, 2012) estimated this equated to 37,400 school aged children in England. Furthermore 95% of these children are born to hearing parents with little experience or knowledge of deafness. While intelligence scores are within the normal range for these children (Braden, 1994), they lag behind their hearing peers in educational achievement. Powers et al. (1998) reported only 14% of 16 year old deaf children achieved the higher grades (GCSE A-C) necessary for advanced studies compared with 44% of hearing children at this age. Powers et al. (1998) in a systematic review of educational achievement of deaf children reported significant delays in language, reading, writing and mathematics which they concluded was an indication of pervasive under-achievement.

Much research over the same time period has described developmental differences between deaf and hearing children in their social-cognitive skills (see recent review in Meristo, Helmquist & Morgan, 2012), yet there is very little research that addresses the question of social-cognition and academic learning directly or even what happens with deaf children's interactions in

the classroom (e.g., Delana, Gentry & Andrews, 2007; Singleton & Morgan, 2006). How might academic achievement and social-cognitive development be linked? It is generally accepted that the early home environment, especially early, rich interaction and language can provide children with good social-cognitive foundations for school learning (see Hintermair, this volume; Tang, Yiu, & Lam, this volume. The same can be assumed for how deaf children develop social-cognitive skills needed for academic achievement.

This chapter focuses on how deaf children view other people and understand the social consequences of their own and others' behaviour and thinking. An increased understanding of this aspect of deaf children's development might help teachers appreciate why deaf children could be different types of academic learners. For example, if a 6 year old deaf child does not understand other people's thinking, this will have an influence on how well they can participate in a classroom discussion about the reasons for different outcomes in a story. Deafness might affect learning in many ways, for example, by affecting the development of language comprehension, by its consequences for different aspects of non-verbal intellectual development (e.g., memory, attention and executive functions) or more widely in terms of the level of parental involvement in a deaf child's education (see Hermans, Vugs, Berkel, & Knoors, this volume). However a child with delays in understanding the reasons for other people's behaviour and mental states will be at a disadvantage for learning in a classroom as well. Social awareness and abilities in understanding others are crucial elements for a deaf child's full inclusion in the mainstream classroom.

The chapter is organised as follows: first a working definition of social-cognition in classroom learners will be outlined. This involves more specifically what Theory of Mind (ToM) and understanding of false belief entail. Many studies have linked language development with ToM and especially children's understanding of explicit false belief tasks (tested with questions and answers) and this will be described in the second section. The third section will describe research on deaf children's performance on ToM tasks. In the same section, a framework based on access to

conversation as a trigger for ToM development will be described (Siegal, 1997), followed by a summary of research in this area with deaf-child hearing-parent dyads. The chapter concludes with a section on possible intervention and training studies for improving social-cognition in deaf children in their families and classrooms. The purpose of this last section is to stimulate discussion on how educational professionals and groups who work with parents of deaf children can intervene in social-cognition development at various levels.

Unpacking social-cognition

Social-cognition revolves around how we learn to understand other people's mental states (knowledge, beliefs, desires, emotions etc.) and how these states are related to certain patterns in other's behaviour. To illustrate one aspect of this domain, appreciating other people's false beliefs, an every-day family interaction is described here. Picture this scene: you arrive home from work and your 6 year old daughter Ruby announces that she has made you a cake. Ruby is wearing an apron and is carrying a dirty bowl. You take this as evidence that there is a cake somewhere that can be eaten. Your 1 year old son James is observing this from his high chair and watches you as you proceed to the kitchen. But on opening the oven you are confronted with a very wobbly looking pile of playdough made of different colors in the rough shape of a cake. You hesitate a second before laughing, Ruby really got you this time and both of you share the joke. At the same time James is looking at the both of you trying to understand what has happened: is there a cake after all, why is this all so funny and what are these two people thinking about as they laugh?

This story describes an example of people using their social cognition. Specifically, Ruby planted a false belief in the parent's mind: he believed that he was going to eat a real cake. Ruby knew what he was thinking while at the same time she knew that this belief was false – there was no real cake. This ability to reason about other's beliefs is enabled by what psychologists term 'meta-representation' and is at the heart of the ability to reflect on the reasons for other people's

behaviour. Meta-representation allows the child to hold in her mind another person's cognitions or thinking, which in the cake example is in fact different from her own understanding of reality. The child knows there is no real cake but also knows that her father is thinking that there is. Being able to do this allows you reason about, predict and explain the behaviour of others.

Ruby was able to understand and even predict your surprise at opening the oven and clearly enjoys the confusion which the false belief led you to. This is all fine for the 6 year old; however the interesting question is what did James get out of it? This question is over 30 years old in the research literature on social-cognitive or ToM development. To be able to enter into the theory of mind game children need to be able to understand the language and pragmatics of the situation ('we made you a cake' but we know it is not a real cake) which entails some appreciation of the rules of conversations, understand the emotional response (surprise, laughter) and why it had come about and also importantly be able to represent another person's belief (he thinks the cake in the oven is going to be a real cake but only I know that) and finally reason about that representation (I know his belief is false). All of these complex developments are required before children can fully understand what has happened in the false belief situation.

The first studies of false belief understanding proposed these abilities emerged in typically developing children between 4-5 years of age. What enabled this development to happen (i.e. the previous stimulation or triggers) is still the subject of much debate. One area of research proposes that ToM development is determined by language acquisition. For this reason, a large number of studies has investigated social-cognitive development in deaf children who have different degrees of language development delay. If we imagine that the children in the cake scenario were the deaf offspring of hearing parents what would we expect of them in terms of understanding false beliefs? Would a 6 year old deaf child playing the cake game have this complex ability to manipulate meta-representations of the beliefs of adults, and how much would the one year old deaf child understand if everyone playing the game around him were hearing and

speaking? From many studies of children born deaf to hearing parents it is clear that these kinds of social-cognitive skills develop significantly later than in both deaf children with deaf parents and hearing children of hearing parents (e.g., Courtin & Melot, 2005; Figueras-Costa & Harris, 2005; Schick, deVilliers, deVilliers & Hoffmeister, 2007; Meristo et al., 2012, Morgan & Kegl, 2006; Wimmer & Perner, 1983). There is however continuing debate as to what factors in deaf children's development may be different or deficient that lead to such ToM delays.

While little of the previous research concerns exactly how delays in understanding false belief would affect academic learning in classrooms, we can speculate how the two areas are related. We know that understanding false belief is linked to appreciating other people's emotions, mental states, desires, and intentions, and so a difficulty in reasoning about the mental lives of others would affect how successful a child is in accessing the inter-personal dynamics of the classroom. Equally, understanding the social-cognitive factors that explain other people's behaviours would offer children in the classroom a better grasp of the reasons for specific requests from teachers and other children. This would be important when these requests involved understanding pragmatics, for example, rhetorical questions from teachers, reflecting on why one's own actions and behaviour is linked to other people's emotions, and so on. ToM would allow deaf children to navigate between different perspectives on the same situation, discussions of scientific or philosophical points of view, for example, in the question: are all wars bad? A well-developed ToM would be extremely important for deaf children's understanding of abstract concepts discussed in the classroom that require some level of meta-representation of mental states. While ToM might not be necessary for all academic learning it is an important skill for accessing the classroom dynamics where learning is taking place.

Two related issues in deaf children's language development are important to set out early. First, language itself (via the semantics, syntax and grammar) will facilitate understanding of complex ToM related concepts encountered in classrooms for the first time. For example

appreciating the difference between "remember," "recall," "call to mind," and "rings a bell," as well as understanding sentence structures used in hypothetical language, for example, "if you were X." In the wider field many theorists have linked the role of language development to the development of ToM in typically developing hearing children (e.g., deVilliers & deVilliers, 2000; Milligan, Astington, & Dack, 2007). Secondly, there is an issue about how deafness affects access to language in the ambient discourse where abilities in understanding other's talk around you will be important for accessing mental state knowledge. The first issue has been very well documented in deaf children and results are changing rapidly. However despite great improvements language development (especially spoken) is effortful and usually delayed in deaf children with hearing parents (e.g., Quittner et al, 2013 and reviews in Spencer & Marschark, 2006). However the second issue: access to overheard ToM related talk of others in the classroom has received much less attention in the research literature. Hearing children typically experience much everyday discussion and conversation of different points of view just by overhearing older siblings or parents talking (O'Brien, Slaughter, & Peterson, 2011) and enter naturally into what Nelson, Plesa and Henseler (1998) termed the "community of minds." There is very little research looking at mainstream classroom interaction with deaf children, but we could speculate that even those children with good hearing because of their use of cochlear implants (CIs) will be less able to access this ambient language in noisy classroom environments. CIs, while they work well for face-to-face communication if a child can use spoken language, do not give a child fully functioning hearing for multiple conversations around them in a noisy classroom to the same extent as for typically hearing children (Akhtar, 2005).

For full participation in classrooms and for effective learning, deaf children need to be able to better understand social situations involving themselves and other children. When other children act in particular ways in response to the teacher, it is important that deaf children in mainstream classrooms grasp what mental states are driving these actions. For example a hearing

child in a classroom hears the upset cry of a fellow hearing pupil on another desk. The first child looks up and while still holding his pencil to the paper works out what has happened. The second child has ripped her drawing. The first child overhears the word "rubber" (eraser) and surmises the second child was upset because while rubbing out her picture the page got ripped. This happens in a split second and the first child takes this in then looks down and continues with his work. The deaf peer sat nearby missed all of this happening. At break time the two hearing children brush past each other and the second child acts as if she is angry about the collision. The first hearing child correctly understands the motives for this reaction are linked to the previous event with the paper and rubber and is able to regulate his own behaviour as a result. The deaf child looks at the angry girl in confusion.

Any deaf child would find this social-cognitive situation quite challenging to resolve, ambient noise and incidental language might be more difficult to process quickly in a noisy classroom, even for a hearing child. A skilled classroom assistant working with a deaf child is going to struggle to explain everything that is happening around a deaf child. We can also think about how much incidental learning happens in the home between parents, siblings and friends. How much information is relayed to young deaf children about things happening beyond their hearing range?

For typically developing children, teachers and parents explain incidental social situations as learning is taking place. As children read, for example, the teacher may be asking one child "explain to your friend what you are reading because she doesn't understand the first line." Deaf children might be getting reduced input of this incidental discussion of mental states. Children develop their social cognition through informal overheard and direct conversation, experience of rich accessible social situations and through their developing language ability (Akhtar, 2005). If even those deaf children with good language skills and some amount of hearing are missing out on some incidental information around them this will contribute to difficulties in completing the

complex picture of how world and social knowledge fit together. There is a part of the ToM difficulty therefore linked to how much young deaf children are active participants in social situations which is connected to their language and conversational skills, and how much they miss from (not) over-heard information occurring around them.

There are significant academic consequences of social-cognitive delay, for example access to higher levels of literacy will require high levels of pragmatic comprehension of plot components and ToM abilities. Teachers and educational professionals need to know more about social-cognitive development and how deaf children are at risk for this important set of milestones

<1>A selective retrospective on ToM research

The first published studies of ToM begin with Wimmer and Perner (1983) and typically developing hearing children where, in the standard test scenario, the experimenter introduces the child being tested to two dolls called Sally and Anne. The experimenter uses the Sally doll to hide a marble in a basket in front of Anne's view. Then Sally is removed from the test situation by telling the child that the doll had to go outside. While Sally is absent the experimenter uses the Anne doll to move a marble from the basket to a closable box. Now the experimenter brings back the Sally doll and the child is asked "Where will Sally look for her marble"? Wimmer and Perner (1983) argued that the ability to appreciate another person's false belief went through a change during 4 - 5 years of age. While younger children answer that Sally will look for her marble in the box (thus failing to appreciate that Sally has a false belief) older children answer correctly that she will look for it in the original location, that is, in the basket.

Following this study, Baron-Cohen, Leslie and Frith (1985) showed that children with autism and Downs Syndrome had difficulties with these types of task but when children with Down Syndrome got older and achieved a sufficient language level to understand the story, they were able to pass the test (i.e., make the correct predictions). Children with autism, even with sufficient

language skills, however, had persistent difficulties in the task. This pinpointed one of the areas of difficulty for children with autism as being in the social-cognition domain. At the same time, linguists were investigating the role of language in the ability to use cognitive meta-representations to solve false belief problems. For many years philosophers and psychologists have questioned what role language has for thinking (e.g., Carruthers, 2009). One theory argued that children needed to have developed an understanding of the syntax necessary to embed one clause in another (termed sentence compliments), for example, Sally thought that, the marble was in the basket. The theory was that by being able to do this in language children would be able to manipulate the two clauses in an internal meta-representation.

Other researchers (e.g., Milligan et al., 2007) have argued that rather than syntax, it is lexical development that triggers children to think about mental states more explicitly. This research highlights the acquisition of vocabulary linked to mental state verbs – "to think, to know, to not know" and so on. But other researchers instead have claimed that the key to understanding the role of language in children's ToM development is to look not at their acquisition of formal properties (verb semantics, syntax etc.) but instead their experience of language and communication in conversation (Siegal, 1997). This point of view focused on how children come to develop the pragmatic skills necessary to understand conversations and interaction between themselves and others, which was thought to be the trigger for ToM development.

<2>ToM development in deaf children

As described previously language and social-cognitive development have been investigated extensively in deaf children over the past two decades. Currently, what childhood deafness means for development is going through rapid and profound changes. The spoken language abilities of deaf children has changed over the last 15-20 years, with advances in neo-natal screening (C. Mayer & Leigh, 2010; Watson, Archbold, & Nikolopoulos, 2006); hearing

technologies (Davis et al., 1997) and changes to educational provisions (Knoors & Marschark, 2014). In the classroom, language development is important for all types of academic activity (literacy, discussions, following instructions, interpreting complex situations, planning your own work etc.) and this might be why much effort is placed on deaf children's learning of vocabulary, grammar, and literacy in the early school years. With the increasing popularity of CIs, it is clear that deaf children have greater spoken language development than ever before. However it is not clear if this is the same for all other areas of communicative development, especially their pragmatics (Surian, Tedoldi & Siegal, 2010). More recently, Rinaldi, Baruffaldi, Burdo, and Caselli (2013) looking at a sample of deaf Italian 12-36 month olds that despite improvements in spoken language vocabulary as reported on the MacArthur-Bates Child Development Inventory (CDI) vocabulary checklist, the young deaf children still had severe difficulties in the pragmatic aspects of language.

Children in a mainstream classroom who use CIs may cope well one-on-one or in a quiet room but as conversation partners, ambient noise, and distances between speakers increase more complex pragmatic skills may be required for academic learning. Despite improved outcomes for hearing and spoken language for children with CIs many still have disruptions to their spoken and signed language development leading to language development delays. In a recently study Woll, (2013) looked at a sample of deaf children with hearing parents who had an early diagnosis of deafness. Using the English and British Sign Language versions of the CDI vocabulary checklist Woll found in both their spoken English and BSL they were significantly delayed compared to their native signing or speaking peers. In other countries changes to the spoken language outcomes of intervention for young deaf children with CIs is also changing rapidly (e.g., Perez, Valmaseda Balanzategui, & Morgan, 2014). One potential concern for language development delay and, especially in pragmatics, is on social-cognitive functions.

When the first studies on deaf children's ToM began to emerge in the 1980s there was

a clear negative affect of deafness on this social-cognitive milestone. There was a wide range of delays reported for deaf children of hearing parents from between 3 to 10 years (for a recent review see Meristo et al., 2012). These findings continued apace throughout the next 20 years with studies appearing in deaf children in different countries. There were variations in how much delay was reported across these studies but there was clearly a difficulty for deaf children on false belief tasks. Many of the early studies were less able to control a number of factors important for passing these tasks, for example, hearing levels, language levels and family background. This made interpreting the overall results difficult. Part of the reason several different delays were reported across different studies may also have been due to different testing methods, including the use of signing or speaking in the testing situation or the use of sign language interpreters to explain tasks.

The main problem in several early studies was that the groups that were tested were very diverse. For example some studies included deaf children from deaf parents (DCDP) and hearing parents (DCHP) in the same sample. This led to great variability in performance and suggested that all deaf children, regardless of prenatal hearing status were performing similarly on the false belief tests. Woolfe, Want, and Siegal (2002) ruled out the notion that deafness per se was the cause of false belief failure by demonstrating that a group of 4-5 year old deaf children of deaf parents passed a standard ToM test at age equivalent levels. Following on from this work Schick et al. (2009) further resolved these issues by comparing groups of children based on parents' hearing status and language preferences: the DCDP and hearing children groups passed standard false belief tasks at the same ages, but the two DCHP groups (educated using oral methods or ASL) displayed a 3 year delay.

Interestingly, family signing skills may not be the only predictor of children's success on ToM tasks. Meristo et al (2007) compared social-cognitive development of DCDP in different school situations. The groups of native signers were in either signing schools adopting a bilingual approach to communication in the classroom (teachers could use sign and spoken language

fluently), while the other native signers were being educated in oral language only school situations. Recall that this group of deaf children has been reported to have typical development of social cognitive skills compared with the deaf children of hearing parents group. Strikingly the children in the oral schools had more difficulty with social-cognitive tasks than their peers in the bilingual signing schools. The argument Meristo et al. (2007) put forward was that the bilingual signing schools provided an accessible environment and stimulation which further developed the native signers' social-cognitive skills. While ToM development progressed well in both groups up to the point of starting school, the necessary conditions for the further development of these abilities were less available in an oral language only school.

<2>Social-cognition beyond false beliefs

Up to this point it has argued that hearing children of hearing parents (HCHP) pass ToM tasks involving false beliefs during their 4^{th}-5^{th} year and this means ToM typically develops in this time-window. The shortcoming with this idea is that it equates understanding of "false belief" with more basic skills involved in ToM and in wider social-cognition. But appreciation of false beliefs is only one area which children use to understand others. What might be more accurate is that there is a spectrum of abilities in ToM and these develop in children over a protracted time frame. From basic precursors of understanding others to more advanced levels of mental state reasoning. Wellman and Liu (2004) put forward just this perspective in a five-stage ToM scale which begins with children first acquiring knowledge about the mind through an understanding of desires ("I like, she likes, wants, doesn't like" etc.), then diverse beliefs (thinking differs across people), followed by an understanding of knowledge and ignorance (e.g., seeing leads to knowing, not seeing leads to not knowing), then false ideas/beliefs, and finally children gain an understanding of hidden emotions (e.g., "she is pretending to be sad"). Peterson and Wellman (2009) went on to investigate the ToM scale in 93 children (33 deaf; 60 hearing) aged 3 to 13 years

who were tested on a set of six ToM tasks. The results showed that deaf children were substantially delayed in the chronological age they passed the tests compared to hearing children, especially in understanding pretending and false belief, and this was correlated with the deaf children's delays in social pretend play. But the results also confirmed the five-step developmental progression for ToM. Both groups progressed through the same sequence, in the same order, albeit at different ages.

To summarize the ideas up to this point, social cognition includes a spectrum of abilities linked to understanding other minds and how mental states link to others' behaviour. One area of development thought to be crucial is the meta-representation of mental states through language, that is, "she thinks that X…." Many researchers have argued that some linguistic abilities lie behind children's use of meta-representations to reason about ToM and research on deaf children with hearing parents and their ability to pass ToM tasks has been used to confirm this. Understanding other's thinking is an important skill for many areas of children's lives, especially mental health, emotional regulation, understanding of complex language and pragmatics, and therefore any delays can be problematic. Once a deaf child demonstrates atypical development of social understanding, this can lead to consequences in other areas of his/her development, for example, appreciation of complex mental state dilemmas in narratives and being able to monitor and regulate one's own emotions (e.g., Rieffe, & Meerum Terwogt, 2006; see Rieffe, Netten, Broekhof, & Veiga, this volume). If a deaf child has difficulty with social-cognition, this will affect their academic learning both directly as a barrier to integrating into the shared discourse around ideas in the classroom. More indirectly, the cognitive resources required for understanding others may also divert resources away from the task of academic learning. While different perspectives exist around what aspects of language are important for social-cognition, a main area this chapter has focused on is conversational interaction.

<1>The importance of conversation for social cognition

There have been many attempts to find a causal explanation for deaf children's difficulty with ToM tasks and these have identified the formal structures of language being delayed in this group's development. We can also think about language not just as a system of words and sentences but as a way people communicate with each other. Through interaction and especially conversation, speakers enter into series of interactive mind-reading activities. This can also happen even when they are not directly involved in these interactions, as in overhearing others' conversations (Siegal, 1997). These skills emerge early in typically developing children, during the first year of life (e.g., Carpenter & Liebalk, 2012). During this period, children establish joint attention and this connectedness to the "conversation" partner is seen as a precursor to later ToM development. Joint attention is something many deaf children with hearing parents have problems achieving (Harris & Chasin, 2005; Lederberg & Mobley, 1990; Lieberman, Hatrak & Mayberry, 2013; Moeller & Schick, 2006). In the preschool, professionals working with deaf children often anecdotally report 3-4 year old deaf children of hearing parents have difficulty with knowing when to look at adults at the right time when they speak or sign.

Connected to the argument that early conversations play a role in the development of ToM skills is work on the importance of the quality of input to young children from their caregivers. Taumoepeau and Ruffman, (2006) reported that maternal mental state talk to hearing infants correlated with these children's later ToM skills. Parents who were more engaged in mental-state talk had children who were more able to solve ToM type tasks later. From previous research, we also know that the types of conversations hearing parents have with their deaf children are somewhat different to those that typically developing children experience (Janjua, Woll & Kyle, 2002; Lederberg & Mobley, 1990; Moeller & Schick, 2006). Language addressed to deaf children tends to be simpler, directive, with more naming and questions. This is also found in other parent-child dyads where hearing children have been identified with a disability.

How does this relate to deaf children's social cognitive development? In a recent study, Morgan et al. (2014) carried out an analysis of the conversational experience of deaf and hearing children with hearing parents, aged 17–35 months. Parents had to describe pictures that elicit mental and emotional state language to their children following the Taumoepeau and Ruffman (2006) methodology. Parents of the deaf children could describe the pictures in their preferred way, whether in sign or speech or a combination of both. We analyzed the content and "connectedness" of the conversations, finding that input to the deaf hearing children from their hearing care-givers differed greatly in terms of mental state labels compared with hearing mother's taking to their hearing same age children. Parents of hearing infants referred to cognitions, that is, using words like "think," "know" or "remember," significantly more often than did those of deaf infants. There were no differences between groups in references to desires or emotions. For conversation connectedness the parents with a hearing child produced significantly more connected turns overall than did the parents with a deaf child. Among parents with a hearing child, turns were significantly more likely to be connected than initiated and more likely to be connected than failed. But for the parents with a deaf child, turns were both more likely to be failed than connected and more likely to be initiated. Parents with a deaf child thus have a difficulty maintaining a conversation and initiate turns more. This suggests conversations are more parent led when a deaf child takes part.

A last finding from the Morgan et al. (2014) study has consequences for how we think about early language intervention with young deaf children and their caregivers. In the hearing child-parent dyads only 2-5% of the interaction concerned references to cognitive and mental states, but this presumably will be sufficient to trigger their typical ToM development. This final point highlights that the amount for parents to adapt their language and conversation style when they talk to their deaf children might not be large.

<1> Future directions for interventions on social cognition

From the previous literature review, it should be clear that deaf children of hearing parents are at risks for delays in development of social-cognition. Deaf children's spoken language skills are improving but it is still the case that these children's ToM development is an issue (e.g., Remmel & Peters, 2000). In the school context deaf children in the classroom are learning some of the pieces of the social puzzle but continue to have difficulty making it all fit together. So how can we try to remedy this?

From studies of false belief understanding we see that deaf children's development is delayed, but they do catch up rather than displaying permanent impairments as in children with autism. This is an important difference as this opens up the opportunity for focused interventions. However any early delays can lead to later academic difficulties as the level of social-cognitive problems children are faced with increases exponentially as they enter primary school and on to adolescence in secondary schools. As children get older the higher level ToM skills needed to be socially included in the classroom get more complex.

Many schools are aware of the importance of social-cognition for hearing children and have in place practices to make this area of development a priority. In the United Kingdom for example it is now common-place to hear about Social and Emotional Aspects of Learning (SEAL), and this policy has been shown to be affective at increasing social inclusion (Durlak, Weissberg, Dymnicki, Taylor & Schellinger, 2011). It is timely that research efforts move from identifying the problem to investigating solutions for deaf school children. The question is how to intervene based on the research evidence to date to try to close the social-cognition gap for deaf children with hearing parents and their peers. Researchers can systematically evaluate what types of interventions are viable and, if through training outcomes change, ask if these affects are long lasting. This final section summarizes research work on interventions for social-cognition in different populations of children. However before this happens it is important to note that in general moving from results from research to an intervention does not happen directly but instead requires several steps:

1) First, identify the risk factors that seem to be evident from the research. For example deaf children have a delay in passing false belief tests and there appears to be a link between this difficulty and their language and communicative development. Furthermore, in some studies deaf children are shown to be involved in qualitatively different types of early interaction with their hearing parents. In this chapter we have identified two risk factors: delays in ToM development and lesser access to conversations.

2) Next, it is necessary to test the reliability of the emerging research findings through replications of these in different contexts and cultures. This is especially important where the initial research was carried out with small numbers of participants, as is often the case with deaf children. The follow up research should include bigger groups as well as an attempt to include parents and children from wider social backgrounds.

3) When designing the intervention an important question is what exactly is the work aiming to achieve (i.e., what is the outcome measure?). In our context, is the training going to attempt to increase deaf children's ability to pass a false belief test, or is it aimed more generally at improving their classroom academic learning? Both of these elements might be related but are very different in terms of how easy they can be evaluated.

4) Following this planning stage, some time needs to be devoted to understanding how a training study is going to be run, before embarking on a bigger and longer intervention project. A training study in this context is a smaller-scale piece of work aimed at implementing some intervention in a small group to test out its feasibility before widening this to a full-scale intervention with a larger group of children and parents. For example, is training parents to involve more mental state conversation in their early interaction a feasible thing to ask parents to do?

5) In developing the intervention, the location and participant details needs to be decided upon: Where will it take place, that is, in a clinic, the home? Will it involve the family, school, siblings etc.? Each of these options opens up a different set of issues for researchers when collecting

evidence of change.

Finally,

6) What are the details for each type of intervention being tested: the duration, rate, who does it, how do you measure change, what are the post-intervention evaluations, are randomized control trials (RCTs) feasible?

It is no surprise that many researchers avoid tackling intervention research given this list of challenges. Fortunately there are many areas of research that have been translated into intervention, especially with children with autism, reading difficulties and developmental language impairments. Here, some of these studies are reviewed with key points highlighted for designing a future ToM intervention.

The first example of a training study stems from research on the linguistic skills hypothesized to be behind children's development of meta-representations of mental states. Hale and Tager-Flusberg (2003) carried out this work with 60 typically-developing children aged 36-58 months who were randomly assigned into 3 groups who received focused training on understanding social-cognitive problems and different types of language structure: Group 1 had training on false beliefs (FB); Group 2 relative clauses (RC), that is, "which one did Mary want to buy," and Group 3 focused on sentence complements (SC), that is, "Mary said that she would like to buy the blue one." The researchers first evaluated false belief, complements and relatives before training the children. The three groups then received two amounts of training with one week apart given by the experimenter. In the context of a carrying out this type of training work with deaf children, in a school setting it would be possible for a teacher or teaching assistant to do this amount of work with deaf children without disturbing their everyday learning.

The training consisted of re-enacting FB scenarios (in a Sally-Anne story) aimed at better understanding of these scenarios through feedback. This is also relevant for schools where deaf children are placed, as many preschool children engage in role playing activities. The two

language training groups also re-enacted RC and SC sentences. Two days after the training the children were tested on three different FB, SC and RC assessments. The results were that children with SC training improved on FB scores, FB training improved FB but training on RC did not lead to gains on FB assessments.

The conclusion we can draw from this ToM training study is that quite a small amount of training over a short time span can make a difference to understanding of ToM in typically-developing children. A more recent study with similar outcomes was reported in Gavazzi, and Ornaghi, (2011). The question for work on deaf children is whether this amount and type of training would be sufficient. Also, it is not clear how the language training would work especially with deaf children who use a sign language. But the false-belief role play is an interesting idea and could be carried out quite easily. During the classroom or assembly time when a conflict is discussed it could be a good time for children to express what caused a problem and why other children might not have understood these causes. These situations stimulate much discussion on false belief. Children can start to talk about mental states that were incomplete of incorrect, for example, "you thought that but I thought something different." Proffessionals working with deaf children might need to make these kind of discussions more explicit using drawings or role play in the classrooms.

Turning to studies with children with a social-cognition disability, Golan et al. (2010) carried out a training study involving children with autism which aimed to improve their understanding of the links between facial expressions and emotions. Much information used in social-cognition is expressed via the face and thus can help to interpret other's behaviours. Individuals with autism generally avoid engaging with other people via facial expressions. Deaf children do not have difficulties with face processing; but some research has suggested they might have problems interpreting emotions correctly (e.g., Rieffe & Meerum Terwogt, 2006). Thus this intervention study is a relevant methodology to consider for social-cognition in deaf children.

The study had 20 children with autism (aged 4–7 years) and two matched control groups who were made up of children with autism who received no intervention and a typically developing group. The training consisted of children watching computer animated cartoons called "Transporters" which were about trains which had human faces and their interactions. The children in the training groups watched the video daily for 4 weeks. Children were tested pre and post training on their understanding of emotional vocabulary and emotion recognition. Post training evaluation was based on watching videos and naming emotions in novel situations. The importance of evaluating effects in novel situations is to test if training had transfer to comprehension of emotion in a wider rather than narrow manner, that is, further than on just the items they had been trained on. The results were that the intervention groups did better than non-intervention groups on the post training evaluations and this transferred to novel situations.

Summarizing this study, it was found that in a relatively easy to carry out intervention involving watching videos every day, children with autism improved on emotion comprehension and this transferred to novel situations. In terms of deaf children with delays in ToM, similar videos could be made with FB role play. These scenarios could be devised with real word characters or animations with either signing characters, subtitles, signed captioned interpreters or non-verbal videos.

A last study looks at results of communication and language training for parents of deaf children. Botting and Morgan (2007) evaluated an already existing family training package delivered face-to-face and via web-based materials to parents of deaf children (see http://www.familysignlanguage.org.uk/mainpage.htm.) The research looked at whether training hearing parents on communication skills and British Sign Language (BSL) vocabulary would lead to improvements in the children's language development, beyond those occurring over time. The study compared pre and post-test scores on the BSL CDI (Woolfe et al., 2010) in children whose parents had and had not received training. There were 29 deaf children of hearing parents (0-5

years) and a matched control group who had no training. Both groups were scored on the CDI at two time points with access to the communication training in between. Training was through face to face courses and access to a website with 300 BSL phrases listed under family-oriented topics.

The analyses revealed faster vocabulary development for the children whose parents received training on several of the CDI subsections: overall sign understanding; use of content words and grammatical/syntactic words. While these results are preliminary, they suggest that parents who get involved in some training can improve communication and this affects their children's language development. Taking from these three studies we can see that an intervention aimed at social cognition in deaf children could target language and ToM skills, using a video or play setting and could be delivered as a parent training component in a course or as web materials.

<2> Proposals for three levels of ToM intervention for deaf children

Training for deaf children, their parents and teachers in social-cognitive skills can be viewed as a gradual process based on the Wellman and Liu (2004) stage framework. Here some ideas for intervention are discussed across three time points:

(1) A first period of intervention can be aimed at early communication in infancy with family members during the whole of the first 12 months of the deaf child's life. While this is a crucial time period for ToM intervention, there are also major effects of early diagnoses of deafness on the family happening at this time which will impact on feasibility. Training will develop skills around establishing joint attention, turn-taking and interaction in direct/indirect conversation about intentions and emotions.

(2) The second period of intervention is aimed at early pre-school aged children (12-36 months). It focuses on parent's being able to discuss mental states and emotions in conversations, exercises in developing child-parent conversations about knowledge and ignorance, talking with the child using de-contextualised language (i.e. not only the here and now "what happened yesterday," "when

granddad was a boy"…), encouraging conversations about overhearing news and stories and also developing skills in "book reading." Many of these activities can take place in the context of symbolic play. For example in a nursery-school (kindergarten) classroom where there are different learning zones or corners one area can be dedicated to Theory of Mind. If a deaf child has very little expressive language it can be the case this will negatively affect the complexity of symbolic play as it may impede games where an object is substituted for another, for example, a box is played with by a group of children as if it is a mountain. Children who have developed a good level of meta-representations can use their language skills to underpin their manipulations of such symbols. For example with linguistic labels such as "imagine if, let's pretend that, this is really an X but let's make it a Y etc." Intervention by professionals can work well here, if during the play situation they can provide deaf children with labels for objects through this level of hypothetical language and propose how to make one object stand-in for another. Another activity around knowledge and ignorance is based on guessing where an object is hidden and clues from a parent, for example, hot and cold help the child find the hidden thing. This game highlights the idea that one person can be thinking something another person does not know and can be played with simple signs or words.

(3) Finally, a school intervention aimed at deaf children aged 3-5 years tackles explicit ToM reasoning. Here the training aims to develop false belief understanding through role play, scenarios where knowledge comes from multiple sources, training on "I do not know situations" where children have to explore what happens when they do not something about someone, second order false belief ("I know that she knows that I do not know"), conversations about unusual ToM situations, training on managing and inhibiting your first response in social situations, and also scenarios with moral dilemmas. All of these activities revolve around social-cognition. These activities and interventions can be linked to literacy time in the classroom. Texts that are rich in false beliefs, for example in the storybook "The Gruffalo" (Donaldson & Scheffler, 1999), can be

chosen for deaf children to read and explain the stories and jokes to adults or other peers. This could be done in small groups or in the whole class using an electronic whiteboard. In other contexts, for example, class or year assembly deaf and hearing children can work together on shared social-cognitive activities. In one of these, for example, each child has a suitcase containing several objects that are important to him/her. The aim is for the other children to get to know more about the child though finding out about the contents. This type of activity encourages children "to put themselves in the shoes of the other child" and to understand more about their tastes and likes/dislikes. Professionals working with deaf children's language development as well as parents might need to work before hand with the deaf child on the language skills required for these activities. Children can express themselves through their preferred way (speech, signs, pictures or even telling a close friend who could then tell the whole group). In all classroom activities (preschool and primary school), it is important these types of interventions are carried out systematically and regularly so that deaf children can anticipate and predict what is going to happen. If professionals are working on augmenting the child's mental state language then anything in the classroom has to be relayed to parents so that they can carry on the activities at home.

<1>Final comments

Several aspects of understanding other people underpin how deaf children learn, as navigating social situations supports inclusion in educational contexts (Chilton & Beazley, 2014). In modern preschools and classrooms, deaf children are achieving greater access to information through hearing and speech and there is a very big emphasis on the evaluation of their vocabulary and literacy. However it is crucial not to neglect the social experiences of these children to avoid exclusion. Interactions in the family and classroom based around complex understanding of mental states and the pragmatics of conversation are still a deficit area for deaf children, and this can be traced back to different early experience of conversations (Surian, Tedoldi, & Siegal, 2010).

Interventions with deaf children thus need to start in the home and build up through pre-school and primary school. As the demands of communication grow once children enter education, the need to be socially aware and have a fully developed ToM also becomes important for learning. Future research needs to be carried out to evaluate the impact of such interventions and the transfer of any effects onto wider school learning.

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