

ABSTRACT

Sibling Effects on Theory of Mind in Children with Autism Spectrum Disorders

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Children, as well as older individuals, with autism spectrum disorders have classically been found to underperform at tests of theory of mind. Some researchers believe that social deficits in individuals with autism spectrum disorders are due to impaired theory of mind. This theory is known as the mindblindness theory. Research in typically developing children has found that having a sibling environment is related to improvements in theory of mind. Interactions in complex sibling environments provide opportunities, such as conflict and play, to exercise skills that can further theory of mind development. Sibling relationships could cause a similar effect in autistic children, or they could result in a different effect altogether. However, few studies have been conducted on this specific topic, and the only ones that have been done have produced contradictory findings. Further research will be needed in order to resolve these mixed findings, but for now, they remain as they are.

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SPECTRUM DISORDERS

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CHAPTER ONE

Theory of Mind in Individuals with Autism

Autism Spectrum Disorder (ASD) is defined by the American Psychological Association (APA) (2013) mainly by deficits in social communication and interaction and by restricted, repetitive behaviors and activities. These symptoms can vary in severity and must be present during early developmental period. The symptoms must also result in clinically significant impaired functioning that cannot be explained by overall delayed development or intellectual impairment. Additionally, children with ASD often, but not always, have some degree of intellectual impairment or language impairment.

Some psychologists believe that social difficulties in autism are due to deficits in theory of mind (Senju, 2011). This theory is known as the mindblindness theory. Studies researching links between theory of mind performance and social adjustment using conventional measures have so far been mixed (Peterson, Slaughter, & Paynter, 2007). However, Peterson et al. (2007) conducted a study using a more age-referenced measure of social maturity, hoping to find a link between social maturity and performance on theory of mind tasks in both typically developing children and children with autism. The results of this study appear promising. Using this measure, Peterson et al. (2007) were able to find a correlation between performance on theory of mind tasks and teacher ratings of social maturity for both typically developing children and children diagnosed with autism spectrum disorders, but further research with this measure may be necessary because the study also found that social maturity ratings were influenced by whether or not the participant had an autism diagnosis. Since the social maturity measures were

confounded by a diagnosis of autism, one cannot state with complete certainty that theory of mind alone has a strong influence on social development.

Regardless of whether or not theory of mind is linked with social functioning, children with ASD have historically been shown to underperform in first-order false belief tests of theory of mind (Baron-Cohen, Leslie, & Frith, 1985; Leslie & Frith, 1988; Perner, Frith, Leslie, & Leekam, 1989). In Baron-Cohen et al.'s (1985) study, participants with autism performed less well than more intellectually impaired participants with Down's syndrome. This study involved the use of the changed location task, which involved the presentation of a scenario in which an object belonging to a doll was moved in the doll's absence. The participant had to predict where the doll would look for its object based on knowledge of the doll's false belief. Since children with autism were historically known for impairments in pretend play, Leslie and Frith (1988) repeated the study using live actors instead of dolls. Additionally, Leslie and Frith (1988) compared the performance of children with autism with that of children with language impairment since theory of mind has been correlated language ability. They found that children with autism were still significantly less likely to pass the false-belief task, providing evidence that theory of mind deficits were not merely due to deficits in language or pretend play. Happé (1995) studied the role of age and verbal ability in theory of mind test performance and found that while typically developing children reach a 50 percent probability of success in first-order false belief tasks at a verbal mental age of 4 years, children with autism require a verbal mental age of about 9 years in order to reach the same level of performance. If poor performance on theory of mind tasks in children with autism was merely due to the impaired language, the verbal mental age

required to pass first-order false belief tasks should be similar to that of typically developing children although physical age may differ.

Even though some autistic children are able to pass first-order false belief tasks, they have been found deficient in passing more advanced tests of theory of mind. Baron-Cohen (1989) found that, in comparison to typically developing children and children with Down's syndrome, children with autism who pass first-order false belief tasks have difficulty with second-order false belief tasks, even though the children with Down's syndrome were of lower mental age. Another example of an advanced theory of mind test is Happé's (1994) Strange Stories task, which involves the presentation of 24 vignettes to the participant who must justify the actions of the characters in the stories. Using this task, Happé (1994) found that although participants with autism were not less likely to use mental states to justify actions than typically developing or mentally handicapped participants, they were, however, less likely to use accurate mental state justifications. The autistic participants in this study may have been taught about certain mental states prior to the study and exclusively used these same mental states as justifications even in scenarios where they did not apply, resulting in a more frequent incorrect mental state justifications even when total use of mental state justifications did not significantly differ from that of typically developing children (Happé, 1994) Brent, Rios, Happé, & Charman (2004) found similar results. However, Brent et al. (2004) found that their autistic participants provided fewer total mental state justifications than their control group. Kaland, Callesen, Møller-Nielsen, Moretensen, & Smith (2007) further confirmed these findings and also found that their autistic participants required more prompt questions in order to obtain a usable answer.

In addition to underperformance in theory of mind tasks, Baron-Cohen's (2001) review notes that autistic children tend to display other signs of theory of mind deficit. For example, compared to typically developing children of similar mental ages, children with autism are less likely to spontaneously use mental state language in conversations (Baron-Cohen, 2001). In fact, mental state vocabulary in autistic children is deficient compared to that of typically developing 4-year-olds even though other aspects of their vocabulary are relatively unimpaired. Additionally, compared to typically developing children, who begin engaging in deception at age 4, children with autism, even those with higher mental ages, have difficulty comprehending or initiating deception.

One question raised by theory of mind research in people with autism is whether theory of mind exists due to a specific cognitive module or not (Belmonte, 2009). According to the Narrative Practice Hypothesis, theory of mind is not modular but instead emerges from the repeated use of more basic cognitive capacities such as understanding volition and recognizing that people have reasons for acting a certain way. By extension, Belmonte (2009), a proponent of the Narrative Practice Hypothesis, believes that autism is not specifically defined by deficits in theory of mind but instead has more domain-general deficiencies. Although individuals with autism commonly fail theory of mind tasks, such failure is neither necessary nor consistent in regards to the diagnosis of autism. Brain imaging studies have found that brain regions involved in social cognition activate in people with autism, which shows that these areas are functional (Belmonte, 2009). However, in individuals with autism, these regions take longer to activate, and the instructions for the required task must be stated explicitly. Additionally, the connectivity between the brain regions involved in theory of mind has

been found to be lower in people with autism, providing possible evidence that theory of mind difficulties may be due to networking abnormalities rather than modular deficits (Belmonte, 2009). These abnormalities may explain why autistic participants in Kaland et al.'s (2007) study required more prompts than their typically developing participants in order to get a response. A longitudinal study by Pellicano (2010) provides further support to this hypothesis by showing that, for individuals with autism spectrum disorders, performance in executive functioning tasks and central coherence tasks at time 1 predicted theory of mind performance at time 2 even with theory of mind performance at time 1 controlled for. Although this finding could be potentially contested with the argument that early theory of mind measures can also influence later measures of executive functioning and central coherence, Pellicano (2010) tested for this influence and did not find evidence for it.

Although a non-modular definition of theory of mind is possible, some deficits in theory of mind in autistic individuals cannot be fully explained by this definition. Some researchers believe that standard theory of mind tasks are cognitively demanding and do not truly measure theory of mind alone (Senju, 2011). In order to address this concern, a test that is similar to the changed location task has been developed to study what is known as spontaneous theory of mind. Unlike traditional changed location tasks, this test is based on eye-tracking and preferential looking rather than explicit, verbal answers. Research has found that neurotypical children, on average, begin passing this task at approximately 2 years of age (Senju, 2011). Senju (2011) used this same task comparing neurotypical adults and adults with Asperger's syndrome and found that although neurotypical adults exhibited anticipatory looking towards the correct side, adults with

Asperger's did not show a bias toward either side despite passing standard tests of false belief. Furthermore, Happé's initial Strange Stories study (1994) found that many autistic children tended to give idiosyncratic non-mental state-based explanations for the different scenarios. Both findings suggest that individuals with autism use strategies different from those used by neurotypical individuals to pass classic tests of theory of mind. Deficiencies in theory of mind in people with autism may not necessarily be a modular problem, but the previously mentioned findings indicate that these deficiencies may result from more innate, biologically-based sources than the Narrative Practice Hypothesis can explain for.

CHAPTER TWO

Sibling Effects on Theory of Mind in Non-Autistic Children

ASD is merely one factor that researchers have found to effect theory of mind development and performance. Another factor that theory of mind researchers have studied is the presence of a sibling in the home. Although little research has been done on how the presence of a sibling affects theory of mind development in children with ASD, the research examining this effect on typically developing children has been extensive.

One of the earliest studies on theory of mind was done by Perner, Ruffman, & Leekam (1994), which found that children with more siblings performed significantly better on tests of false belief than children who had fewer siblings. Although later studies also found that the presence of siblings affected performance on theory of mind tests in children, the studies are conflicted about what aspects of a sibling relationship affect theory of mind development. For example, a study by Jenkins and Astington (1996) sought to find whether or not language ability mediated the relationship between number of siblings and theory of mind performance. Their study found that, like Perner et al.'s (1994) study, children with more siblings performed better on theory of mind tasks than children with fewer siblings and that this effect occurred independent of language ability. However, they also found that having siblings appears to have a compensatory effect on children with less language ability. Parenting style was also believed to mediate sibling effects on theory of mind, and a later study by Ruffman, Perner, & Parkin (1999) sought to test this hypothesis. They found that, although the child's birth order affected the

mother's disciplinary style, the number of siblings, specifically older siblings, affected theory of mind performance independently of parenting style. Another study found that, despite the association between executive functioning and theory of mind, sibling effects were not mediated by executive functioning (McAlister & Peterson, 2006). A later longitudinal study found similar results (McAlister & Peterson, 2013).

Additionally, researchers have found conflicting evidence about whether certain types of siblings have a significant effect on theory of mind development. The studies by Perner et al. (1994) and Jenkins and Astington (1996) found that whether the child's siblings were older or younger did not affect theory of mind performance in preschool-age children. However, other studies have found that only older siblings have an effect on theory of mind (Ruffman, Perner, Naito, Parkin, & Clements, 1998; Ruffman et al., 1999). Why having older siblings provides this advantage has yet to be discovered. Maybe older siblings talk about mental states and engage in pretend play more than younger siblings. Perhaps the addition of children changes how parents rear children in a way that affects theory of mind. Although Perner et al. (1999) failed to find such a connection in their study, the results may possibly have occurred because the parenting component that would cause such an effect was not taken into account. Another possibility is that the relationship between a child and an older sibling is merely one example of an apprenticeship relationship. Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge (1996) found that not only was a child's theory of mind associated with the number of older siblings he or she has but also associated with the number of adult kin who live in the child's neighborhood and the number of adults and older children the child interacted with on a daily basis. The study suggests that theory of mind

is affected by interactions with more socially adept community members in general rather than from older siblings specifically. However, this particular study may have cultural limitations because it took place in communities where living in close proximity with extended kin is not uncommon. Additionally, Perner et al. (1998) failed to find an effect for either older or younger siblings in a younger sample of children, suggesting that children must acquire a certain developmental precondition before interactions with older siblings can be advantageous for them.

However, other researchers believe that only child-aged siblings would be able to significantly affect theory of mind and as a result, grouped children with only either adult, adolescent, or infant siblings with only children (McAlister & Peterson, 2013, 2007, 2006,). The reasoning behind this is that infant siblings are too young to provide any significant interaction that would affect theory of mind and that interactions with adolescent and adult siblings would be too similar to interactions with parents to provide a unique benefit to theory of mind development. The studies found that the number of child-aged siblings was associated with performance on theory of mind task. Children with more child-aged siblings are more likely to perform better on tests of theory of mind. However, merely interacting with another child may not be adequate to significantly affect theory of mind. A study with twins found that children with only a twin sibling did not perform significantly differently from only children while children with only non-twin siblings and children with both twin and non-twin siblings both outperformed children with only twin siblings and only children on tests of false belief (Cassidy, Fineberg, Brown, & Perkins, 2005). The reason for this finding may be that children not only require interaction with a child mind to improve their theory of mind

but also require interaction with a child mind different from their own. This study also found that children with twins were better able to predict their own twin's false belief as opposed to the false belief of a friend. This result shows that theory of mind performance, at least in twins, may depend on how familiar the child is with the mind in question.

Other research has suggested that the quality of sibling relationships may be more important in the development of theory of mind than the number of opportunities for sibling interaction (Hughes & Ensor, 2005; Woolfe, 2003). Hughes and Ensor (2005) and Woolfe et al. (2003) found that children who had more positive relationships with their siblings performed better on tests of theory of mind. However, the children used in these studies are different from most children used in other studies. Woolfe et al. (2003) used deaf, native signing children while Hughes and Ensor (2005) examined more socioeconomically disadvantaged children as opposed to middle-class children used in most theory of mind research. Since the researchers sampled from more deviant populations of children, the generalizability of their findings may be questionable.

The link between sibling relationships and theory of mind may be due to the specific interactions that occur between siblings, such as conflict and play. Randell and Peterson (2009) found that theory of mind positively correlated with positive affect during sibling disputes and less post-conflict stress. Although causality cannot yet be proven, the negotiation of conflicts with little negative emotion and stress could quite possibly stimulate the development of theory of mind awareness in children.

Additionally, Hughes, Fujisawa, Ensor, Lecce, & Marfleet (2006) found that the amount of reciprocal play that children and their siblings engaged in was associated with the

amount of mental state talk used by the child and that inner state talk was associated with theory of mind performance. Although the connection between reciprocal play and theory of mind was not directly examined in this study, reciprocal play could possibly affect theory of mind through mediation of mental state talk, or it could affect theory of mind directly, which in turn, affects mental state talk.

Although how it affects theory of mind is still open for more debate and research, the presence of siblings has repeatedly shown to be beneficial to the development of theory of mind at least in non-autistic children. Additionally, research has shown that the relationship between sibling effects and theory of mind is very complex and is influenced by many different components. Due to this complexity, whether or not sibling relationships will show a similar effect in children with ASD will still require more research.

CHAPTER THREE

Sibling Relationships in Children with Autism and Their Effects on Theory of Mind

So far, only two studies have been conducted on how the presence of siblings affect theory of mind in autistic children, and the studies have found conflicting results (Matthews, Goldberg, & Lukowski, 2013; O'Brien, Slaughter, & Peterson, 2011). O'Brien et al. (2011) found that children with ASD who had older siblings perform less well on theory of mind tasks than children with ASD who did not have older siblings. This result does not correspond with that previously found in typically developing children. Older siblings of children with autism could possibly overcompensate for the autistic child's disability, preventing the child from experiencing opportunities to practice skills that could help improve his or her theory of mind. Additionally, autistic children who are first-born may have access to better interventions than later-born autistic children due to less competition for their parents' resources (O'Brien et al., 2011).

However, Matthews et al. (2013) found that, consistent with findings for typically developing children, children with ASD who had at least one older sibling performed better on theory of mind tasks than children with ASD who did not. Furthermore, the performance of autistic children who had older siblings was not significantly different from than of a comparison group of typically developing children (Matthews et al., 2013). However, the sample in Matthews et al.'s (2013) study included participants who had siblings who also had ASD while O'Brien et al. (2011) only studied children who had typically developing siblings. Additionally, the participants in O'Brien et al.'s

(2011) study appeared to have more severe symptoms than the participants in Matthews et al.'s (2013) study.

Since ASD has a genetic influence, siblings of people with ASD are much more likely to either have ASD themselves or display autistic-like traits while remaining in the normal range of development. This genetic component may affect how children with ASD and their siblings interact, which in turn affects theory of mind development. Siblings of autistic children possibly may have impaired theory of mind themselves. Studies researching the genetic influence of autism on theory of mind have found mixed results (Dorris, Espie, Knott, & Salt, 2004; Nydén, Hagberg, Goussé, & Rastam, 2011; Shaked, Gamliel, & Yirmiya, 2006). Nydén et al. (2011) and Shaked et al. (2006) did not find any evidence indicating that unaffected siblings of children with autism significantly differed from other typically developing children in theory of mind. Shaked et al. (2006), however, did find that theory of mind in siblings of children with autism was significantly correlated with receptive language while no such relationship was found in the typically developing comparison group. This finding appears to imply that siblings of children with autism may rely on their verbal ability to pass theory of mind tasks while members of the comparison group may not. Perhaps siblings of children with autism have a differently neural pathway for theory of mind than other typically developing children.

On the contrary, Dorris et al. (2004) found that siblings of children with Asperger's syndrome performed less well than the age-matched control group on the Reading the Mind in the Eyes Test, which requires the inference of mental states from looking at photographs of eyes. Although this finding could indicate a genetic effect, the

results could be due to learned behaviors. Studies have shown that individuals with ASD are less likely to focus on another person's face, especially the eyes (Kirchner, Hatri, Heekeren, & Dziobek, 2010; Klin, Jones, Schultz, Volkmar, & Cohen, 2002). The siblings in Dorris et al.'s (2014) study may have learned this fixation behavior from their autistic siblings and may not gather information from the eyes as much as most typically developing individuals. In light of all these results, autism does not appear to exert a genetic effect on theory of mind. If it does, the effect does not appear strong.

Research on the nature of sibling relationships in children with autism can provide insight on how the presence of siblings affects theory of mind. For example, Kaminsky and Dewey (2001) found that sibling relationships with autistic children were marked by less prosocial behavior and less quarreling and competition. Less quarreling could result in less conflict and fewer negative emotions experienced during conflict. However, less conflict would also result in fewer opportunities to negotiate disputes and fewer opportunities to practice skills that could improve theory of mind. Additionally, less prosocial behavior could result in fewer positive interactions with the sibling, which could also put an autistic child at a disadvantage in developing his or her theory of mind.

A study by Aksoy and Yildirim (2008) also found that siblings of children with autism appear to report less positive relationships than siblings of children with other types of disabilities. The study also found that the less understandable and more severe that a disability is, the less positive a sibling relationship would be reported. Since theory of mind has been linked to positive sibling relationships, children with more severe symptoms may not benefit as much from interacting with their siblings, especially if the

severity of their symptoms prevent them from forming positive relationships with their siblings (Hughes & Ensor, 2005; Woolfe, 2003).

Other factors can affect the quality of a sibling relationship in ASD. Since positive relationship quality has been associated with theory of mind development, these factors may require further study on how they affect theory of mind in both autistic children and typically developing children. Factors that have been studied and shown to influence sibling relationship quality in children with ASD are temperament, differential parenting, and environmental stressors (Petalas, Hastings, Nash, Hall, Joannidi, & Dowey, 2012; Rivers & Stoneman, 2008). The component of an autistic child's temperament and their sibling's temperament that most contributed to their relationship quality was persistence (Rivers & Stoneman, 2008). Persistence is defined as sustained attention towards a task even if the task is challenging. Rivers and Stoneman (2008) found that if the autistic child possessed high levels of persistence, the more likely the sibling relationship quality will be reported as positive and that the same result occurred if the sibling had high levels of persistence. However, the sibling's level of persistence had a stronger effect on relationship quality than the autistic child's level of persistence.

Rivers and Stoneman (2008) also found that sibling relationships tended to be more positive when the siblings were more satisfied with the differential attention that their parents gave to their autistic siblings. On the other hand, stressors such as behavior problems in the child with ASD and a critical family environment predicted less a positive sibling relationship between a child with ASD and his or her sibling (Petalas et al., 2012). Additionally, Petalas et al. (2012) found that when siblings of autistic children displayed more Broad Autism Phenotype characteristics and had parents with more

mental health problems, the sibling relationship is more likely to be reported as negative. Since the research on sibling relationship quality and theory of mind so far has been conducted on non-autistic children, the link between these two variables may not be generalizable to autistic children. The factors mentioned previously could influence theory of mind development through the mediation of positive sibling relationships, but they could also be completely unrelated to theory of mind development. Further research may be needed to confirm which statement is most accurate.

CHAPTER FOUR

Conclusion and Discussion

Current studies on how siblings affect theory of mind in children with ASD have been inconclusive so far. Furthermore, too few studies have been conducted on this specific research area. The only two studies conducted on this specific topic have produced contradictory results. However, studies on how ASD alone affects theory of mind have shown that it generally impairs theory of mind while studies on how siblings affect theory of mind on non-autistic children have shown that the presence of siblings generally enhances theory of mind. The presence of siblings could possibly be beneficial for autistic children in regards to theory of mind similar to how it benefits non-autistics, or it could have an entirely differently effect if at all.

The results found in this research could, however be affected by certain limitations. Firstly, researchers have a tendency to focus on false belief and are likely to heavily rely on tasks measuring false belief as measures of theory of mind (e.g. Baron-Cohen et al., 1985; Baron-Cohen, 1989; Cassidy et al., 2005; Charman, Ruffman, & Clements, 2002; Jenkins & Astington, 1996; Leslie & Frith, 1988; Lewis et al., 1996; Matthews et al., 2013; Pellicano, 2010; Perner et al., 1994; Perner et al., 1989; Peterson et al., 2007; Randell & Peterson, 2009; Ruffman et al., 1998, 1999; Woolfe, 2003). False belief alone may not be the most comprehensive measure of a child's theory of mind, and studies may need to incorporate other tasks, such as appearance-reality tasks and tasks measuring pretense, in order to fully understand theory of mind.

Secondly, most researchers tend to focus on studying theory of mind in preschoolers, especially in studies focusing on typically developing children (e.g. Cassidy et al., 2005; Jenkins & Astington, 1996; Lewis et al., 1996; McAlister & Peterson, 2006; Perner et al., 1994; Ruffman et al., 1999). Although theory of mind develops most drastically during this stage, placing too much focus on it may not provide the full explanation of how theory of mind develops. Since theory of mind development is a life-long process rather than a singular event, the study of children younger and older than preschool age may provide greater understanding on how this development occurs.

Theory of mind studies tend to use small samples (e.g. Baron-Cohen, 1989; Brent et al., 2004; Cassidy et al., 2005; Kaland et al., 2007; Lewis et al., 1996; Matthews et al., 2013; McAlister & Peterson, 2007; O'Brien et al., 2011; Pellicano, 2010; Peterson et al., 2007; Ruffman et al., 1999; Shaked et al., 2006; Woolfe, 2003). Using larger sample sizes could allow researchers to find effects on that would otherwise be overlooked. However, obtaining larger sample sizes may be especially difficult for studies researching autism because of how relatively uncommon people with autism are in the general population.

Additionally, ethnicity, culture, and socioeconomic status could affect theory of mind development in both autistic and typically developing children. Most of the studies have taken place in English-speaking, Western countries and have been conducted on children from middle class white families (e.g. Cassidy et al., 2005; Jenkins & Astington, 1996; McAlister & Peterson, 2006; O'Brien et al., 2011; Pellicano, 2010; Perner et al., 1994; Ruffman et al., 1999). The results found in these studies may not be applicable to ethnic minorities, populations in Eastern countries, or the economically disadvantaged.

Studies that include these different populations could give further insight on how theory of mind develops and what kinds of environments affect it. Additionally, research in such populations would provide possible evidence that can either supports or refutes the universality of theory of mind and the effects that ASD and siblings have on it.

Lastly, further research on the effects of gender could be beneficial to our understanding of theory of mind. Recent studies have shown that females have, at least, a slight advantage in theory of mind (Calero, Salles, Semelman, & Sigman, 2013; Charman et al., 2002; Ibanez, Huepe, Gempp, Guitiérrez, Rivera-Rei, & Toledo., 2013; Peterson et al., 2007). An earlier study by Happé (1995) found similar results, at least for typically developing children. Gender could also have an effect on how sibling relationships influence theory of mind. Cassidy et al. (2005) and Ruffman et al. (1998) found that children with at least one opposite-sex sibling performed better than children with only same-sex siblings on theory of mind tasks. Having an opposite-sex sibling could give a child exposure to a mind that is significantly different from his or her own. Furthermore, males are four times more likely to be diagnosed with ASD than females, and females diagnosed with ASD are more likely to also have intellectual impairments (American Psychiatric Association, 2013). Because of this, females may experience ASD differently from males, which can be studied, at least partially, in how both gender and ASD affect theory of mind.

On a final note, further research will definitely be needed in this topic due to a lack of conclusive studies done on this specific topic. Extended research on this topic could be helpful in developing more effective interventions for autistic children.

Additionally, improvements on the limitations of previous studies may provide new information on the development of theory of mind in general.

REFERENCES

- Aksoy, A. B., & Yildirim, G. B. (2008). A study of the relationships and acknowledgement of non-disabled children with disabled siblings. Retrieved from <http://www.edam.com.tr/kuyeb/pdf/tr/3e0d94c7d12f307258f74e397ce10683nFULL.pdf>
- American Psychiatric Association. (2013). Autism Spectrum Disorder. In *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., pp. 50–59). Washington: American Psychiatric Publishing.
- Baron-Cohen, S. (1989). The autistic child's theory of mind: A case of specific developmental delay. *Child Psychology & Psychiatry & Allied Disciplines*, 30(2), 285–297. doi:10.1111/j.1469-7610.1989.tb00241.x
- Baron-Cohen, S. (2001). Theory of mind and autism: A review. In L. M. Glidden (Ed.), *International review of research in mental retardation: Autism* (vol. 23). (pp. 169–184). San Diego, CA US: Academic Press.
- Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a “theory of mind”? *Cognition*, 21(1), 37–46. doi:10.1016/0010-0277(85)90022-8
- Belmonte, M. (2009). Whats the story behind theory of mind and autism? *Journal of Consciousness Studies*, 16(6-8), 6–8.
- Brent, E., Rios, P., Happé, F., & Charman, T. (2004). Performance of children with autism spectrum disorder on advanced theory of mind tasks. *Autism*, 8(3), 283–299. doi:10.1177/1362361304045217
- Calero, C. I., Salles, A., Semelman, M., & Sigman, M. (2013). Age and gender dependent development of theory of mind in 6- to 8-years old children. *Frontiers in Human Neuroscience*, 7. doi:10.3389/fnhum.2013.00281
- Cassidy, K. W., Fineberg, D. S., Brown, K., & Perkins, A. (2005). Theory of mind may be contagious, but you don't catch it from your twin. *Child Development*, 76(1), 97–106.
- Charman, T., Ruffman, T., & Clements, W. (2002). Is there a gender difference in false belief development? *Social Development*, 11(1), 1–10
- Dorris, L., Espie, C. a. E., Knott, F., & Salt, J. (2004). Mind-reading difficulties in the siblings of people with Asperger's syndrome: Evidence for a genetic influence in the abnormal development of a specific cognitive domain. *Journal of Child Psychology and Psychiatry*, 45(2), 412–418. doi:10.1111/j.1469-7610.2004.00232.x

- Happé, F. G. (1994). An advanced test of theory of mind: Understanding of story characters' thoughts and feelings by able autistic, mentally handicapped, and normal children and adults. *Journal of Autism and Developmental Disorders*, *24*(2), 129–154.
- Happé, F. G. (1995). The role of age and verbal ability in the theory of mind task performance of subjects with autism. *Child Development*, *66*(3), 843–855.
- Hughes, C., & Ensor, R. (2005). Executive function and theory of mind in 2 year olds: A family affair? *Developmental Neuropsychology*, *28*(2), 645–668.
- Hughes, C., Fujisawa, K. K., Ensor, R., Lecce, S., & Marfleet, R. (2006). Cooperation and conversations about the mind: A study of individual differences in 2-year-olds and their siblings. *British Journal of Developmental Psychology*, *24*(1), 53–72.
doi:10.1348/026151005X82893
- Ibanez, A., Huepe, D., Gempp, R., Gutiérrez, V., Rivera-Rei, A., & Toledo, M. I. (2013). Empathy, sex and fluid intelligence as predictors of theory of mind. *Personality and Individual Differences*, *54*(5), 616–621. doi:10.1016/j.paid.2012.11.022
- Jenkins, J. M., & Astington, J. W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology*, *32*(1), 70.
- Kaland, N., Callesen, K., Møller-Nielsen, A., Mortensen, E. L., & Smith, L. (2007). Performance of children and adolescents with Asperger syndrome or high-functioning autism on advanced theory of mind tasks. *Journal of Autism and Developmental Disorders*, *38*(6), 1112–1123. doi:10.1007/s10803-007-0496-8
- Kaminsky, L., & Dewey, D. (2001). Siblings relationships of children with autism. *Journal of Autism and Developmental Disorders*, *31*(4), 399–410.
- Kirchner, J. C., Hatri, A., Heekeren, H. R., & Dziobek, I. (2010). Autistic symptomatology, face processing abilities, and eye fixation patterns. *Journal of Autism and Developmental Disorders*, *41*(2), 158–167. doi:10.1007/s10803-010-1032-9
- Klin, A., Jones, W., Schultz, R., Volkmar, F., & Cohen, D. (2002). Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism. *Archives of General Psychiatry*, *59*(9), 809–816.
doi:10.1001/archpsyc.59.9.809
- Leslie, A. M., & Frith, U. (1988). Autistic children's understanding of seeing, knowing and believing. *British Journal of Developmental Psychology*, *6*(4), 315–324.

- Lewis, C., Freeman, N. H., Kyriakidou, C., Maridaki-Kassotaki, K., & Berridge, D. M. (1996). Social influences on false belief access: specific sibling influences or general apprenticeship? *Child Development*, *67*(6), 2930–2947.
- Matthews, N. L., Goldberg, W. A., & Lukowski, A. F. (2013). Theory of mind in children with autism spectrum disorder: Do siblings matter?: Theory of mind and autism spectrum disorder. *Autism Research*, *6*(5) 443-453. doi:10.1002/aur.1308
- McAlister, A., & Peterson, C. C. (2006). Mental playmates: Siblings, executive functioning and theory of mind. *British Journal of Developmental Psychology*, *24*(4), 733–751. doi:10.1348/026151005X70094
- McAlister, A., & Peterson, C. (2007). A longitudinal study of child siblings and theory of mind development. *Cognitive Development*, *22*(2), 258–270. doi:10.1016/j.cogdev.2006.10.009
- McAlister, A. R., & Peterson, C. C. (2013). Siblings, Theory of Mind, and Executive Functioning in Children Aged 3-6 Years: New Longitudinal Evidence. *Child Development*, *84*(4), 1442–1458. doi:10.1111/cdev.12043
- Nydén, A., Hagberg, B., Goussé, V., & Rastam, M. (2011). A cognitive endophenotype of autism in families with multiple incidence. *Research in Autism Spectrum Disorders*, *5*(1), 191–200. doi:10.1016/j.rasd.2010.03.010
- O'Brien, K., Slaughter, V., & Peterson, C. C. (2011). Sibling influences on theory of mind development for children with ASD: Sibling influences on theory of mind development for children with ASD. *Journal of Child Psychology and Psychiatry*, *52*(6), 713–719. doi:10.1111/j.1469-7610.2011.02389.x
- Pellicano, E. (2010). Individual differences in executive function and central coherence predict developmental changes in theory of mind in autism. *Developmental Psychology*, *46*(2), 530–544. doi:10.1037/a0018287
- Perner, J., Frith, U., Leslie, A. M., & Leekam, S. R. (1989). Exploration of the autistic child's theory of mind: Knowledge, belief, and communication. *Child Development*, *60*, 689–700.
- Perner, J., Ruffman, T., & Leekam, S. R. (1994). Theory of mind is contagious: You catch it from your sibs. *Child Development*, *65*(4), 1228–1238.
- Petalas, M. A., Hastings, R. P., Nash, S., Hall, L. M., Joannidi, H., & Dowey, A. (2012). Psychological adjustment and sibling relationships in siblings of children with Autism Spectrum Disorders: Environmental stressors and the broad autism phenotype. *Research in Autism Spectrum Disorders*, *6*(1), 546–555. doi:10.1016/j.rasd.2011.07.015

- Peterson, C. C., Slaughter, V. P., & Paynter, J. (2007). Social maturity and theory of mind in typically developing children and those on the autism spectrum. *Journal of Child Psychology and Psychiatry*, 48(12), 1243–1250. doi:10.1111/j.1469-7610.2007.01810.x
- Randell, A. C., & Peterson, C. C. (2009). Affective qualities of sibling disputes, mothers' conflict attitudes, and children's theory of mind development. *Social Development*, 18(4), 857–874. doi:10.1111/j.1467-9507.2008.00513.x
- Rivers, J. W., & Stoneman, Z. (2008). Child temperaments, differential parenting, and the sibling relationships of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 38(9), 1740–1750. doi:10.1007/s10803-008-0560-z
- Ruffman, T., Perner, J., Naito, M., Parkin, L., & Clements, W. A. (1998). Older (but not younger) siblings facilitate false belief understanding. *Developmental Psychology*, 34(1), 161.
- Ruffman, T., Perner, J., & Parkin, L. (1999). How parenting style affects false belief understanding. *Social Development*, 8(3), 395–411. doi:10.1111/1467-9507.00103
- Senju, A. (2011). Spontaneous theory of mind and its absence in autism spectrum disorders. *The Neuroscientist*, 18(2), 108–113. doi:10.1177/1073858410397208
- Shaked, M., Gamliel, I., & Yirmiya, N. (2006). Theory of mind abilities in young siblings of children with autism. *Autism*, 10(2), 173–187. doi:10.1177/1362361306062023
- Woolfe, T. (2003). Siblings and theory of mind in deaf native signing children. *Journal of Deaf Studies and Deaf Education*, 8(3), 340–347. doi:10.1093/deafed/eng023