

Mind Blindness and Autism: Theory Theory Versus Simulation Theory

Student: M. Wijn

Studentnummer: 1048074

Begeleider: L. C. de Bruin

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Abstract

In this paper, mind blindness is examined as an explanation for autism. The aim is to understand whether mind blindness could be explained better by theory theory or simulation theory. For this, the main skills that are needed for these accounts to work are explored. For simulation theory, multiple empirical studies on imagination are discussed. Regarding theory theory, studies of specific rule learning are analysed. The hypothesis is that children with autism ought not to have these skills if these explanations are correct. It was found that children with autism experience problems when it comes to imagination.. Also, it was found that autistic children can understand general principles. Hence, simulation theory would likely be a better explanation for autism.

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Introduction

Autism is a disorder that was discovered in 1911 by the Swiss psychiatrist Eugen Bleuler. He saw it as a form of social withdrawal where the individual turns inward and does not engage in social contact (Achkova & Manolova, 2014). Since then, autism has been broadly researched and is still the topic of extensive debate in the field of philosophy as well as psychology (Wolff, 2004). At first, deficiencies that were related to it were seen as a symptom of schizophrenia, but through the years the disorder took its own course. It has had various definitions since it first appeared in the DSM in 1980. It was particularly difficult to conceptualize this disorder, because autism presents itself only through behaviour, therefore it is not easily defined and tested. Additionally, the disorder has many different ways of exhibiting itself, one factor of the disorder can be of major influence on one person, but in another it can be much less severe. Because of this, researchers started speaking of the autism spectrum (Achkova & Manolova, 2014).

Over time, autism gained a more independent and stable conceptualization. Because of this, it gained even more attention in psychiatry as well as other fields of study. Nowadays, it is characterised by developmental deficiencies and problems concerning social interaction and communication (Kumbier et al., 2010). These three conditions are seen as the main characteristics of autism and are classified as a triad of impairments (Achkova & Manolova, 2014; Belkadi, 2006). Children with autism often start speaking much later than their peers and find it difficult to be social. In addition, the condition is often related to repetitive and selective behaviour (Belkadi, 2006). Individuals with autism usually have very specific interests that they can spend many hours on. For example, an autistic child might want to watch the same movie over and over again, multiple times a day.

Moreover, humans are often credited with the amazing ability to infer the mental states of others and use them to make predictions about behaviour (Goldman, 2012). They understand that someone is thirsty when they take a sip of water or that they are going outside when they grab their jacket. Even in very complicated situations, humans can use subtle clues to come to the right conclusions. For example, when they are talking to someone, they can catch a glimpse of an uncategorizable facial expression and immediately understand what it means. From something so subtle one can conclude that the other does not like the food they are eating or disapproves of something that was said. This ability to infer mental states and predict behaviour is often referred to by philosophers and psychologists as having a “theory of mind”, but it is also called “folk psychology”, “mind reading” or “mentalizing”. These terms are often used interchangeably in the debate on this topic (Shanton & Goldman, 2010).

Furthermore, people who interact with others have many thoughts and beliefs about them (Goldman, 2012), which are used to understand each other better. According to the theory of mind we need this skill to be able to communicate with others in an effective manner and it is seen by them as essential for making sense of the behaviour of other people (Colle et al., 2007). They state that it is used to navigate the social world and not having this ability makes it extremely hard to behave in accordance with social situations.

In general, children with autism are seen as having a deficiency when it comes to this ability. They are often referred to as being “mind blind” (Baron-Cohen, 1985; Baron-Cohen, 2000). It is claimed that children with Autism Spectrum Disorder (ASD) do not have the same skills when it comes to ascribing mental states and coming to conclusions about behaviour as regularly developed children of the same age. This is viewed as one of the main explanations of the autism condition, because it is specific to individuals with autism. People with autism experience great trouble when it comes to the social domain and find it extremely hard to navigate the social world (Parsons & Mitchell, 2002). They often experience social exclusion and difficulties when finding jobs or acquiring and sustaining friendships (Howlin, 1997). From the perspective of the mind blindness hypothesis, this can be explained by the inability to mentalize, because they do not really know what the other means or is planning to do.

There are two main accounts in the theory of mind debate, which are theory theory and simulation theory. The one states that we infer mental states using a theory, the latter claims that we simulate others. These accounts could both be an explanation for mind blindness. In this thesis I aim to explore whether simulation theory or theory theory better explains autism. I examine if it is more likely that mind blindness is caused by the inability to theorize about mental states or the inability to simulate others. For this, I will look at the skills that are necessary for these accounts to work. My hypothesis is as follows: if mind blindness can be explained by theory theory, children with autism do not have the skills that are needed for this. The same goes for simulation theory. To understand the ability of children with autism I analyse their ability to learn about specific rules and mechanisms (relationships between cause and effect). To gain insight in their ability to simulate, I examine their skills regarding imagination. My choice to evaluate these specific characteristics will be elaborated on in section II.

If we understand what being mind blind entails we will also gain better understanding of how people usually interact with each other. If we know what is missing when one is mind blind, we also know what is needed to use a theory of mind. So, if theory theory or simulation theory turns out to be a better explanation for mind blindness, it will likely also be a better

explanation for theory of mind. This provides us with more insight in the theory of mind debate in general. In addition, it helps us gain understanding of how humans can understand each other.

In this thesis, I first explore the results of autistic children on the false belief task, which are often used as evidence for mind blindness. This is to understand what ideas of mind blindness are originally based on. In addition, the scope and limitations of this task will be discussed. For this, I will look at the ways in which memory deficiencies and language deficiencies can influence the results of autistic children on the test. Also, various critiques of the false belief task will be elaborated upon to understand how the false belief task actually relates to mind blindness. The aim is to gain an understanding of how we can interpret the results of the false belief task and to what extent they provide evidence for mind blindness.

Next, I will analyse two other theories that aim to explain autism and their criticisms on mind blindness in general, namely: weak central coherence theory and embodiment cognition. I examine if these theories can explain aspects of autism that mind blindness cannot and the other way around. The goal is to gain an understanding of the scope and limitations of the mind blindness hypothesis.

Moreover, I will discuss various accounts of theory theory that show us the importance of understanding general principles and mechanisms. This knowledge will be used to understand which empirical evidence should be looked at. After this, I will also discuss different accounts of simulation theory, which demonstrate that imagination is needed for simulation to work. Then, I will elaborate on various empirical studies on imagination and creativity. Additionally, I will examine rule learning and the understanding of mechanisms in autism. The aim is to find out whether children with autism have the skills that are needed for theory theory and simulation theory to work. Lastly, I will analyse the results on these specific abilities and relate them back to theory theory and simulation theory. The aim is to come to a conclusion about the ability of children with autism to simulate and theorize. This helps understand which of the two accounts better explains mind blindness.

By examining the mechanisms behind the social and communicative problems that children with ASD experience, we might also gain insights on how we can help them. The aim of this thesis is to state the importance of empathy versus theory, which provides us with a basis for helping children with autism to navigate the social world more effectively. If we understand which one is more important, we can also conclude what social and communicative training should be focused on.

Section I: False Belief Task and Mind Blindness Hypothesis

1.1 False Belief Task

Firstly, let us discuss how the false belief task was originally used to provide insight in the mentalizing abilities of autistic children. This shows us where the mind blindness hypothesis actually comes from. The hypothesis that autistic children have trouble with social interaction due to mind blindness was first considered by Baron Cohen et al. (1985). Their main idea was that, if it is indeed the case that individuals with autism deal with social impairments due to the lack of mentalizing abilities, then this means that they are not able to ascribe false beliefs to others. Furthermore, they would not be capable of predicting behaviour on the basis of these false beliefs. It is important to note that this should not depend on differences in development concerning cognitive and verbal skills (Frith, 2001). A test was conducted where the development in normally developed children, autistic children and children with down syndrome was evaluated and compared. For this, the false belief task was used, also known as the Sally-Ann task.

When children participate in the task a story is performed, after which they answer a specific question. Sometimes this is done with dolls, other times with actual people. Two girls called “Sally” and “Ann” are introduced to the child. Sally has a box and Ann has a basket. Sally also has a marble, which she puts in her box before going away to go for a walk. In the meantime, Ann takes the marble and puts it into her own basket without the other girl being there to see it. When Sally comes back, the child is asked where she will look for her marble.

Before the age of four, regularly developed children do not answer this question correctly. But, after they pass this particular age they will be able to provide the right answer. 88,9% of the normally developed children with an average age of four to five years old answered correctly. In addition, 85,7% of the children with Down syndrome, of approximately 11 years old, passed the test as well. Thus, a great percentage of both control groups understood that Sally will look where she believes the marble to be, even if it is not actually there. Because she was not there when the toy was moved, she will look in the box. However, children with autism who were much older than the control groups found it difficult to complete the task successfully. 80% of the children with autism were not able to pass the test, while the mean age of the studied group was around 11 years (Frith, 2001; Baron-Cohen, 1985).

Moreover, according to Baron-Cohen (1985) the test can only be passed when children understand that different people can have different thoughts about a specific situation. In this case, they have to infer the mental states of one person. This is called the first-order test: a first-

order test asks the subject about the thoughts of another person. These thoughts could be about any object or situation. A second-order test, on the other hand, considers beliefs about beliefs. So, if the experimenters would ask the child what Ann thinks Sally believes, this would be second-order. It is concluded that autistic children find it very difficult to understand the viewpoint of another person and come to a conclusion about what their thoughts are. Often times, they simply report what they themselves know (Baron-Cohen, 2001). To pass the test, the child has to understand that they have other thoughts about the situation than the person or doll that just left. Hence, these results are used as proof for the mind blindness hypothesis.

1.2 Memory Deficiencies

Baron-Cohen (1985) states that failure on the test indicates that a child does not have mentalizing abilities. But, results could also be ascribed to other disabilities. A child has to have an understanding of more than just mental states to be able to answer questions about false beliefs correctly. I will now discuss if memory deficiencies could influence the results of autistic children on the false belief task. If this is the case, this would mean that the results could not just be ascribed to mind blindness. This will help us the scope of the false belief task and it will help interpret the results of autistic children on this task.

Firstly, it is important to mention that Baron-Cohen (1985) starts the experiment by asking a question to see if the children remember where the toy is, to check if their answer is not influenced by the inability to remember where it is. All the children that participated answered this question correctly. Yet, to examine the possibility that failure is related to memory further another test is conducted by Baron-Cohen (1985). In this condition, a picture is taken of a bear sitting on a chair. The photograph is then put away and the bear is placed on a bed. After this, the child has to answer what was depicted on the photo. Does it display the animal on the bed or the chair? In this case, the autistic children did answer correctly. From this it is concluded that their failure in the false belief task cannot be attributed to memory deficiencies.

However, even if the findings on mind blindness by Baron-Cohen (1985) are seen as not related to memory deficits, this does not mean that there is no relationship at all. If a child with autism has severely impaired memory, this will have an influence on their ability to attribute mental states. If they cannot remember where the toy is or what Ann saw, they cannot come to conclusions about beliefs. Various studies have been done on memory deficits in children with autism. For instance, Williams et al. (2006) conducted a study where they compared memory skills of children with autism with those of regularly developed children.

They found that children with autism scored lower on tests that examined various kinds of memory. Among them were: recognition memory, verbal working memory and spatial working memory. This is not yet proof of the influence of memory on false belief attribution. Still, it does show that there might be differences in memory skills that can be attributed to autism.

Therefore, Lind and Bowler (2009) investigated semantic and episodic memory in relation to ASD and specifically, how this would influence their theory of mind. Their aim was to see how memory and mind blindness are related to each other. According to them, children with autism have no impairments when it comes to semantic memory, which includes impersonal and factual knowledge. For example, children might easily remember the capitals of countries in the world. But, they do have deficiencies when it comes to episodic memory, which means they have problems with remembering personal experiences. For example, they might have difficulty remembering if they enjoyed their dinner two days ago. It is about the difference between knowing something and knowing something about oneself and one's subjective experience. A person needs to be aware of themselves to have a good episodic memory.

Perner (2000) states that this inability to remember subjective experience could be caused by theory of mind deficiencies. According to him, individuals need to be able to understand that those memories are mental representations of something that happened in the past. So, if children with autism have problems understanding mental states, then they also cannot represent these memories correctly in their minds. This means their memory will be worse when they have to represent their own subjective experience.

In this manner, problems that are experienced when representing mental states can influence episodic memory. But memory problems would not be the cause of mind blindness, rather, it would be the other way around. It could very well be possible that mind blindness influences the memories children have of subjective experience. This would also influence their performance on false belief tasks. And, there are likely instances where memory deficiencies make it hard to predict false beliefs correctly.

Hence, research on memory shows that there is indeed a relationship between memory and autism. Autistic children experience deficits regarding specific types of memory, like episodic memory. These deficiencies could very well be caused by mind reading deficits. Therefore, these memory deficiencies are not seen as the cause for failure on the false belief task. But, it is not impossible that some of the failures on the task can be explained by memory deficits. All in all, failure on the false belief task generally is not attributed to problems concerning memory, even if it could be of influence.

1.3 Language Deficiencies

Another important factor when it comes to passing the test is having sufficient language abilities. During the false belief test, the child has to understand what the experimenters are saying and has to communicate the answer using language. Therefore, I will also look into the language abilities of children with autism and I will examine whether results on the false belief task could be ascribed to this. Once again, this will tell us if the results of autistic children on the test are possibly caused by something else than mind blindness.

Belkadi (2006) states that language deficiency is an important factor of autism spectrum disorder. According to her over half of individuals with autism experience problems concerning language. The inability to test subjects with severe language deficiencies is seen as a limitation of the original task. Therefore, Colle et al. (2007) have conducted another test where the amount of verbal communication is reduced to a minimum. This is done by replacing verbal communication as much as possible with pointing.

Moreover, this version of the false belief task is used to rule out the possibility that failure is caused by lack of verbal development. For this purpose, the researchers made use of three groups. One group consists of children with autism and language deficiencies. The next one consisted of children without autism, but also with language deficiencies. The last group was the control group with regularly developed children.

In this version of the task, two experimenters are present: experimenter A and experimenter B. There are two boxes placed on a table behind a cardboard screen. At first, experimenter A shows the empty boxes and tells the child that they have to find out where a sweet is. Then, the sweet is placed in one of the boxes out of view of the participant. Thereafter, experimenter B points to the box containing the candy. Then, experimenter B leaves the room and experimenter A switches the boxes. The child is able to see this. When the other experimenter B comes back he points towards the box he thinks it is in. He would give the wrong indication, pretending that he did not know about the switch. Following this, the child is asked to point in the direction of the actual box it is in. A correct answer indicates that children can reason about mental states that are not in accordance with the state of the world. This means they have understanding of false beliefs.

The researchers found that children who just suffered from verbal deficiencies performed way better than children who were also autistic. Hence, it is stated that autistic children with low language development are also impaired when it comes to their mentalizing abilities. The results of the verbal mind blindness test can also be found in these children with verbal deficiencies.

In addition, another study was done by Senju et al. (2010) in which a non-verbal and unstructured variation on the false belief test was used. This was done to come to conclusions about the abilities of autistic children to spontaneously anticipate an action, which considers the developing of certain expectations of behaviour without prompting from researchers. It is measured before any questions about actions or beliefs are asked. In this variation of the false belief task, eye movements were tracked to see if children with autism predict correctly where someone will look for an item that was displaced while they were away. Children with autism did not show spontaneous action anticipation, while control groups did.

Also, looking time was examined to conclude whether children were surprised by certain actions. A longer looking time indicates that something unexpected occurred for the subject. In one instance, an experimenter would go to the hidden location of an object without actually being able to know it was there. If the children were surprised, it showed that they knew the experimenter could not actually have known this. Children with autism were not surprised, while children who only suffer from language disabilities were. From this it is also concluded that failure on false belief tasks of children with autism cannot be attributed to language deficiencies.

Thus, both these studies show that mind blindness cannot be explained away by deficient language skills. It is still seen as something specific to autism and is still present in other variations of the test that make use of less verbal communication. This does not mean that language deficiencies do not play a role in mind blindness, they very well might. And I do believe that problems concerning language should be taken into account when trying to understand autism. But, the results on false belief tasks are, for the most part at least, not caused by the fact that children do not have the language abilities to participate. These findings indicate that failure on the false belief task is not caused by language deficiencies. We can still ascribe the results of autistic children to mentalizing abilities.

These findings on memory and language deficiencies indicate that failing the false belief task is specific to autism and that it can give us some insight in this disorder. However, the exact relationship between the false belief task and mind blindness is something we have to look into further. We have to understand to what extent the Sally-Ann task and mind blindness are related to each other. This is what I will discuss next.

1.4 Critiques of the False Belief Task

So, we have looked at the possible role memory and language deficiencies play in mind blindness. They indicate that there is something going on which is specific to autism and is of

importance when researching this disorder. However, there are still some other critiques we have to look at before we can come to any conclusion about the scope of the false belief task. The task measures mentalizing abilities, but it is not yet clear to what extent it provides insight in mind blindness. I will examine two types of critiques to gain understanding of the relation between the false belief task and mind blindness.

One objection to the false belief task is posed by Carpendale and Chandler (1996). They claim that being able to pass a false belief task is not a guarantee that a child understands that events can have different interpretations. They state that we do not have good reason to accept that passing this test is proof for insight in mental life being interpretative in character. They do acknowledge that passing the false belief task is a first step when it comes to gaining understanding of different perspectives. However, according to them the development of a child's theory of mind does not begin or end with an understanding of false beliefs. The real insight into knowledge as being interpretative is only beginning to show itself from 6 to 8 years of age.

Moreover, children who pass the false belief task when they are four only need the much simpler understanding that people who experience different things also hold different beliefs (Carpendale & Chandler, 1996). This does not mean that there is an understanding about the fact that people can have different beliefs when they experience the same thing. Carpendale and Chandler (1996) conducted a study where they examined the abilities of autistic children to understand that events can have different interpretations. They found that individuals that passed the false belief task often still had problems with tasks involving explaining or understanding varying interpretations. 7 to 8 year old's were already significantly better at this. This indicates that more complex understanding is needed to understand that people can interpret the same event differently. These findings indicate that the false belief task can only give us limited knowledge about the abilities to understand others.

In addition, Bloom and German (2000) state that there is more to theory of mind than merely passing a false belief task. They give the example of an experiment with a child that is placed in a room. A toy they really want to play with is placed on a high shelf they cannot reach. Their parent was either in the room or not while the toy was placed. The children were more likely to gesture in the direction of the toy and name it when the parent had been away and then came back. In that case the parent had not seen the placement of the toy. If the parent was there the whole time, they were less likely to gesture towards it. In this case the parent had seen the placement of the toy. This shows that the children already have some idea of how the circumstances can influence the forming of a belief. Also, before 2 years of age children can

already engage in pretend play and understand when someone else is pretending. This means they have some insight in other's mental states.

In my view these researchers make a fair point. When we consider the false belief task we have to take into account that it is part of a process that is incredibly complex and goes far beyond this particular ability. A child does not magically gain understanding of false beliefs. It keeps developing its ability to understand others long after they turned 4. So, false belief tasks can be seen as a tool to gain understanding of a specific step in development. Yet, there is much more to inferring mental states than just the ability to attribute a false belief. The fact that we are also in need of non-verbal and spontaneous versions of tasks also shows that the classical false belief task is not sophisticated enough to provide complete understanding of mentalizing abilities. Results might differ when language plays a less important role or the story is made more simple or more complex.

Additionally, there is much more to mind blindness than just failing a false belief task. Being able to attribute false beliefs during an experiment and being mind blind are not one and the same thing. It could very well be that a child with autism can pass the test, but shows deficiencies with mentalizing in other, more complex situations. Thus, false belief tasks can be seen as a first step and a tool that can be used for understanding mind blindness. This shows that the false belief task can provide us understanding of mind blindness to some extent, but its scope is limited. Hence, mind blindness does not begin or end with the ability to attribute false beliefs.

1.5 Weak Central Coherence

Now, what is left is to understand the relationship between mind blindness and autism. We have to know to what extent mind blindness provides an explanation for this disorder before we examine its exact workings further. This means that we have to look at other possible explanations for this disorder to understand the limitations and scope of the mind blindness hypothesis. These might be able to explain aspects of autism that the mind blindness theory cannot. There are many ideas about the workings of autism, but in this thesis I will focus on the weak central coherence theory and the embodiment cognition explanation of autism.

Firstly, let us discuss the weak central coherence theory. This theory aims to explain some of the aspects of autism that theory of mind cannot, such as the tendency to focus on parts of objects, and having specific interest and desires for sameness (Hoy et al., 2004). According to this view, these aspects of autism can be explained by the inability to see the whole from the parts. So, children with autism are seen as focusing too much on details and not having

understanding of the bigger picture. For instance, it is shown in various experiments (Frith & Happé, 1995; Happé, 1997) that children with autism have significantly more problems with understanding the meaning of a word in the specific context. It is hypothesized that this happens because they fail to look at the sentence as a whole.

Moreover, Frith and Happé (1995) state that autism is caused by an imbalance in incorporating information at varying levels. Normally, an individual would take different parts of information and put them together to come to a higher meaning in a specific context. That is why it is called “central coherence”. Therefore, it is expected that children with autism will be good at tasks that concern attention to detail, but will have problems with recognizing global meaning. This aims to explain why children with autism are outstanding at some tasks, but worse in others that require them to see the bigger picture.

Nonetheless, these researchers state that central coherence cannot explain away mind blindness deficits. They state that weak central coherence is present in all children with autism, while mind blindness varies in its severity. Autistic children who pass the false belief task have the same problems regarding weak central coherence as children who do not pass. This shows that mind blindness and weak central coherence are not one and the same thing. Otherwise, there would not be a difference in their mind reading abilities. Because of this, these researchers conclude that weak central coherence is not the cause for the results in mind blindness experiments. Happé and Frith still think that there is some specific deficiency related to mentalizing which is of importance for autism. Hence, it could be possible that weak central coherence theory and mind blindness theory supplement each other, since neither of them can explain autism as a whole.

1.6 Embodiment Cognition

There are also researchers that completely oppose the mind blindness account and propose an alternative. Gallagher (2001; 2004) and De Jaegher (2013) are advocates of an embodiment approach to autism. Gallagher argues that theory of mind is not a good explanation for autism and that both simulation theory and theory theory are not fit to do this. He does not think that regularly developed people actually use theory of mind a lot, only in very specific situations, which means that it also could not explain the difficulties individuals with autism experience.

Gallagher (2004) states that it is problematic for the theory of mind explanation of autism that a significant percentage of children with autism are able to pass the false belief test as well as other theory of mind tests. According to him, this would mean that some children with autism actually do have a theory of mind. In addition, he also emphasizes that theory of

mind cannot explain all the factors that are of significance for ASD. For instance, it cannot explain why children with autism have certain characteristics that are not related to social behaviour. These are things like repetitive behaviour, specific interests and oversensitivity for loud sounds or sensory-motor deficiencies, which do not have anything to do with inferring mental states. He concludes that research on autism using the false belief task is limited.

So what could be a better explanation according to him? He states that there is something which happens before we can even begin to mentalize, which is much more important for understanding social interactions. Mind reading has to be preceded by something else, because otherwise we would not be able to know what to pay attention to (Gallagher, 2001). We are in need of some background knowledge which is provided to us by our understanding of the other's behaviour. These are things like movements, eye directions and facial expressions. According to Gallagher, this is the first step for understanding others and it is what we make use of almost all of the time. He calls this view *interaction theory* (Gallagher, 2004). We are born with the abilities for intersubjective understanding and this is what form the basis for social interaction.

In addition, he says that children with autism have sensory motor problems that inhibit them to make use of these skills. De Jaegher (2013) states that children with autism have difficulties with perceiving and moving. They do not have the abilities that are needed for primary interaction because their embodiment is so different. This, together with the fact that normal people do not use mind reading, shows that it could be a good explanation for deficiencies related to autism in his view.

In my view, Gallagher and De Jaegher have a valid point that has to be taken into account when examining autism. This is mainly due to two reasons. Firstly, if children with autism have sensory motor problems this will influence various aspects of their life and social abilities. Secondly, primary interaction cannot be completely explained by mind reading abilities. Explicit mind reading is not always needed to understand another and we already make use of some sort of intuition before we mentalize, which cannot be explained by mind reading abilities themselves.

However, I do not think this means mind blindness is of the table. This is once more for two reasons. Firstly, Gallagher aims to disprove the importance of mind blindness by looking at the results on the false belief task. He concludes that some children with autism do have a theory of mind or at least that mentalizing is not the main problem, because they pass the task. Therefore, it cannot be a good explanation for autism. But, as we have concluded in the former paragraph, the task is flawed and just indicates mind blindness. Mentalizing and explicitly

attributing false belief are not one and the same. Passing it does not mean that problems with inferring mental states are suddenly overcome. His arguments mainly show that we have to look beyond the false belief test. This means that we have to examine other experimental evidence to prove the mind blindness hypothesis.

Second, Carruthers (2007) provides us with a defence of the mind blindness hypothesis that shows us the limits of primary interaction theory. He states that mind blindness does not only impair understanding of other minds, it also makes it difficult to have an understanding of one's own emotions and thoughts. His claim is that someone who does not have the ability to read other minds also does not have insight in their own mental states. The mind blindness hypothesis claims that children with autism have a flawed understanding of belief. This would also mean that they also cannot ascribe beliefs to themselves.

The fact that autistic individuals have problems with understanding their own experiences, is shown in the studies on their episodic and semantic memory that I discussed earlier. They find it difficult to recall their own beliefs about something they experienced. This indicates that they do not have sufficient insight in their own experience and thus in their own mental states.

Additionally, one particular experiment that was done on the insight of autistic individuals in their own experiences was done by Hurlburt et al. (1994). In this study, autistic individuals were asked to write down details on their experiences in a notebook. At varying times during the day an alarm would go off and they would have to freeze their thoughts. Then, they had to write down details about their experience at that moment. Usually, individuals write down things like emotions, visual images and inner conversation. The autistic test subjects had significantly less notes about their subjective experience than regular individuals. From these results it was concluded that people with autism had significantly less insight in their own minds. Even though individuals with autism have inner experience, it is shown that they do not have understanding of what these are exactly.

This inability of people with autism to understand their own experiences cannot be explained by primary interaction. We do not interact with ourselves as we do with others. We do not read our own facial expressions and do not assess our own bodily movements. Therefore, this aspect of mind blindness cannot be explained away by primary interaction. It shows that there is something particular to mind blindness that has nothing to do with interaction. Individuals with autism are not merely blind for other minds, but also do not have this insight into their own mental states. This means that the mind blindness hypothesis is not of the table

and that it accounts for characteristics of autistic individuals that cannot be explained by primary interaction.

Thus, we have discussed two theories that could be an alternative to mind blindness and their arguments against this hypothesis. Now we can come to conclusions about its scope and limitations. Firstly, Frith and Happé show that mind blindness cannot explain the desire for sameness that autistic individuals have as well as their tendency to focus on details. Therefore, it is only seen as an explanation for communicative and social deficits. The inability to understand other minds is a part of autism. Mind blindness and ASD are not one and the same and mind blindness cannot explain all aspects of this disorder. This could mean that the mind blindness hypothesis has to be supplemented with another explanation for autism to gain insight in all aspects of this disorder.

Also, we have seen that theory of mind does not explain how we know what to focus on before we engage in mentalizing. Something happens before we even start to mind read that cannot be explained by mind reading itself. This also shows that there are some limitations to mind blindness that we have to take into account when further examining the mind blindness hypothesis. However, both weak central coherence theory and primary interaction cannot explain away deficits that are particular to mind blindness. This shows that this explanation of autism is still of importance and is worth looking into further.

Section II: Theory Theory and Simulation Theory

2.1 Theory Theory

Let us now discuss the views that are part of the theory of mind debate. To understand these theories, is to understand what abilities normal people are believed to have. It shows us how mentalizing could work and the skills that are needed for this. And thus, it shows us what children with autism should not be able to do according to these theories. Firstly, I will discuss theory theory, which is one of the main theories in the theory of mind debate. I will elaborate on varying theorist within this debate and then I will come to a conclusions about the skills that are needed and how these are acquired. I will not provide any conclusions about the importance of theory theory in the theory of mind debate yet. My goal is to examine what are the most important skills for theorizing.

Philosophers and psychologists who defend theory theory claim that when we infer mental states, we develop and use a theory of human behaviour that is present in our minds. The core of this perspective is that individuals use their theoretical reasoning skills to come to conclusions about the behavior of others. One takes into account the context and the person in question, and uses this to deduce their mental states (Ravencroft, 2019). For instance, when I see someone eating chocolate I can theorize that they were probably hungry, and desired a tasty snack.

Furthermore, if we want to understand theorizing, we have to first understand what a theory consists of. This gives us insight in what it is exactly what we use to understand others. Gopnik and Wellman (2012) provide a list of aspects of a theory. According to them, it consist of a distinctive structure, which involves coherent, abstract causal representations of the world. In addition, these representations consist of theoretical objects that cannot be observed. They allow for prediction of the future and allow us to make counterfactual inferences, which means that one can theorize about what would have happened if something would change about the past. For example, one could formulate what would have happened if they had not gone to school on a certain day. And, theories can also change when new evidence is brought to the table.

Now, there are many different variations of theory theory. For instance, Gopnik and Wellman (2012) defend the view that we make use of statistical information to navigate the social world. When we infer mental states, we use our understanding of the multiple hypotheses, rather than ruling everything out except one. If we look at the probability of the possible options we can select one that is most probable. This mainly makes it possible for us to have knowledge

of causal relationships. For instance, when one considers the cause of a headache, it might be most probable that one has it because one has been sitting at his desk in the wrong position for too long. Yet, if this person also has a fever, it might be more likely that he/she has the flu. Hence, according to them, we take into account varying factors to draw conclusions about probabilities. We gain an understanding of causal relationships in our environment.

Gopnik and Wellman defend an empirical version of theory theory. They state that children have the ability to learn about causal relationships. This happens when they interact with the world in the form of informal experiments. When children engage in play they are not evaluating everything that happens explicitly. But, if they notice a certain behaviour that causes a certain response, they can learn from this. Their own interaction with the world as well as those of others around them can cause them to gain understanding of causal relations.

These different types of informal experiments lead to adaptations to children's theories about the world. For instance, if a child throws a stick in the air and it comes back down she will understand that if something goes up, it must go down. This occurs even if there is no grownup around who can tell her about gravity. According to them, having specific knowledge of actual science is not needed to theorize about the world as a child. So, when we look at this account of theory theory we can see that understanding of causal relationships is very important. General principles are used to understand which outcome is most probable. These are things that can be learned. Thus, according to this theory individuals who have a theory of mind can understand and learn about causal relationships. This would mean that children with autism are not believed to have such an understanding.

Additionally, Scholl and Leslie (1999) state that we make use of propositional attitudes to come to conclusions about mental states. According to them, we have this ability because we have a theory of mind "module", which is part of our cognitive functions. They claim that theory of mind is like a mechanism that is part of our brain. This forms the basis for more developed theories. We have the innate ability to develop heuristics that we use to understand others and develop our theorizing skills (Leslie et al., 2004). In this manner, general knowledge and reasoning skills are not necessary to come to conclusion about other's mental states.

So, how does theorizing develop according to Leslie et al. (2004)? They state that we already develop highly abstract theories of mind before we gain reasoning abilities about mental states of other people. Children understand the relationships between concepts thanks to these heuristics. The ability to infer mental states starts with heuristics, which enables children to learn mind reading very fast, because they know what to focus on. So, we are basically made to theorize and we already are in possession of mechanisms that make it easy to do so. This is

related to the nativistic account of theory theory, which claims that theorizing abilities are inborn. So, according to this theory children with autism would not have this innate ability.

Additionally, Peter Carruthers (1996) argues that we make use of our theoretical knowledge of relationships between cause and effect to understand others. For instance, we know how perception and intention can influence our actions. For example, when we see a chocolate cake and we intend to eat it, we will likely do so. This knowledge of cause and effects relationships can take the form of propositional attitudes. General knowledge that is not related to a context can be seen as a framework for theorizing.

He also argues that at least some of our theorizing ability is innate. According to him learning a theory according to non-nativistic accounts would mean that there should be some explicit learning process, which is not the case according to him. He claims that children do not have the ability to behave like a scientist and gather evidence without the explicit help of an adult. The innate ability to theorize is more so seen as an organ that slowly develops as one matures, similar to one's heart or brain. So, in his view, theorizing is not like a process of learning about rules through trial and error. Therefore, he does not agree with accounts of theory theory that claim that children learn theories in this manner. And, if his ideas are correct, this would indicate that children with autism do not have this innate ability to theorize.

Now, Boterill (1996) defends another view, which he calls *core theory theory*. This is based on the idea that we use a small number of specific overarching rules as a basis for mind reading. He aims to explain this by adding another element to the definition of theory. Boterill claims that a theory (p. 107): "... must contain principles that provide a systematic integration of knowledge." He emphasizes the importance of systematic integration for explaining and predicting actions of others. We use a small number of general principles to infer mental states. An example he gives of such a mechanical theory is of Newtonian classical mechanics. We use it to understand that when we throw a ball in the air it will come back down. It is a general rule that helps to understand the workings of the world around us and makes it possible to predict and explain phenomena. According to Boterill, having knowledge of something means one has ideas of such general rules concerning it. So, we need understanding of the mechanisms underlying something to be able to understand it.

He also states that in many situations we can come to conclusions about mental states using general rules and the mechanism behind them. This would mean that in these cases a representation in one's own mind is not needed. He calls this the hard core of folk psychology. An example he gives is the action principle, which states that (p. 115): "An agent will act in such a way as to satisfy, or at least to increase the likelihood of satisfaction, of his/her current

strongest desire in the light of his/her beliefs.” This can be the overarching mechanism behind a social situation.

Thus far, I have discussed different versions of theory theory. We can see that there are actually two different questions we have to answer to come to conclusions about the skills that are needed for theorizing. First, we have to understand how theorizing can be learned. Is this ability innate or do we make use of informal experiments? In addition, we have to understand how it works once it is acquired. What do we do exactly while inferring mental states?

It is my view that part of the theorizing abilities might very well be innate, but children are able to learn about certain mechanisms by interacting with the world around them. They can learn about general principles without needing an understanding of the science behind it. And, they can come to an understanding about mechanisms without an adult explaining it. When a child interacts with the world and this causes something, they learn. We learn new things every day without learning about the scientific explanations behind it. You can understand that when you touch fire, you will get hurt, without having an understanding of the exact biological processes. Children might have the innate ability to learn from the world around them, but it does not mean that they cannot learn from informal experiments. We might have some aptitude for theory, yet we cannot ignore our ability to understand things by experiencing them. So, I would say that children can develop theories by interacting with the world around them. They learn about cause and effect relationships.

Additionally, we can see that an understanding of mechanisms and specific rules is needed for theorizing to work. The ideas on how this ability is gained or how this works exactly differ. One states that we make use of probabilities while the other states we make use of propositional attitudes. But, they generally have in common that we make use of general principles when developing a theory about mental states. The ability to understand specific rules and mechanisms can be seen as the core of theorizing. If theory theory is a theoretically sound explanation for mind blindness, this would mean that children with autism do not have this ability, since theory theory is seen as absent in them. Therefore, I will examine the abilities to learn about and understand specific rules. In addition, I will look at skills concerning insight in mechanisms to come to conclusions about the role of theory in mind blindness.

2.2 Simulation Theory

The other main viewpoint in the theory of mind debate is called simulation theory. To be able to compare this view to theory theory we also have to understand the abilities that are needed

for this. This will help to come to a conclusion about the empirical research that we will discuss regarding the skills of autistic children.

The simulation perspective on mindreading is based on the idea that we often arrive at explanation and prediction of behaviour by mentally simulating their mental states (Barlissa & Gordon, 2017). Goldman is one of the main defenders of mindreading as simulation. He states that individuals use their understanding of their own emotions, motivations and practical reasoning when inferring mental states of another person (Goldman, 1989). Rather than moving from belief to belief, people move from mental state to mental state to come to conclusions about behaviour. One simulates the role of the other using their own experiences. This means that we imagine to be in the same position as the person we are trying to understand.

Goldman (2010; 2012) writes about different aspects that are needed for simulation. People need to make use of their imagination, employ semblance of another's mental states and they have to be able to take another's perspective. These abilities are used to put oneself in the other's shoes to come to conclusion about their mental states. A mind reader creates pretend mental states in their own mind that resemble those of the person they are trying to understand. They go from mental state to mental state to infer what the target would behave like and then this final state is taken "offline" so that the mentalizer does not act on it. Rather, this state is now assigned to the subject of the simulation (Goldman, 2010). So, according to Goldman we imagine to be in another's situation and due to this process we can infer mental states. Hence, children with autism should not have imagination skills needed for this.

Gordon (1996) is also one of the main advocates for simulation theory. Yet, he takes simulation a step further and develops the notion of radical simulationism. He states that we make use of ascent routines when we simulate, which means that we use our imagination to directly transform into the other. We come to conclusions about someone else's mental states without referring back to ourselves. The mind reader forgets about themselves for a moment and answers questions about the other from their perspective. They do not take their own emotions, motivations or beliefs into account.

Gordon (1996) explains this further using the example of the question: "Does Mickey Mouse have a tail?" When someone makes use of ascent routines to simulate, this means that instead of answering "he thinks Mickey Mouse has a tail" they would say "Mickey Mouse has a tail." This is because they answer directly from the perspective of the other. There is no need to refer back to themselves, because they answer questions from a lower semantic level. This means that instead of answering a questions about a belief, we answer a direct question about the object.

But, how does this work exactly? According to Gordon we need to have understanding of a mental location. This means that we are able to make a clear distinction about what mental states belong to whom. In a sense we connect them to the right physical body. We have to understand that our own mental states do not belong to the other and the other way around. So, we know that certain thoughts and beliefs are only applicable to ourselves and we leave them “at the gate” when we start simulating the other. That is also why it is not necessary to understand yourself before the other. Answering questions about mental states is linked to a particular individual. That is why children have to learn how to simulate without carrying their own feelings with them. This is something we become better at when we grow older.

Furthermore, when simulating in this direct manner, many adjustments need to be made to be able to really understand the other’s situation. One has to take into account their point of view, the context, reasoning skills, character traits, background information, etcetera. When directly simulating people we have to think about all the aspects that come into play and how the subject has behaved before. We have to compensate for the differences between oneself and the other (Gordon, 2004). Hence, we transport a transformed self completely in the situation (Gordon, 1996). For example, when a guy of twenty years old simulates an old lady there are major differences between them that he has to take into account. Maybe she has five kids and ten grandchildren, maybe she just had a hip surgery, her hearing might be bad and her processing a bit slow. If the young man just thinks of what he would do in the situation without taking her specific characteristics into account, he would definitely come to the wrong conclusions about her mental states. Therefore, he has to leave his own mental-states behind and directly imagine to be her. Thus, according to this account autistic children do not have the imagination abilities that are needed for direct simulation.

So, both accounts of simulation theory put emphasis on the importance of imagination to be able to simulate. According to Goldman, we use this to imagine to be in the position of the other. And, Gordon states that we have to be able to completely imagine to be the other. there is no doubt about the importance of imagination for this account of theory of mind. Therefore, children with autism should have difficulties imagining and pretending if simulation is a probable explanation for mind reading. Thus, this will be the first skills we will be looking at concerning simulation theory.

Section III: Empirical Studies on Autistic Children

3.1 Creativity and Imagination in Autism

Thus far, we have concluded that imagination is important for simulation to work. Therefore, we will look into the abilities of children with autism regarding imagination. If simulation theory can explain mind blindness, then children with ASD should be worse at this than their normally developed peers. To begin, I will discuss empirical studies regarding pretend play, then I will discuss varying drawing tasks. These represent varying ways in which imagination as well as creativity can be measured. So, these experiments should tell us if simulation theory might be an explanation for mind blindness.

A lack of imagination in children with autism is indicated by studies on the lack of pretend-play they exhibit. Various studies have reported that there is much less occurrence of pretend-play when autistic children are engaged in spontaneous play compared to regularly developed children (Baron-Cohen, 2001; Baron-Cohen, 1987). Pretend-play occurs when objects are used in unconventional ways. For example, when a child acts as if a piece of cardboard is an airplane. According to Baron-Cohen (1987) children with autism are actually able to spontaneously engage in reality-play. This occurs when the object is used in a conventional way. For instance, when one drinks from a toy tea cup as if there was actual tea inside.

Moreover, pretend play involves situations in which the child knows what the object actually is and what it is supposed to be during play. The child is not just mistaken, but is deliberately imagining something to be something else. For instance, they pretend that a banana is a telephone or that a stick is a sword. The difference in spontaneous pretend-play between children with ASD and normal children could be explained because they lack the imagination to do so. So, these results indicate deficiencies regarding imagination. Also, we can see that they especially experience deficits regarding imagining unconventional ways to use an object.

Additionally, Craig and Baron-Cohen (1999) tested the creativity of autistic children using the Torrance creativity test. This test is often used to assess whether one has creative thinking skills. The results of autistic children and normally developed children were once again compared. The experiment made use of different phases. First, the experimenter asked the child to add to straight lines to make up a figure. They were asked to come up with a lot of different ways to make a picture. There were no restrictions and the children had all the time to draw. At the end the child was asked what the drawing was supposed to do. The answer was written below the picture. This was repeated and the child was encouraged to keep drawing different

things. The experiment ended when the participant was out of ideas. The results were evaluated by looking at the number of responses, the number of different categories the responses cover and the originality and rarity of responses. These three conditions were then added to form one total score. It was found that autistic children had a deficiency in creativity when compared to the control group.

The experimenters went on to draw a distinction between two types of creativity to better understand where the difference in test results between children with ASD and regular children comes from. One form of creativity is related to the imagining of fictional but real-world events. For instance, making up a new design for a dress or composing a song. The other concerns fictional but entirely imaginative things. Such as, an animal that could never exist or a world where the laws of nature do not apply.

In the second part of the experiment the children were given a toy elephant and they were asked if they could tell the experimenter how the elephant could be made more fun to play with. So, they had to think about ways to make the toy different or about things the elephant could do. Once again there were no restrictions and this went on until the participant said they were out of ideas. Here, the difference between the two types of creativity was noted. The results showed that children with ASD displayed less imaginative creativity, so they had the tendency to add to or manipulate reality. In general they produced less replies to the question. This shows that it is easier for children with ASD to produce answers that are based on reality, even though they generally perform worse than the control group.

Another range of experiments was conducted by Baron-Cohen, Craig and Scott (2001) where children's imagination was tested more directly. In this case, the researchers made use of different drawing tasks. The focus was on imagining unreal entities (for example a dancing broom) and unreal transformations (for instance turning a boat into a house). Imagination is needed to complete these tasks, and therefore it is a good way to test imaginative abilities.

Firstly, the children were asked to draw a man. After they passed this control condition they were tasked with drawing an impossible man. The children with ASD were significantly worse at this task than children with normal development. However, their results were not different from the children with moderate learning difficulties. The researchers theorize that this test might be too low level and developed a test that is more challenging to see if there are differences to be found.

In the second experiment children were asked to mix two categories to come up with something that does not exist. Here, the researchers found that all children were able to draw entities combining two categories into something that exists and something that does not exist.

There was no real difference in this version of the test. However, in the condition concerning drawing unreal entities the children with ASD scored significantly worse. This points towards problems imagining unreal entities.

Moreover, in a different part of the research, the participants looked at some pictures. The children had to make transformations to these, first real ones and then unreal ones. In the “unreal condition”, the transformation proposed by the child should be something that is not possible in the real world. A cloud could not really turn into an airplane, for instance. They did this test again, but this time around the children could decide themselves what kind of transformation they wanted. They could choose a real or unreal transformation themselves.

In both these conditions significant group differences were found. There was a substantial difference between children with autism and the other groups when asked to produce unreal transformations. Also, when they were asked to spontaneously transform, the answers given by autistic children did not contain many unreal possibilities or category changes. Hence, when they can think of something themselves they will actually show less imaginative ability than other children.

This study suggests that children with ASD mainly have imaginative problems when it comes to unreal things. They are also less likely to come up with unreal transformations when they are asked to choose themselves what kind of change they want to make to a picture. However, they have less problems transforming or combining things into a product that could possibly happen or exist. In addition, specific kinds of imagination are especially difficult for children with autism.

Thus, these studies on imagination and creativity indicate that children with autism do not have the same imagination abilities as their normally developed peers. They perform worse on drawings tasks and do not spontaneously engage in pretend-play. These findings indicate that they do not have the skills that are needed for simulation.

3.2 Learning of General Rules

Earlier, I concluded that an understanding of specific rules and mechanisms is specifically important for theory theory to work. This means that we have to look into these abilities in children with autism. If this account of theory of mind is an explanation of mind blindness, then children with ASD should be worse at understanding general principles than their peers. So, the results of the following experiments regarding rule learning and understanding mechanisms can tell us whether mind blindness can be explained by a lack of theory. To begin, I will discuss the rule learning abilities of children with autism. After this, I will also discuss their general skills

regarding the understanding of mechanisms. These will provide insight into the abilities of children with autism to theorize. This will be of help to draw conclusions about theory theory as a possible explanation for mind blindness.

According to Frith (2001), people with ASD are seen as having the ability to learn the rules for social conventions, however they lack the intuition that is needed to behave properly in specific situations. They do not understand when a rule is not appropriate and become confused when they are confronted with exceptions. Jones et al. (2013) state that it is especially difficult for children with ASD to learn abstract rules. And once they have learned a rule it is very challenging to deal with conflicting situations. The difference between children with autism and normally developed children when it comes to rule learning is even more prominent in social situations.

The way children with autism hold on to the literal meaning of words is an example of understanding specific rules without having insight in the exceptions. They can learn what a sentence means specifically and in what particular situations to use it, but they become confused when they are confronted with irony or figurative speech. These are exceptional situations in which the literal meaning is no longer of use (Frith, 2001). Moreover, understanding figurative speech and irony is an important part of being able to navigate social contexts (Baron-Cohen, 2001). Several studies have been conducted that examined autistic individuals' ability to recognize humour and figurative speech. For instance, Happé (1995) researched autistic individuals comprehension of figurative language.

The test was as follows. They first conducted a control situation that was very similar to the false belief task, to see if the participants could comprehend first order and second order beliefs. Then, the participants did two different kinds of tasks. Firstly, they had to complete a sentence with words provided to them from a list of options. One of the answers was correct and the researchers wanted to examine if the subjects could choose the right option. There were three conditions. In the first condition, they could choose from literal synonyms. In the second, they had to choose between metaphors (he really was...). In the third, they had to choose between similes (he was like...). The aim was to see if it was easier for the subjects to answer in one condition than the others. This could show if it is especially difficult for children with autism to answer correctly in the metaphor condition.

In the second test participants had to read or listen to five stories in which two characters were talking about a third individual. One comment is ironic and the other is metaphorical. An example of irony that is given by Happé, is when one of the characters says someone is very clever, when they did something stupid. An example of a metaphor would be stating that

someone's head is made out of wood. After the story the participants had to answer a question about what the speaker actually meant. They could choose between the literal and the intended meaning.

The individuals with autism that did not pass the false belief task were also not able to comprehend the intended meaning from the stories. In addition, these people were as good with finishing a sentence when they could choose from a literal synonym or the simile condition, but they scored way lower in the metaphorical condition. The people with autism that did pass the false belief task were better at understanding the sentence completion in the irony condition. However, they also scored significantly lower than non ASD control groups on the understanding of ironic utterances in the story task. The autistic individuals that passed the second order false belief task were able to pass all the tasks successfully. Although, they did state they had problems with mind reading in everyday life, which means their abilities on the task did not guarantee success in real life social situations.

These results indicate that mind blindness and understanding of irony are closely related. Being able to pass the false belief task is a predictor of understanding irony. And, understanding irony means one can comprehend figure of speech and utterances that are an exception to a learned rule. Furthermore, we can see that individuals with autism generally have an understanding of the literal meaning of words. However, they find it difficult to understand exceptions. Learning about the specific meaning of a word can be seen as learning a specific rule. Now, there is also research that focuses on the understanding of rules specifically. This is what we will go into now.

There have been several studies conducted that aimed to understand whether children with autism can be taught social rules that and if they can apply these to different contexts. For instance, Parsons and Mitchell (2002) have researched the potential of virtual reality for learning social skills. They state that most studies that aim to teach children with ASD mind reading skills provide improvement in a specific social task, but these abilities are not generalizable to other contexts and situations. So, children with ASD can learn specific rules that apply to a specific situation, but they still have problems when it comes to context-related understanding. Therefore, it does not help them navigate the real world.

In an experiment done by Hadwin et al. (1996), children with ASD were taught general rules that are used for mind reading. They showed great improvements regarding related tasks, but did not show any changes in other unrelated tasks. Children could learn to score significantly better on false belief tasks, but this did not help them become more socially

competent. They conclude that teaching explicit rules can help when it comes to completing specific tasks. This also shows that children with autism can have knowledge of specific rules.

Hwang and Hughes (2000) give an overview of empirical studies that aimed to teach autistic children social skills by interactive learning. The specific setting, the durability and the generalizability are all analysed to conclude how these types of teaching can help children with ASD navigate social situations. These social interactive programs focus on improving the communicative and social abilities of the participants by probing them to initiate social interactions. In these studies limited generalization is reported. So, in this case there was also no evidence that children with ASD used these skills in situations outside the specific context they were taught in.

Also, Senju et al. (2009) report that adults with Asperger can understand mental states when they are specifically asked to do this. This means that even if they learn how to mentalize and have the higher ability to pass the Sally-Ann task, they still do not do this spontaneously. In this article, spontaneous looking behaviour is tested using a non-verbal version of the false belief task. By looking at eye movements it can be concluded whether someone anticipated Ann's erroneous search for the marble in the wrong box, and if this was an unexpected event. When a participant spontaneously uses a theory of mind, his or her eyes will move towards the place the object was last seen by Ann. So, the difference in eye movement reveals whether individuals with Asperger have this ability.

The participants with Asperger could actually pass the verbal task. The Asperger group showed significantly less looking towards the right hiding place than the control group in the non-verbal condition. This shows that even if they gain the ability to mentalize and are able to pass false belief task, they do not make use of this skill if they are not specifically asked to do so. They still have trouble mind reading outside of verbal test conditions and continue to struggle in everyday social interactions. This can also be related to attempts to teach autistic children social skills. Even if they learn how to pass specific social tasks, they still do not use this ability in everyday life, because they do not do it spontaneously.

In addition, the learning of specific rules and passing the false belief task by autistic children could be explained by the learning of behavioral rules. This would mean that children with autism come to understand that in that particular situation a certain behaviour follows the other (Yott & Poulin-Duboiss, 2012). For instance, understanding that an individual will look for something in the last place they saw it. For this, they do not need any real understanding of false beliefs or mentalizing. They just have to know what behaviour is followed by another (Perner & Rufman, 2005). So, this is about some specific output leading to a particular

behavioural response, which does not exactly require perspective taking. This could also be seen as a kind of specific rule that could be learned and applied to a specific situation.

So, in conclusion, children with autism can learn about specific rules and can apply these to specific situations. They understand the literal meanings of words, but have problems grasping metaphors and irony. This means that they can understand the specific meaning of a word. Moreover, they can come to an understanding of the general principles that are needed to pass the false belief task. However, even if they gain this insight children with ASD still have trouble with mind reading in other settings. They still do not do this spontaneously and these abilities to pass the false belief task are not generalizable to other situations. This means that learning about specific rules does not solve social problems.

3.3 Understanding Systems

The ability to understand specific rules or behavioural rules could be attributed to the following characteristic of children with autism, which is their competence in understandings systems. This is also one of the main abilities for theorizing as was described by Boterill (1996). The ability to understand general rules is intertwined with the ability to understand mechanisms. This is because general rules are what make up a system. Therefore, I now examine findings regarding the skills autistic children have when it comes to understanding mechanisms. This can also show us whether children with ASD have the ability to understand general principles, which means it also indicates if theory theory is an explanation for mind blindness.

Baron Cohen et al. (2002) write about the difference between the systematic understanding of children with autism and their empathic understanding. Empathizing is the ability to understand mental states. This is particularly hard for children with ASD which results in mind blindness. Systemising, on the other hand, is something they are rather interested in and are actually very good at.

Baron-Cohen describes systemising as: "...the drive to analyse and build systems, in order to understand and predict the behaviour of non-agentive events." There are many different systems that can be understood not by understanding mental states, but by looking at regularities and underlying rules. For example, social structures in society can be understood by looking at probabilities and things like losses and profits. It can also be related to natural systems, regularities in biology, computer programs, mathematics and so on. When looking at these kinds of processes, it is possible to find the exact cause for an event and very precisely predict what will happen. Baron-Cohen states that understanding these systems is a matter of analysing

the relationship between input and output. When it is possible to understand all the inputs, it is possible to very specifically predict the outcome.

Moreover, experimental studies show that children with ASD do not just understand systems like physics intuitively, they are even superior at it. Their development in this field is faster and better in comparison with children that are not autistic. Autistic children are better than normally developed children from the same age in understanding the relationship between physical causes and effects. They can also explain this relationship better (Baron-cohen, 2002). Their understanding of mechanical systems is also shown in the test using a photograph, which was mentioned earlier. The autistic children could very well understand that a photo would stay the same even if reality was altered. Thus, they show a deficit when it comes to understanding what a person knows, but they do understand the workings of a camera.

Even though systemising is defined in this article as a way of understanding non-agentive events (it is about objects rather than people), it can also give us insight in the way autistic children approach social situations. Behaviour can be understood as a relationship between input and output. Baron-Cohen gives the example of a boy named Joey that explained his own actions as well as actions from others in a mechanical manner. This systematic way of thinking is a way of understanding the world.

Baron-Cohen states that autistic children have strong interests in systems that can be understood using specific rules and regularities. They search for the exact outcomes and are in need of specific and predictable answers to questions. When such an exact answer to a question is not available this leads to problems. And often times this is what happens in social situations. For example, when you ask: “when do you have to go to the dentist?”. This could be answered in different ways. Does this person want to know what week, what day or the exact time? Yet, when the question is precise enough the autistic child will have no problem processing it. For instance if one asks: “at what time is your dentist appointment?” he or she will know what to say.

Therefore, children with autism will understand social situations with predictable and exact outcomes more easily. This happens when underlying regularities can be uncovered and understood by the autistic child. Their systemizing abilities show how they can be taught general rules that can be applied to a specific situations. When the cause and effect is exact they will very well understand what to do. However, when the social situations becomes too complex and unpredictable they will no longer be able to do this.

Hence, children with autism can understand specific input and output relations. They can make use of general principle to understand what cause will lead to a specific effect.

Children with ASD can understand mechanisms and the specific rules that are needed for this. This indicates that they have the abilities that are needed to develop a theory about other people and their behaviour.

Section IV: Analysis of Findings

4.1 Imagination and Simulation

So, we have looked at imagination skills and rule learning abilities and the way they are present in children with autism. Now, I will go over the specific findings of the experiments and relate them back to the theories we discussed. This provides insights on how these abilities would impair or enable children with autism to use theory theory or simulation theory. The aim is to understand if these different accounts would or would not be an explanation of mind blindness.

Firstly, I discussed impairments in autistic children when it comes to imagination. Experiments have shown that children with ASD show less spontaneous pretend play than normally developed children. They do not pretend that objects represent something they are clearly not, which indicates that they have deficiencies with imagination. This is a clear difference between normally developed children and children with autism. Children with autism do, however, engage spontaneously in reality play. This indicates that they do not experience deficiencies regarding all sorts of play.

Also, children with ASD are less creative when they are presented with different drawing tasks. They generally come up with less adjustments and they find it significantly more difficult to come up with adjustments that would be impossible. This also shows that they lack imagination as well as creativity. Both these experiments indicate that children with ASD have a deficiency when it comes to creativity and imagination, which is especially related to their abilities to come up with impossible or “unreal” adjustments. So, it is harder for them to think of things that are not already given by an object in some way.

These studies show that children with autism experience deficiencies regarding imagination and creativity in comparison to regularly developed peers. This lack of imagination inhibits the production of pretend states. If one cannot generate pretend states, then it is not possible to come to conclusions about mental states and behaviour using simulation. Additionally, these findings show that simulation could be an explanation for mind blindness. Children with autism do not have the skills needed for simulation to work, because they do not have the necessary imagination skills. Hence, they cannot acquire insight in other minds using simulation.

Moreover, these experiments on pretend play and creativity indicate that children with autism find it particularly difficult to come up with impossible adjustments. This is an interesting finding that we can look into a little bit further. The two different accounts of simulation theory I discussed make use of different types of imagination. Therefore, these

experimental results can also be used to understand whether classical simulation theory or radical simulation theory is a better explanation for mind blindness.

In classic simulation theory, as proposed by Goldman, an individual can still make use of their own perspective of the situation. One can still relate back to themselves to some extent and make use of their own thoughts to understand the other's behavior. A person does not completely imagine to be someone else, but can make adjustments to their own view of the situation. So, the conclusions about mental states are still to some extent related to what individuals know and their own experience. Even though they are supposed to rule out mental states that do not correspond to those of the target (Goldman, 2012), they can still make use of the similar states they already have.

Because people can think of what they would do in a certain situation, they can make use of the things they already know. They can refer back to their own mental states. This form of imagination is easier for children with autism, even though they are shown to have deficiencies when it comes to do this as well. This could mean that classical simulation is not as problematic for them as direct simulation. As the empirical evidence on pretend play and drawing tasks has shown, children experience less problems when the transformation is related to the object. This is the case with Goldman's account of simulation, because one can make use of what they already know. This indicates that Goldman's theory is limited as an explanation of mind blindness, because children with autism find it easier to imagine things that are related to what they already know themselves.

In the case of radical simulation theory, an individual cannot refer back to themselves and has to completely imagine to be the other. One cannot make use of their own mental states and cannot relate to what they already know. The individual needs to make an *impossible transformation*, because he or she cannot actually turn into someone else and the simulation is not in any way related to their own mental states. They cannot think about what they would do in the situation. So, the adjustment is not given by the object (in this case: the mentalizer). If they could use their own mental states, they could make an adaptation that is logically related to what they already know. But, this is not possible when one simulates directly. This indicates that direct simulation would be much more difficult for an autistic child. It requires the specific abilities regarding imagining an impossible transformation. Therefore, radical simulation could be a better explanation for mind blindness.

So, children with autism do not have the imagination abilities that are needed for simulating in general. However, their specific deficiencies regarding impossible transformations points towards direct simulation as a possible explanation for mind blindness.

It would be incredibly difficult for children with autism to directly simulate the other. They would not be able to make use of the things they already know and adjust them.

4.2 Rule Learning and Theory Theory

In addition, I discussed the ability of children with autism to learn general rules. I explored if these abilities can be generalized to other contexts and real social situations. First, I discussed a study on figurative speech and the ability of autistic children to understand this. We found that children with autism experience difficulties when a word or a sentence is not used in a literal sense. This shows that these children have an understanding of the specific rule related to the words.

But, they generally do not have insight into adaptations of this rule. If they learn about the specific meaning of words, they still do not have understanding of how to use it in different contexts. This shows that children with autism can understand specific principles and have the ability to develop a theory about the meaning of words. However, when they have understanding of such a rule, they still do not have the social flexibility that is needed for applying it effectively. This shows that this ability to understand specific rules should be complemented with the ability to adapt to varying contexts. One needs to know about the exceptions that are not given by the rule itself. Individuals should be able to understand various social situations, without being specifically taught about these circumstances.

Moreover, I found that autistic children can be taught general principles about mind reading. They can have an understanding of these rules and apply them to the specific context they are taught in. Once again, this shows us that children with autism have the ability to learn about and apply general principles. This indicates that autistic children have the skills that are needed to develop a theory, which can be used to understand social situations. However, these findings also indicate that the knowledge of these rules is not generalizable to other contexts. These children still have mind reading deficiencies. Hence, the knowledge of general principles does not cure mind blindness.

Also, I discussed studies on social interactive training, which is used to help children with autism become more social. These findings showed that these children can come to understand specific social situations. However, these skills are once again not generalizable. So, they cannot make use of the principles they learn in other contexts. This is in line with the results of the other experiments. Autistic children can come to understand specific situations, but this knowledge is not applied to other situations. This also shows that having knowledge of

specific situations does not further social abilities in general. Something more is needed for navigating the social world effectively.

I also found that autistic individuals do not make spontaneous use of theory of mind to understand others, even if they gained understanding of the general principles behind it. Individuals with the ability to pass a false belief task still experienced problems in their social life. This also shows us that autistic people can understand general rules. They can understand the principles behind specific tasks or situations. Once again, this shows that individuals with autism have the abilities that are needed for developing theories. They know what to do in social situations where a specific principle can be applied. But, these autistic individuals still lack the ability to use this knowledge spontaneously. This means that they cannot effectively use their understanding of other minds in their daily life.

Additionally, I discussed that children with autism can come to understand behavioural rules. For instance, they can come to understand that a specific action will always be followed by a specific type of behaviour. This also shows that children can understand specific principles, which enables autistic children to develop a theory about behaviour. They can apply a general principle to predict what behaviour someone will display. This means they have an understanding of relationships between cause and effect, which is the understanding that is needed for theorizing.

Lastly, I looked at the skills of autistic children regarding systemizing. We saw that these children are actually very good at understanding mechanisms and theories when all the aspects of the input and the output are known. This means that predictable social situations are not as problematic for children with ASD. These are situations where a general principle can be applied. These findings also show that children with autism would be able to use theory to understand others. When we look at their systematic way of thinking, we can see that they are able to form a theory as long as the input and output are completely predictable.

So, from all of these studies we can conclude that autistic children actually have the ability to learn specific rules that can be applied to specific situations. This means that children with ASD actually have the ability to learn about general principles, that was indicated as the main skill that is needed for theorizing. They experience significantly less problems with applying specific rules to specific situations where context or exceptions are not relevant. This indicates that autistic children have the ability to theorize, which means that theory theory is not likely an explanation for mind blindness.

Additionally, we saw that learning about these specific rules does not solve the problems that are experienced with mind reading. The skills that are learned are not applicable to other

contexts or situations, which means that learning about general rules does not solve problems concerning mentalizing. This would have been the case if theorizing was truly the source of the mentalizing problems for children with autism.

These results also point in the direction of simulation theory as the right explanation for mind blindness, because the importance of context and intuition is emphasized. Context and intuition can be more easily taken into account when one uses simulation. One does not form conclusions by using general rules, but just looks at that particular person and moment. And, they cannot apply the rules they have learned in a class that teaches them social skills if they do not really have an understanding of specific contexts. So, the ability to learn specific rules indicates that theory theory is likely not an explanation for mind blindness. In addition, the fact that social situations can only be used using empathy indicates the importance of simulation theory.

4.3 Simulation Versus Theory

Thus, the results of these studies indicate simulation theory as the most plausible explanation for mind blindness. In addition, radical simulation theory is possibly even a better explanation for mind blindness than classic simulation theory. Children with ASD do not have the skills that are needed for simulation, but would experience most trouble with the direct variant of this. One thing is certain when we look at the specific characteristics of children with autism that were examined in this paper: we are in need of an underlying mechanism of mind blindness that understands the importance of the specific context and takes into account characteristics of someone who is different from us.

The experiments regarding rule learning show us that social rules cannot be applied properly without understanding of the context. Context and intuition are things that cannot be taught and cannot be summarized by a small number of general principles. The children could gain understanding of principles and apply them to a situation. However, this way of teaching theory of mind did not take into account how conclusions about behaviour have to change when the context changes.

Regularly developed children can adapt to different situations and exhibit social flexibility. They can take a rule that they have learned behaviour and understand why it does not work in that particular situation or how it should be adapted. Children with autism have such problems with unpredictable social situations, because they have to understand the specific context and take into account factors that they could not have learned about in advance. These

are things that just cannot be taught in a class. This indicates that context and intuition are incredibly important for understanding others.

When developing a theory using general principles the specific context is not taken into account. General principles are rules that always apply when a specific situations occurs. They do not tell us anything about exceptions. That is why these principles cannot be used to effectively navigate the social world. And, that is also why learning about general principles does not solve mind blindness. Knowledge of the specific social situation is needed to understand others. General principles could be a point of departure when understanding others, but this knowledge should be supplemented with insight into the context.

Contrastingly, while simulating one takes into account all aspects of the context. All factors that are relevant for that specific situations are used for an accurate simulation. In addition, a lot of intuition and empathy is needed to simulate. So, simulation theory puts much more emphasis on the importance of the context. Therefore, It is my view that simulation can account much better for the problems autistic children experience regarding mind reading.

Conclusion

In this thesis I explored theory theory and simulation theory as possible explanations for mind blindness. Before we dove into these two accounts I looked at the false belief task, as it is used as the evidence for this explanation of autism. I found that passing the false belief task cannot be explained away by memory or language deficiencies. Thus, failing the false belief task gives us insight in impairments that are specific to autistic individuals. I also concluded that passing this test is merely one step in the development of theory of mind. Before and after passing this task children gain abilities that are related to understanding others. For instance, they learn later on in life that people can have different opinions about the same object. Understanding other minds is incredibly complex and cannot be grasped by one test. Passing a false belief task does not mean that one does not experience communication and social problems any more. Hence, being mind blind and failing a false belief task are not one and the same thing. Therefore, we have to look beyond the false belief task to really understand autistic children and their insight in other's mental states.

In addition, I looked at the mind blindness hypothesis to understand to what extent it explains autism. For this, I looked at other explanations of autism and their criticism of mind blindness. We can conclude that mind blindness cannot account for autism as a whole. It is no explanation for the fact that autistic children prefer routines and have very specific interests. We saw that weak central coherence theory could actually be a supplement for mind blindness to really understand autism in general. Both theories can explain autism only partly, but together they explain all aspects of this disorder.

Because the scope of mind blindness is limited, it should be complemented to really gain an understanding of autism. Also, theory of mind cannot explain how we know what to focus on when we mentalize. This means that it cannot account for all our skills regarding interactions, which also shows that this explanation of autism is limited. I concluded that there is something specific about autism that can only be explained by the theory of mind approach. This was based on the fact that individuals with autism also lack insight in their own mental states. This cannot be accounted for by primary interaction. Therefore, mind blindness is a theory which is worth looking into further.

Moreover, we looked at theory theory and simulation theory. This was done to gain an understanding in the abilities that are needed for both accounts to work. These insights could then be used to conclude which of the two is a better explanation for mind blindness. Even though, there are many different views on theorizing we could come to conclusions about the

general abilities that are needed for this. Namely, one has to understand and apply general principles and one has to be able to understand specific mechanisms. For simulation theory it is extremely important that one has skills regarding imagination. This is because one needs to imagine to be in the same situation as the other, or one has to imagine to completely be the other. I concluded that these skills were crucial for these accounts to work. Additionally, if these theories provide us with an explanation for mind blindness, this means that children with autism cannot have these skills. Hence, we looked into empirical evidence regarding specific rule learning and imagination.

I concluded that children with ASD show a significant impairment in both imagination and creativity. Additionally, they do not engage spontaneously in pretend play, but do not show deficiencies when it comes to reality play. This shows that they find it especially hard to imagine things that are not given by an object. These results are also supported by empirical studies using drawing tasks. Children with autism find it especially difficult to imagine transformations that are “impossible”, even though they showed deficiencies regarding imagination in general. I concluded that generally children with ASD experience imagination impairments, but this particular type of imagination is more difficult for them.

Also, the empirical evidence indicates that children with ASD actually have the ability to learn specific rules. They can understand specific social situations in a particular context, but these acquired abilities are not generalizable to other circumstances. Children with autism can gain an understanding of a specific task or situation, but they still experience difficulties regarding interaction with others in their daily life. The literature on systemizing indicated that it is easier for them to understand social situations where output can be precisely predicted. This indicates that it is a lot less difficult for them to understand social situations where a general principle can be applied.

So, these empirical findings provide with a basis for my conclusions on whether theory theory or simulation theory is a better explanation for mind blindness. We can see that children with ASD do not have the abilities that are necessary for simulation. This indicates that simulation theory could be an explanation for mind blindness. In addition, the difficulties that these children experience regarding “impossible” transformation indicate that radical simulation could be of importance. Children with autism would find it especially difficult to use this account of simulation theory.

Also, we found that children with ASD do have the ability to understand general principles and mechanism. This means that they could develop a theory about other minds. These findings indicate that theory theory is most likely not the right explanation for mind

blindness. Also, learning about these general principles does not fix problems that are experienced by autistic children regarding the understanding of others. This also points in the direction of simulation theory as a better explanation for mind blindness. These findings indicate that simulation theory could be a better explanation for theory of mind in general. If mind blind individuals do not have the ability to simulate, this could mean that simulation is most crucial for understanding others using a theory of mind. Thus, these results also give us more insight in the theory of mind debate.

Furthermore, from the empirical evidence on rule learning I concluded the immense importance of understanding the context for understanding others. Individuals are in need of social flexibility to be able to navigate varying social contexts. To apply a rule effectively, one needs to take into account the specific aspects of the circumstances. This means that an explanation for autism should always take into account their inability to understand contexts. These findings also point in the direction of simulation theory. However, they also indicate the importance of intuition in general. Thus, by looking at the specific characteristics of children with ASD we could conclude that simulation is likely a better explanation for mind blindness than theory theory.

We can also come to conclusions about the importance of intuition when it comes to understanding different contexts. An explanation of autism should take these factors into account. Understanding social situations is something which is incredibly complex and cannot easily be taught. To really be socially flexible one needs intuition. This is needed to adapt to varying social situations. These findings show us that social training of autistic children should focus on social flexibility and understanding of context. This could be done by making use of many different contexts while helping them become more social. Also, we should make use of more realistic circumstances. It would probably be of great help to teach them at school or at home, because these are the contexts their new knowledge should eventually be applied to.

Moreover, this thesis shows us that looking at the specific skills of autistic children can give us insight in the cause of the disorder. Hence, these findings provide us with insight into directions for further research. We should look at the different characteristics that are needed for theory of mind to understand the workings of mind blindness. We could look further into the importance of intuition as well as empathy to gain insight in the things children with autism can and cannot do.

Also, this research indicates that we should look more in the direction of simulation. Skills that are especially related to this account of theory of mind can be examined in more detail. One could look further into the ability to directly simulate the other and skills regarding

giving something a mental location. If this account is indeed an explanation for mind blindness, children with autism ought not to have other skills that are needed for it to work.

This thesis also provides insight in the workings of theory of mind in general. If children with autism do not have the skills to simulate and they are mind blind, this means that simulation could be a better explanation for mentalizing in general. So, if we look more into the specific characteristic of children with autism we might come to an understanding of this disorder. And, we might even come to understand how theory of mind actually works.

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