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Communication abilities of children with ASD and ADHD

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Appendices

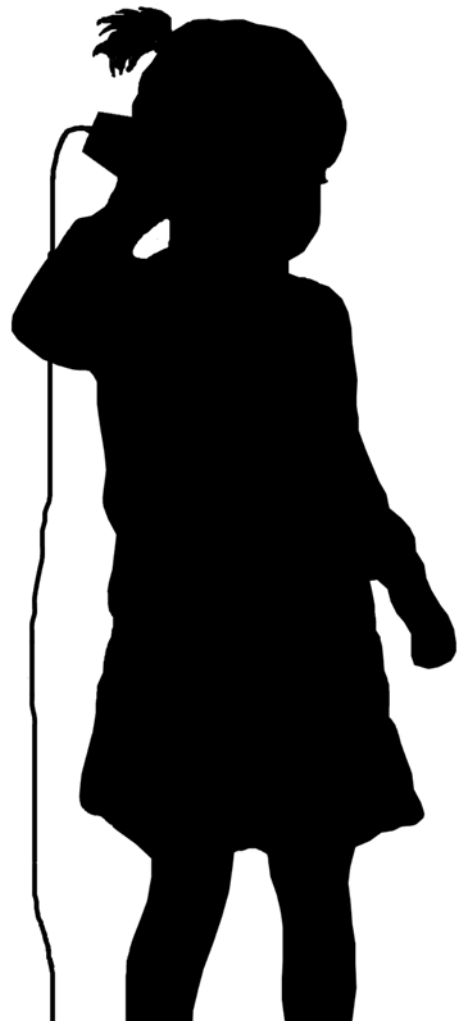
Appendix 1: Verbal False Belief task

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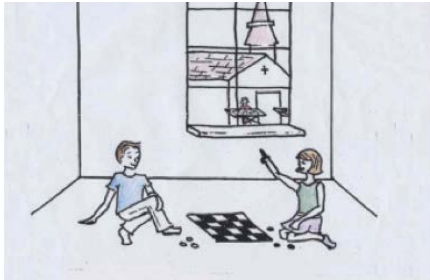


Appendix 1: Verbal False Belief task

The verbal FB task from Hollebrandse et al. (2008, 2014) is modeled after the original ice cream truck story by Perner and Wimmer (1985). However, in contrast to the ice cream truck story, the stories of Hollebrandse et al. (2008, 2014) do not contain overlapping beliefs. That is, each character has his own, distinct belief that is different from the belief of the other character, as well as from the belief of the participating child. All stories are accompanied by four pictures and were read to the child by the experimenter. Each story contains one second-order FB question and two first-order FB questions. The first first-order FB question is asked in the middle of the story and the second-order FB question at the end of the story, immediately followed by the second first-order FB question. This second first-order question is used in order to check whether children have difficulties with the length and complexity of the story. After answering a FB question, children are always asked to give an explanation for their answer. Also two probe questions are asked during the story and an ignorance question is asked at the end of the story. The task was divided into two blocks with a short break in between. The order of stories was counterbalanced across participants. In order to gain insight into the structure of the stories in this tasks, we provide an example story below.

One story was removed from further analysis, since analysis of responses to the FB questions of this story showed that they differed from the other seven items: on the second first-order FB question, mean accuracy on this item was only .48, while mean accuracy on other items varied between .79 and .92. Additionally, on this item, mean accuracy on the second-order FB question was higher (.80) than on the easier first-order FB question (.48). Inspection of this item revealed that its content differed from the other items in that an extra belief had inadvertently been introduced, which made the first-order FB answer less plausible.

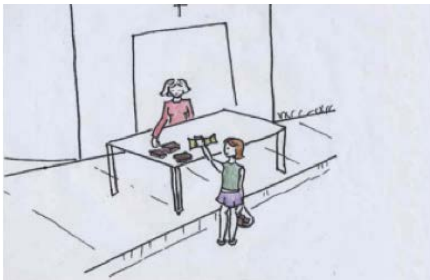
Example of verbal False Belief item



Picture 1



Picture 2



Picture 3



Picture 4

[Picture 1] Sam and Maria are playing together. They look outside and see that the church is having a bake sale. Maria tells Sam: "I am going to buy cookies for us there," and she walks away.

[Picture 2] Mom comes home and she tells Sam that she just drove past the bake sale. "Are they selling cookies?" Sam asks. "No," mom says, "they are only selling apple pie." "Maria will now probably get apple pie at the bake sale," Sam says.

Probe question 1: Does Maria know they are selling apple pie at the bake sale?

[Picture 3] Maria has arrived at the bake sale. "I would like to buy cookies," she says. "All we have left are waffles," says the lady behind the stall. Since Maria also likes waffles, she decides to get some waffles.

Probe question 2: Does Sam know that Maria bought some waffles?

First-order False Belief question: What does Sam think they are selling at the bake sale? Why does he think that?

[Picture 4] On her way back, Maria meets the mailman. She tells the mailman: “I have just bought some waffles. I am going to share them with my brother Sam. It is a surprise”. “That is nice of you,” says the mailman. Then he asks Maria: “Does Sam know what you bought him?”

Ignorance question: What does Maria tell the mailman?

Then the mailman asks: “What does Sam think they are selling at the bake sale?”

Second-order False Belief question: What does Maria tell the mailman? Why does she say that?

First-order False Belief question: What does Sam think they are selling at the bake sale? Why does he think that?

Appendix 2: Low-verbal False Belief task

The low-verbal FB task is adopted from Hollebrandse et al. (2014) and consists of eight short movies, in which objects are manipulated. In half of the movies an object is moved between three different locations (following the Unknown-Change-of-Location scenario of the Sally-Ann task²) and in the other half, the contents of a box is changed. While the child is watching the movie, the experimenter points out whether the person(s) in the movie can see the manipulations of the objects. The task is presented in two blocks with a short break in between. In the first part, children have to keep track of another person’s belief about the manipulations of the objects (first-order FB). In the second part, the child’s task is to keep track of what a second person in the movie knew about the beliefs of the first person in the movie. At the end of each second-order FB movie, a second-order FB question, a reality question and a first-order FB question are asked. After answering a FB question, children are always asked to give a justification of their answer. All participants started with four first-order movies. We did not vary the order of presentation of first-order and second-order movies, since the instructions for the second-order movies built upon the instructions for the first-order movies. The order of stories within each block varied across participants. Although the use of language is limited, the task is not completely non-verbal, since the experimenter points out whether the persons can see the manipulations of the objects, however without giving any clues about these

persons' beliefs. Furthermore, the test questions are verbal. Still, this task is much less verbal than the verbal FB task, in which the whole story is presented verbally. Below the storyboards of one of the movies are provided.

Storyboards of low-verbal False Belief items



Still 1



Still 2

First-order False Belief item [Still 1]

We are going to play a game. And you are the player. We are going to watch a movie and at the end of the movie I will ask you some questions. Look carefully at what happens with the objects and who is watching.

(Start movie)

Look, the girl is watching.

There is a cookie.

Look, the cookie goes into the box.

The girl is still watching.

(The screen closes)

Now the girl cannot see it.

(The screen opens)

There is the girl again.

There is the cookie. Now a small car goes into the box.

The girl is still watching.

(The screen closes)

Look, now the girl cannot see it anymore.

There is the car again.

Look, now an egg goes into the box.

The girl cannot see it.

(The screen opens)

There is the girl again!

Reality question: What is inside the box?

Probe question: Does the girl know?

***First-order False Belief question: What does the girl think is inside the box?
Why does she think that?***

Second-order False Belief item [Still 2]

This time the man (*point at the man*) will be the player. So he will play the game the way you did it last time. Look carefully to what he can and cannot see.

(Start movie)

Look, the girl is watching and the man is watching too.

There is an apple.

Look, the apple goes into the box.

They are both watching.

(The left screen closes)

Now the girl cannot see it.

The man is still watching.

(The right screen closes)

Now the man cannot see it.

(The left screen opens)

There is the girl again.

There is the apple. Now a small basket goes into the box.

The girl is still watching. The man is not watching.

(The left screen closes)

Look the girl cannot see it anymore.

There is the basket again.

They both cannot see it.

Look, there's a turtle.

(The right screen opens)

There is the man again!

The turtle goes into the box.

The man is watching. The girl cannot see it.

(The left screen opens)

And there is the girl again!

Before the break I asked you what the girl thinks is in the box. Now we're going to ask the man that question.

Second-order False Belief question: What will the man say that the girl thinks is in the box? Why will he say that?

Reality question: What is in the box?

First-order False Belief question: What does the girl think is in the box? Why does she think that?

Appendix 3: Response inhibition task

Response inhibition is tested with the Stop task adopted from Van den Wildenberg and Christoffels (2010), based on the stop-signal paradigm (Logan & Cowan, 1984). In this task, simple drawings of a tree and a door are presented on the computer screen with a stimulus duration of 1500 ms. During go-trials, participants are asked to press the button corresponding with the picture on a two-button box (e.g., press left to a tree, press right to a door, or vice versa) with a maximum time of 1600 ms to respond. In 30% of the trials a visual stop-signal is presented: a red square frame surrounding the picture border. Confronted with the stop-signal, participants have to inhibit the go-response by not pressing the button. The interval between the onset of the go-picture and the onset of the stop-signal (stop-signal delay) is set at 200 ms on the first stop-trial. An online tracking algorithm adjusts stop-signal delay as a function of individual stopping performance, which ensures successful inhibition on about 50% of the stop-trials, a procedure that yields reliable estimates of the Stop Signal Reaction Time (SSRT) (Band, Van der Molen & Logan, 2003). Participants start with a practice session of 60 trials, followed by three test sessions of 60 trials each. SSRT is taken as measure for response inhibition.

Appendix 4: Working memory task

Working memory is tested with an n-back task including three experimental conditions: 0-back (baseline), 1-back, and 2-back. In each condition, pictures of simple drawings are presented randomly on a computer screen with a stimulus duration of 1000 milliseconds, followed by an interstimulus interval of 1500 milliseconds. We used pictures instead of letters, because the youngest children (age 6 – 7) just started reading and therefore might encounter some difficulties with the recognition of letters. In the 0-back condition, participants are instructed to press the yes-button when they see a picture of a car, and to press the no-button when another picture appears. In the 1-back condition, participants have to press the yes-button when the

current picture matches the picture immediately preceding it, and otherwise press the no-button. In the 2-back condition, participants have to press the yes-button when the current picture matches the picture that appeared two pictures back. Participants start with a practice session of 15 trials per condition (0-, 1- and 2-back), followed by a test session consisting of four sequences of 15 trials per condition (resulting in a total of 60 trials per condition). The total number correct on the 2-back condition is calculated as measures of working memory (WM).

Appendix 5: Examples of narrative measures

Measure	Example	Translation English	
Syntactic units	<i>De man was bang, want hij zag de kikkers.</i>	<i>The man was scared, because he saw the frogs.</i>	Syntactic units = 2
MLU	<i>De schildpad zag een vliegende kikker.</i>	<i>The turtle saw a flying frog.</i>	MLU = 6
Pauses	<i>Dan gaan ze ... door de tuin.</i>	<i>Then they go ... through the garden.</i>	Silent pause
	<i>Eh iemand zit een broodje te eten.</i>	<i>Eh someone is eating a sandwich.</i>	Filled pause
Repetitions	<i>Komen ze langs een oude vrouw vrouw die ligt te slapen.</i>	<i>Come they past an eh old lady lady who is sleeping.</i>	
	<i>Wat doet die, wat doet die mevrouw?</i>	<i>What is that, what is that lady doing?</i>	
Retracings	<i>De kikker, de schildpad kijkt naar de kikker.</i>	<i>De frog, the turtle is looking at the frog.</i>	
Simple clauses	<i>De kikker vloog weg.</i>	<i>The frog was flying away.</i>	
Complex clauses	<i>Want hij zag de kikkers.</i>	<i>Because he saw the frogs.</i>	
	<i>En dan komen ze door de schoorsteen.</i>	<i>And then they go through the chimney</i>	
Morphosyntactic errors	<i>Nu zet Ø de tv aan bij een oude oma.</i>	<i>Now Ø turns on the television of an old grandmother.</i>	Word omission
	<i>Nu komt er meer padden op de honden af.</i>	<i>Now more frogs is heading the dogs.</i>	Agreement error
	<i>Ze gingden onder de grond.</i>	<i>They goned under the ground.</i>	Overregularization error
	<i>Hem eet een broodje.</i>	<i>Him is eating a sandwich.</i>	Case error
	<i>Dan gaan ze naar de huis [= het huis] toe.</i>	<i>Then they go to the house. (masculine article instead of neuter article)</i>	Gender error
	<i>Zitten ze tv te kijken.</i>	<i>Are they watching television.</i>	Word order error
	<i>De kikkers gaan langs een hegt [= heg].</i>	<i>De frogs come past a hegt [= hedge]</i>	Lexical error

Measure	Example	Translation English	
Tensed complements	<i>Hij weet niet dat er een hond is.</i>	<i>He doesn't know that there is a dog.</i>	
Emotional and cognitive terms	<i>En hij kijkt verbaasd. Ze vonden het niet leuk. Hij dacht: dit kan niet waar zijn.</i>	<i>And he looks surprised. They didn't like it. He thought: this can't be true.</i>	
Maintaining reference	<i>Een meneer zit brood te eten. En hij kijkt verbaasd. En dan zien ze een hond. En de hond gaat achter ze aan.</i>	<i>A man is eating a sandwich. And he looks surprised. And then they see a dog. And the dog is chasing them.</i>	
(Re)introduction of referents	<i>Een oma slaapt op de stoel. En ze [= de kikkers] vlogen gewoon door. Oh ja deze vind ik altijd zo leuk. En toen zat die mevrouw televisie te kijken. en en toen ze slapen. en toen gingen hun televisie kijken</i>	<i>A grandmother is sleeping in the chair. And they [= the frogs] flew on. Oh yes I always like this one. And then that lady was watching television. And and then she sleeping. And then they were watching television.</i>	Introduction Reintroduction
Causal conjunctions	<i>De de hond wordt achterna gezeten door alle andere padden. Want die willen niet dat hun vriend wordt opgegeten.</i>	<i>The the dog is being chased by all the other frogs. Because they don't want their friend to be eaten.</i>	
Causal conjunctions in relation to emotional or cognitive terms	<i>En en de schildpad wordt kwaad. Omdat ie niet geslapen door die vervelende kikkers.</i>	<i>And and the turtle is angry. Because he didn't sleep due to those stupid frogs.</i>	
Subject shift	<i>En de vogels fluiten. En de kikkers lachen.</i>	<i>And the birds are singing. And the frogs are laughing.</i>	
Interruptions of story	<i>In de schoorsteen. He heb je ook een papiertje waarmee ik die....</i>	<i>In the chimney. He, do you have a piece of paper which I....</i>	

