Psychology of Language and Communication 2022, Vol. 26, No. 1

sciendo

DOI: 10.2478/plc-2022-0011

Signe Tonér
Department of Linguistics; Department of Child and Youth Studies
Stockholm University, Sweden

Conveying a fictional false belief in narrative

Narrative ability is an important life-skill and mature narrators do not only provide information about actions and events when telling a story but also include the motivations, emotions and beliefs experienced by protagonists. It is rare for young children to spontaneously explain the beliefs of story characters but the reasons are unclear. In the current study, frog story data from 143 Swedish children aged 4–6 showed that children's level of explicitness in conveying a fictional false belief was associated with referential narrative ability and use of mental vocabulary, but not to the ability to formulate embedded propositions. Socioeconomic status predicted level of explicitness, whereas no associations were found to age, sex or being multilingual. Future work should examine narrative practices in preschool and in the home more closely, enabling improved support to provide children with equal opportunities.

Key words: executive functions, narrative, language development, Theory of Mind, false belief understanding

Address for correspondence: Signe Tonér

Department of Linguistics, Department of Child and Youth Studies, Stockholm University, Svante Arrhenius väg 21, 11418, Stockholm, Sweden.

E-mail: signe.toner@ling.su.se

Narrative skills are a vital part of communication, important for academic success as well as social relationships. Telling a complete story involves describing what happened as well as explaining why it happened. The latter is an ability which develops gradually (e.g., Aksu-Koç & Tekdemir, 2004), and is achieved by inferring the thoughts, emotions, and beliefs of protagonists and explaining their motives for acting in a certain way (Küntay & Nakamura, 2004). The ability to explain a false belief can, to some extent, be viewed as a window into children's Theory of Mind (ToM), and previous work has shown that young children are not inclined to explicate a false belief of a story character (e.g., Aksu-Koç & Tekdemir, 2004). The authors proposed that when children meet complex task demands with regard to narrative skills, their use of ToM is negatively affected. ToM may be thus be necessary, but not sufficient, to explain the variation in mental state attribution in narrative (see also Eaton et al., 1999; Veneziano et al., 2009).

In a specific scene of the wordless picture book *Frog, Where Are You?* (Mayer, 1969), the main protagonist mistakes the antlers of a deer for the branches of a tree and, subsequently, finds himself caught on the deer's head. The topic for the current study was to examine to what extent Swedish children aged 4-6 spontaneously refer to this fictional false belief. The present work builds on and expands earlier work by investigating associations between children's level of explicitness in relating the fictional misunderstanding and aspects of language, executive functions (EF), and emotional comprehension, controlling for age, sex, multilingualism, and socioeconomic status (SES).

Social Cognition

Refined aspects of shared intentionality such as the understanding of other's beliefs and emotions are a result not only of individual cognition but of profound experiences of interaction, in particular linguistic interaction, and of participation in reflective discourse (e.g., Tomasello, 2018; Tomasello & Rakoczy, 2003). Children generally pass traditional false belief tasks at approximately age 4 (e.g., Sundqvist et al., 2018; Tomasello, 2018; Wellman et al., 2001. Such tests are usually set up so that children are explicitly asked to make conclusions regarding a fictional character's (false) belief, thus bearing strong similarities to explaining a false belief in a story setting. However, to spontaneously express reasons for events in the context of telling a story is still rare at age 6, regardless whether those reasons are related to false beliefs or other internal states of the story protagonists (e.g., Aksu-Koç & Tekdemir, 2004; Berman & Slobin, 1994). Previous findings showed that children aged 5–7 were able to include information about mental states and causal explanations with the aid of prompting or scaffolding, indicating that they do not have limitations per se in the ability to make inferences about the beliefs of story characters, but rather in the ability or likelihood to express those inferences (Eaton et al., 1999; Veneziano et al., 2009). Therefore, false belief understanding needs to be considered together with language, not least since it

has been suggested that verbal designs of false belief tasks may disrupt children's perspective-tracking process (Rubio-Fernández & Geurts, 2013; Tomasello, 2018; Tomasello & Rakoczy, 2003). Since ToM and pragmatic aspects of language may, to some extent, be overlapping functions (Frank, 2018), investigations of language should take pragmatic abilities into account. Previous studies have yielded mixed results with regard to the relationship between false belief understanding and emotional understanding. It has been suggested that these constructs are related but distinct aspects of social cognition (Eggum et al., 2011) but emotional understanding has also been framed as a part of ToM (e.g., Wellman et al., 2001).

Language Skills

The ability to shift between describing actions and events in narrative and providing reasons, explanations, and motivations for those actions and events undergoes refinement into adulthood (e.g., Aksu-Koç & Tekdemir, 2004; Bamberg & Damrad-Frye, 1991), and is an advanced aspect of pragmatic ability connected to false belief understanding and ToM. To describe what happened as well as why it happened has been referred to as combining referential and evaluative narrative functions (see also Labov & Waletzky, 1967), and to verbalize inferences about protagonists' goals and internal states are regarded as aspects of story grammar or narrative macrostrucure. However, specific linguistic devices are also necessary to express internal states. Such aspects of narrative microstructure include the use of causal linking devices and mental verbs. Access to mental language is needed to generate more complex narrative structures (e.g., Gamannossi & Pinto, 2014; Milligan et al., 2007), whereas the capacity to formulate embedded propositions is claimed to be useful in expressing different perspectives and to possibly be necessary to represent them in one's own mind (de Villiers & Pyers, 2002; Fernández, 2013). The literature indicates that a combination of the ability to formulate embedded propositions and the use of cognitive verbs such as "think," "believe," and "know" in such embeddings is positively correlated with false belief development (see Whitehouse & Hird, 2004, for a summary).

Executive Functions

Executive functions are often described as consisting of three core components: inhibition, working memory, and cognitive flexibility/shifting (e.g., Diamond, 2013). Associations between EF and ToM are widely attested (e.g., Austin et al., 2014; Carlson & Moses, 2001; Kloo & Perner, 2003), and a meta-analysis including studies from 15 countries and involving nearly 10,000 children aged 3–6 indicated a genuine relationship between individual differences in EF and false belief understanding (Devine & Hughes, 2014). There are also a number of studies indicating connections between EF and narrative ability, for instance, that

reduction of memory load may facilitate children´s use of evaluative comments in narrative (Eaton et al., 1999), that the ability to maintain focus at age 4 supports subsequent narrative ability (Friend & Bates, 2014), and that difficulties with narrative may be related to working memory deficits (Fisher et al., 2019).

Background Factors

Socioeconomic Status

Socioeconomic status is connected to children's performance on false belief tasks (e.g., Chasiotis et al., 2006; Shatz et al., 2003), language skills (e.g., Noble et al., 2007), and EF (e.g., St. John et al., 2019). It needs to be accounted for when describing children's explanations regarding a fictional misunderstanding. In Sweden, income differences are small (Organisation for Economic Co-operation and Development, OECD, 2017), and preschool is universally available. Among Swedish 4–6-year-old children, 95% attend preschool more or less full time (Skolverket, 2016), and Swedish preschool has a strong compensatory ambition with regard to providing possibilities for development to children from less resourceful backgrounds (e.g., Tallberg Broman, 2017). However, children with at least one foreign-born parent are at higher risk of poverty compared to children with Swedish-born parents (Statistiska centralbyrån, SCB, 2017). Connections between SES and aspects of cognitive development have hitherto received little attention in the Swedish setting, but most existing studies have not found an effect of SES on language or EF (e.g., Berglund et al., 2005; Bohnacker et al., 2016; Bruce et al., 2006; Eriksson, 2017; but see Tonér et al., 2021, for an exception). This suggests that results regarding SES from other contexts do not necessarily generalize to the Swedish situation.

Sex Differences

Girls may show an advantage in the ability to ascribe mental states to story characters, which could be based on stronger ToM, superior language skills, and/or better EF. Girls have been shown to outperform boys on false belief tasks in several studies (Calero et al., 2013; Charman et al., 2002; Frank et al., 2015; Sundqvist et al., 2018; Walker, 2005). Regarding Swedish children, girls have superior general language skills compared to boys (e.g., Eriksson et al., 2012; Tonér et al., 2021), which may lead to an advantage in describing fictional false beliefs. Any sex differences in explaining fictional false beliefs could also be related to girls including more emotions in their narratives (Buckner & Fivush, 1998; Leaper et al., 1998). Girls outperformed boys with regard to EF in several studies (e.g., Fuhs & Day, 2011; Mulder et al., 2014). However, results are not consistent across cultures, and sex differences in EF have been disputed (Gestsdottir et al., 2014; Grissom & Reyes, 2019). Furthermore, boys' and girls' language is not equally affected by SES (Barbu et al., 2015), indicating complex interactions.

Bi-/Multilingualism

Chen and Yan (2011) found that bilingual children produced more evaluative clauses than monolingual children also when telling stories in their second language, and Burdett (2018) stated that bilingual children may have an advantage with regard to ToM. The literature suggested a similar bilingual advantage for EF (e.g., Adesope et al., 2010; Barac et al., 2016; Calvo & Bialystok, 2014), but results diverge. Duñabeitia et al. (2014) conducted a large-scale study with school-aged children and adolescents, and found no support for a bilingual advantage. A recent meta-analysis by Gunnerud et al. (2020) concluded that effects were marginal and affected by publication bias. Foreign-born children tend to start preschool later than Swedish-born peers (SCB, 2019), and a recent study revealed that multilingual children aged 4–6 had lower receptive vocabulary than monolingual Swedish-speaking peers when controlling for SES (Tonér et al., 2021).

The Current Study

The current analysis was conducted on existing data concerning Swedish children aged 4–6 , building on previous work regarding fictional false beliefs in the frog story narratives of English and Turkish children (Aksu-Koç & Tekdemir, 2004). The current analysis expands it by investigating potential links to language skills, EF, and emotional comprehension as well as controlling for an array of background factors.

Research Questions

- RQ1. To what extent do Swedish children aged 4;0–6;4 spontaneously relate a specific fictional false belief when narrating *Frog, Where Are You?*
- RQ 2. Is a more explicit strategy to explain the fictional false belief related to more advanced language/EF/emotional comprehension skills?
- RQ 3. Is there an effect of age, sex, SES, and/or multilingualism on children's likelihood to explain the fictional false belief?

We expected response patterns from Swedish children similar to those found in previous studies with English and Turkish children, as well as a significant effect of age, in accordance with Aksu-Koç and Tekdemir (2004). High language skills, EF, and emotional comprehension were hypothesized to be associated with higher levels of explicitness in mentioning the fictional false belief, based on previous results. Of particular interest were: (a) syntactic complexity, given studies indicating a connection between the ability to formulate embedded propositions and to express false belief (e.g., de Villiers & Pyers, 2002), and (b) children's use of mental vocabulary in the narratives and as rated by parents, since it has been shown that verbs of cognition in particular are related to more complex narrative structure and to false belief development (e.g., Milligan et al., 2007).

Parental ratings of emotion words were also included, since it can be argued that the ability to talk about internal states in a broader sense could be connected to ToM and thus the likelihood to explain the fictional false belief. Executive functions are connected both to narrative ability in a more general sense (e.g., Friend & Bates, 2014) and to false belief understanding (e.g., Devine & Hughes, 2014). Thus, EF should be examined/controlled for in the analyses. Emotional understanding, as measured with the Test of Emotional Comprehension (TEC), is not a pure measure of ToM, but it nevertheless taps into abilities connected to perspective-tracking and shared intentionality, justifying its inclusion in the current investigation. Potential connections to SES, sex, and bi-/multilingualism were analyzed, but no specific hypotheses were formulated, since previous results are diverging. The inclusion of background variables could also be seen as controlling for the variation occurring in the present sample.

Materials and Methods

Participants

The data set came from a randomized controlled trial including 431 preschool children in a municipality in the Stockholm region and had been collected in 2016/2017 (Gerholm et al., 2018, 2019). Ethics approval was obtained from the Regional Ethical Review Board (DNR nr: 2015/1664–31/5). Inclusionary criteria for the current analysis were that children were 4 years of age or older, had at least two years of preschool attendance (to ensure sufficient exposure of and experience with Swedish and narrative practices), and that their frog story narratives included the three main plot elements(the boy discovers that the frog is gone, and/or some reference to the boy's search for the frog, and/or the boy finds the frog; Aksu-Koç & Tekdemir, 2004). The final sample thus consisted of 143 children (81 girls, Mage 5;5 years, *SD* = 6 months). Multilingual children constituted 28% of the sample, in line with the proportion of multilingual children in Swedish preschools, estimated to be 25% (e.g., Puskás & Björk-Willén, 2017), and 22 languages were represented. Information regarding first versus second (and third) languages was not available in the data set used in the current study. Information regarding SES was provided as a composite measure of parental income and education on a scale from 1 to 10. Annual income was classified on a three-level scale: 0: 200 000 SEK, 200 000–500 000 SEK,and > 500 000 SEK. Education level was classified on a four-level scale: elementary school only, upper secondary school, vocational education, and university education. A composite score on a scale from 0 to 10 was calculated for each parent in the following way (for children living with both parents the mean SES composite score was used, see also Gerholm et al., 2018):

SES=((Income+Education) × 2)−4

Children mostly came from higher SES backgrounds: the median value was 8. Children spent an average of 38 hours per week at their preschools (range = 24–50 hours, *SD* = 6).

Materials

For an overview, including references, of the measures included in the data set used in the current study, see Table 1. For a summary of the results, see Appendix 1. It should be pointed out that no traditional assessments of false belief understanding had been conducted. All direct assessments were conducted in Swedish. For a thorough description of instruments and measures, see Gerholm et al. (2019), Tonér et al. (2021), and Tonér and Nilsson Gerholm (2021). Some measures had been extracted based on transcripts of the frog story narratives; two of which concerned morphosyntax in the form of morphosyntactic accuracy (% of correct clauses) and syntactic complexity (number of clauses including a subordinate clause). Two measures concerned the narrative content specifically: unified predicates (Berman, 1988) and event structure score (Berman, 1988). Unified predicates is a measure of story length and story content, reflecting the number of clauses expressing a single state/event/activity (see Table 2). All clauses that were deemed relevant to the story were included, meaning that the unified predicates includes referential as well as evaluative story content. The measure also allowed for more individual perspectives on the story and captured larger variation than the story event score. The children produced between 10 and 101 unified predicates, (*M* = 35; *SD* = 14, see Appendix 1). On the other hand, the event structure score strictly reflected the story events and actions which were evident from the pictures in *Frog, Where Are You?*, as described by Berman (1988, see Table 2; see also Appendix 2 for the full description). Thus, it could be seen as a more standardized measure of narrative ability regarding referential narrative functions. The range of the event structure score was 3-38 (no child reached the maximum score of 51), *M* = 18, *SD* = 7 (see Appendix 1).

Additionally, children's receptive vocabulary was assessed with the Peabody Picture Vocabulary Test (PPVT-4) and via parental ratings in the Swedish version of the McArthur Bates Communicative Inventories (SCDI-III). Parents of multilingual children were instructed to take into consideration the vocabulary in both/all of the child's languages. Of particular interest were the SCDI-III subscales regarding thought and emotion words, but these results were treated with caution, since the SCDI-III is intended for children aged 2;6 – 4;0. Results from several well-established performance-based EF tests were combined into a composite EF score (see Table 1). Additionally, a composite score of teachers' and parents' ratings of children's behavioral strengths and difficulties (SDQ) was used. The SDQ reflected EF, with statements such as "Restless, overactive, cannot stay still

Table 1. Overview of Available Data, Including Selected References

Domain	Measure	Material/test etc.	Reference
Language	Morphosyntactic accuracy	Frog, Where Are You?	Gerholm et al., 2018
	Syntactic complexity	Frog, Where Are You?	Renfrew, 1995
	Unified predicates	Frog, Where Are You?	e.g. Berman, 1988
	Event structure score	Frog, Where Are You?	Berman 1988; Appendix 2
	Receptive vocabulary	PPVT-IV	Dunn & Dunn, 2007
	Thought words	SCDI-III (unvalidated version)	Berglund & Eriksson, 2000; Eriksson, 2017
	Emotion words	SCDI-III (unvalidated version)	Berglund & Eriksson, 2000; Eriksson, 2017
Executive function	Composite score	Forward and Backward digit span; DCCS, Fish Flanker task, Heads-Toes-Knees-and-Shoulders	Gathercole, 1999; Gershon et al., 2013; Weintraub et al, 2013; Zelazo et al., 2013
	Behavioral strengths and difficulties	SDQ – Strengths and Difficulties Questionnaire	Goodman, 2001; Malmberg, Rydell & Smedje, 2004
Socioemotional comprehension	TEC score	TEC – Test of Emotional Comprehension	Pons, Harris & De Rosnay, 2004; Pons, Lawson, Harris, &, De Rosnay, 2003
Communicative behavior	Non-verbal communication score	Rated based on recordings from test sessions	Tonér & Nilsson Gerholm, 2021

for long," "Easily distracted, concentration wanders," "Good attention span," and so forth. It has been argued that direct assessment and parents' and teachers' questionnaires capture different aspects of EF. The former possibly indicates maximum performance whereas the latter may be a better indicator of real life EF (Toplak et al., 2013). The SDQ furthermore evaluates children's prosocial behavior, such as "Often volunteers to help others," or "Kind to younger children."

No traditional false belief task test had been administered. Results from the Test of Emotional Comprehension (TEC) reflected aspects of emotional skills, namely, emotion recognition, comprehension of external emotional causes, impact of desire on emotions, emotions based on beliefs, memory influence on emotions, possibility of emotional regulation, possibility of hiding an emotional state, having mixed emotions, and the contribution of morality to emotional experiences.

Seven observable aspects of children's nonverbal communication in the test situation (gaze, gestures, body posture, fluency, and prosody, the ability to follow instructions, turn-taking, and curiosity/initiative) were rated on a binary as predominantly present or absent based on video recordings (Tonér & Nilsson Gerholm, 2021). The total score was calculated as proportion of adequate communicative behavior and is a crude measure of general pragmatic ability/ non-verbal communication skills (Tonér & Nilsson Gerholm, 2021).

For the purpose of the current study, the children's output regarding the story character's false belief was assigned to one of five categories, ordered from the most to the least sophisticated in the response hierarchy suggested by Aksu-Koç and

Tekdemir (2004), reflecting increasing levels of explicitness.[1] The categories are:

1. Explicate the misrepresentation
2. Hint at the misrepresentation
3. Rendering the boy non-intentional
4. Rendering the boy intentional
5. No mention

Table 2. Examples of Unified Predicates and Event Structure Scoring

	Story excerpt (paraphrased translation from Swedish):	Unified predicates (UP) score	Event structure score	Comment
Child A	The dog is really clumsy	1	0	Coherent with the story content, is scored as UP but not as a story event/action (see also Appendix 2)
	(Should I tell you what the dog did),	0	0	Metacomment, not scored
	who was clumsy?			Repetition, not scored as UP
	(This is from the beginning)	0	0	Metacomment, not scored
	Er, he has a frog and a dog	1	1	
	But the dog is super clumsy	0	0	Repetition, not scored as UP
	And when he was sleeping	1	1	
	it ran away from the jar	1	1	
Child B	He looks everywhere, in his sweater	1		Event scoring is given according to the event "the search starts" (Appendix 2)
	The dog put his head in the bowl-	1	1	
	They look outside-	1	2	Event scoring is given according to the events a) the boy looks outside, b) the dog looks outside
	And then the dog tried to run away	1	0	This is reasonable and renders UP score but is not scored as event since it involves the dog's intention rather than the actual action. The child needs to mention that the dog falls out in order to receive event structure point
Child C	But the reindeer threw him off down a cliff	1	1	
	But it was only two meters above the water	1	0	Relevant content but not scored as event/action
	And the dog also fell down	1	0	Only one event point is given for the event "the boy and the dog fall down"
	And they fell down in the lake	1	1	Event score is given for mentioning that the boy and the dog fall in some sort of water

1 During data collection, examiners were instructed to avoid any prompting and no special attention was directed to the deer event, which introduces the character's false belief.

Criteria for assigning the response category and examples from the data are found in Table 3.

A measure of children's use of mental verbs was extracted from the story transcripts, excluding repetitions and utterances related to children's meta-comments during storytelling, such as "I think we skipped a page" or "I don't know what that animal is called." For twelwe transcripts, mental verbs could not be extracted due to technical problems.

Analytical Strategy

RQ 1 was addressed from a descriptive point of view. For RQ 2 and RQ 3, ordinal regression was employed, treating the level of explicitness as an ordinal scaled outcome variable. The full model investigated the main effects of the following variables on level of explicitness: morphosyntactic accuracy, syntactic complexity,

Table 3. Response Categories, Criteria for Assigning Category and Examples from the Current Data

Category	Criteria	Examples from the data
No mention	No mention of the deer event at all	Null answer
	OR	
	Some mention of deer or 'animal' and/or antlers	'A giant took him.'
	No mention of mismatch	'He looked at some antlers and he threw him down.'
	Mentions another specific animal or creature than some kind of deer	
Rendering the boy intentional	Mention of deer or 'animal' and/or antlers.	'The boy wants to ride on a reindeer.'
	No mention of mismatch or false belief	'One of those animals came and he jumped on it.'
	Protagonist is intentional	
Rendering the boy non-intentional	Mention of deer or 'animal'	'He accidentally climbed onto a deer.'
	No mention of mismatch or false belief	'He happened to fall on a moose.'
	Protagonist is non-intentional and/or deer is subject/agent	'The deer carried him away.'
Hinting at the misrepresentation	Mention of deer or 'animal'	'It wasn't a tree, it was branches from a moose. Then he fell down.'
	Mention of mismatch and/or false belief	
	Lacking link to preceding and following events	'He held on to a branch, but it wasn't. Then the animal stood up and threw him down.'
Explicating the misrepresentation	Mention of deer	'He thinks he is holding on to branches but they are antlers and then the reindeer comes, he gets stuck on its head and the reindeer throws him in the water.'
	Mention of mismatch and false belief	
	Link to preceding and following events	

unified predicates, story event score, mental verbs, receptive vocabulary, SCDI-III thought words, SCDI-III emotion words, nonverbal communication, EF composite score, SDQ score, TEC score, child age, sex, family SES, and bi-/multilingualism. Interaction terms of bi-/multilingualism × SES and sex × SES were included. Model selection considered the tradeoffs between accuracy and parsimony by applying the Akaike information criterion (AIC; Akaike, 1998). The AIC estimates the quality of each fitted model relative to the other models using the full regression model as baseline. The AIC values are not very informative in themselves. Therefore, AIC differences and AIC weights were also reported. The level of empirical support for the models is considered substantial when the AIC differences ranges between 0 and 2 whereas differences larger than 10 may be omitted from further consideration (e.g., Burnham & Anderson, 2002). The AIC weights can be interpreted as conditional probabilities for each model. In other words, the proportion of the total amount of predictive power (Burnham & Anderson, 2002). All statistical analyses were conducted with *R* software (R Core Team, 2017).

Results

For a summary of results and demographic information for children in each response category, see Table 4. For details regarding the test results, see Appendix 1. Mono- and bi-/multilingual children were collapsed in the descriptive data since there were no significant differences in language measures extracted from the narratives or in parental ratings of thought and emotion words. However, multilingual children did score lower on receptive vocabulary, $M_{\text{multilingual}} = -0.1$, $M_{\text{monolingual}} = 0.5$, 95% CI = −0.98–−0.31.

RQ 1

Nearly half the sample (44%) did not mention the deer event, and children in this category covered the entire age range of the full sample. Rendering the boy nonintentional was the second most common strategy, used by 32% of the children, whereas 13% rendered the boy intentional. Hinting at the misrepresentation was done by 8% of participants. Only five children fully explicated the deer event, corresponding to less than 3% of the sample.

RQ 2 Descriptive Statistics

Nonparametric correlations were calculated for the level of explicitness and submeasures of language and EF, including parental ratings of children's use of thought and emotion words, researcher-rated nonverbal communication, and SDQ. The TEC was also included. Language measures extracted from the frog story narratives and PPVT score correlated statistically significantly and moderately with level of explicitness in relating the false belief (Spearman's

Table 4. Demographic Information per Response Category

Response category	% total	% multilingual (28 % of full sample)	% girls (57 % of full sample	Mean age, months (*SD*)	Age range
Boy explicates misrepresentation (*n* = 4)	2.8	0	50	65 (2)	62-67
Boy hints at misrepresentation (*n* = 12)	8.4	25.0	58.3	67 (5)	59-74
Boy nonintentional (*n* = 45)	31.5	33.3	57.8	66 (6)	51-76
Boy intentional (*n* = 19)	13.3	15.8	42.1	66 (6)	53-76
No mention (*n* = 63)	44.1	30.2	60.3	64 (7)	48-76

Note. Number and percentage of children for each response category, percentage of children from multilingual backgrounds in each category, proportion of girls, mean age, standard deviation and age range for each response category.

ρ ranging from .18 to .39), but parental ratings regarding the children's use of thought and emotions words did not statistically significantly correlate with the level of explicitness. The association between the level of explicitness and nonverbal communicative behavior did not reach statistical significance (ρ = .16, p = .06). The EF composite correlated statistically significantly with the level of explicitness; the EF submeasures Dimensional Change Card Sort task (DCCS), Flanker and Head, Shoulders Knees and Toes task (HSKT) were statistically significantly associated to level of explicitness, whereas digit span tasks were not. The SDQ did not statistically significantly correlate with level of explicitness. The TEC correlated weakly but statistically significantly with level of explicitness (ρ = .18, p = .03; see Table 5 for all significant correlations).

RQ2 and RQ3 Regression Analysis

Two models had substantial support in the data according to rules of thumb (Burnham & Anderson, 2002). In the top-ranked model, event structure score (CI = 0.16–1.42), the use of mental verbs in the narrative (CI = 0.001–1.22), SCDI-III thought words (CI = −0.33–−0.03), and SES (CI = 0.07–0.50) statistically significantly predicted the children's level of explicitness in relating the fictional false belief. In the second-best model, mental verb use did not reach statistical significance. See Table 6 for model comparison. Syntactic complexity, EF, SDQ, and TEC score were not statistically significant in any of the models taken into consideration. No background variable except SES were statistically significant in any model.

Discussion

The first aim of the current study was to investigate to what extent Swedish children aged 4;0-6;4 spontaneously related a fictional false belief when narrating *Frog Where Are You?* In line with previous work, the most common strategy was to not mention the misunderstanding, and all children who fully explicated the false belief

Table 5. Significant Spearman Correlations Between the Level of Explicitness and Language, Executive Function, Socioemotional, and Nonverbal Communication Measures

Language		
Measures extracted from the narratives:	Morphosyntactic accuracy	.27***
	Syntactic complexity	.32***
	Unified predicates	.26**
	Event structure	.39***
	Mental verbs	.18*
Receptive vocabulary:	PPVT	.26**
Parent ratings:	SCDI thought words	-
	SCDI emotion words	-
Researcher ratings:	Non-verbal communication	-
Executive functions	EF composite	.28**
	Forward digit span	-
	Backward digit span	-
	DCCS	.25**
	Flanker Fish Task	.23*
	HTKS	.17*
Parental and teacher ratings:	SDQ	-
Socioemotional comprehension	TEC	.18*

*$p < .05$; **$p < .01$; ***$p < .001$

Table 6. Comparison of Ordinal Regression Models

Rank	K	Significant predictors	AICc	Δi (AICc)	wi (AICc)
1.	20	Event structure score, SCDI thought words, SES	285.43	0.00	0.51
2.	21	Event structure score, SCDI thought words, SES	287.27	1.85	0.20
3.	14	Event structure score, mental verbs, SCDI thought words	288.57	3.14	0.11
4.	22	Event structure score, SCDI thought words	289.24	3.81	0.08

Note. K is the number of parameters in each model; the default K is 2, so a model with 10 parameters will have a K of 2 + 10 = 12; AICc is the information score for each model, lowercase c indicates that the value has been calculated correcting for small sample sizes; Δi (AICc = [AICci – min(AICc)]; wi (AICc) = the rounded Akaike weights, which can be interpreted as conditional probabilities for each model.

were older than 5 years. Second, it was examined whether a more explicit strategy to explain a fictional false belief could be related to more advanced language/EF/emotional skills. Results from ordinal regression indicated that children's referential narrative ability (retelling events and actions) and their use of mental vocabulary was related to level of explicitness in conveying the fictional false belief. Contrary to expectations, neither syntactic complexity, EF, nor emotional understanding predicted level of explicitness. Third, associations between level of explicitness and age, sex, SES and multilingualism were investigated, revealing a connection to SES but not to any other background variable.

RQ 1

To use a more explicit strategy in explaining the fictional false belief was rare in the current data set. In the original study, explicating or hinting at the boy's misrepresentation was not only very rare among young children but also relatively unusual among adult participants (Aksu-Koç & Tekdemir, 2004), indicating that neither ToM ability, general language skills, nor age sufficiently explain the variation in relating the fictional misunderstanding. Perhaps the deer event is not perceived as important for the outcome of the story. Another possibility is that the information is omitted due to working memory constraints, as suggested by Eaton et al. (1999). Differently from the method adopted by Eaton et al. (1999), the elicitation material was constantly available to the children and it thus seems unlikely that memory limitations caused children to exclude information about the misrepresentation. However, contextual factors such as details in how data were collected may be relevant. In the present study, as well as in previous work (Aksu-Koç & Tekdemir, 2004; Eaton et al., 1999), participants first watched the elicitation material to familiarize themselves with the story, then saw the material again while generating the narrative. Some studies have instead let the child tell their story to a third person (e.g., Peristeri et al., 2017), which could potentially increase children's explicitness in general and underscores the potential influence of contextual factors on children's language use in discourse.

RQ 2

The hypothesis that stronger language skills would be related to higher levels of explicitness was partially supported. Children's referential narrative ability was a significant predictor of explicitness in relating the fictional false belief. Additionally, children's use of mental vocabulary significantly predicted the level of explicitness, providing support for the idea that cognition verbs are related to more complex narrative structure (e.g., Milligan et al., 2007). It has been suggested that the use of cognitive verbs in combination with the ability to formulate embedded propositions is correlated with the development of false belief understanding (Whitehouse & Hird, 2004). However, contrary to expectations, children's syntactic complexity was not associated with level of explicitness in the current data, to some extent contradicting previous results (de Villiers & Pyers, 2002; Fernández, 2011). An interpretation of the current results is that mental vocabulary is necessary to express a false belief in the current context, in which no specific questions or prompting were provided, whereas formulating embedded clauses is not a requirement to express what the boy in the story believed versus the (fictional) reality. For instance, the child could use direct speech in a way that would render a high explicitness score without using any complex syntax: "I can hold on to those sticks! Oh, help, what's going on!! They are the antlers of a deer!" The lack of connection between syntactic complexity

and level of explicitness could furthermore be related to a lack of sufficient variation in syntactic complexity in the current sample (see also Appendix 1).

Neither EF nor SDQ score predicted level of explicitness in any fitted model, suggesting that the role of executive abilities are not vital to explain a fictional false belief, although EF are connected to narrative ability in a broader sense. The TEC is thought to reflect aspects of children's social cognition in the form of emotional understanding, which to some extent may overlap with ToM (e.g., Eggum et al., 2011; Wellman et al., 2001), but TEC was not related to the level of explicitness.

RQ 3

SES, but not age, sex, or bi-/multilingualism predicted level of explicitness. SES-related differences may be detected even in a sample such as the current one, skewed towards higher SES, when investigating complex and subtle aspects of discourse-level language such as the use of evaluative narrative functions.

Aksu-Koç and Tekdemir (2004) found a significant age effect on response category when investigating children aged 3, 4, 5, and 9 years. The lack of a significant association with age in the current data could be due to methodological differences: Aksu-Koç and Tekdemir's (2004) sample was divided into discrete age groups and the analysis did not include any covariates, whereas the current study treated age as a continuous variable and included/controlled for several variables. Additionally, the exclusion of children who did not include the three main plot elements may also have reduced any effect of age. There was no difference between girls and boys in the level of explicitness, which could be connected to statistically controlling for language and EF, thereby possibly reducing biases. The inclusionary criteria and the analytic strategy may also have served to avoid biases with regard to multilingual children.

Limitations and Future Directions

Since the current study analyzed existing data, the elicitation material was not selected with a specific research question regarding the fictional false belief in mind and no traditional false belief task had been administered. *Frog, Where Are You?* (Mayer, 1969) has been described as a very complex task for young children (Trabasso & Nickels, 1992), since the structure of the story may lead to a heavier cognitive load compared to more typical stories for young children. The structure of the story is recursive, with a series of attempts (searching) to reach the same goal (find the frog) instead of several goal-attempt-outcome episodes (see also Trabasso & Nickels, 1992). Future studies could use elicitation materials at different complexity levels, but could include similar misrepresentations to examine the potential effect of story structure complexity on children's level of explicitness. It seems crucial to elicit internal states of story characters that have

a clear importance for the story outcome, as opposed to the current fictional false belief, which does not appear to be salient enough even for adults to conceive of it as obligatory to include (Aksu-Koç & Tekdemir, 2004). It has been suggested that depictive aspects of story-telling have not received sufficient attention in the study of narratives (e.g., Clark, 2011). Since children may refer to a fictional misunderstanding by other means than verbal, a multimodal approach could be adopted in which aspects such as gestures, facial expression, and character speech could be examined in relation to the fictional false belief, not least since it has been demonstrated that children's story retell can be improved when they have access to speech and gesture when they hear a story (Demir et al., 2014) and when children are encouraged to produce similar beat gestures as the original narrator (Vilà-Giménez & Prieto, 2020). The role of visual information provided in the pictures could also be more closely examined (e.g., Cohn, 2013).

Since 2018, the Swedish preschool curriculum states that preschool shall give children opportunities to listen to book-reading and discuss literature and other texts (Skolverket, 2018), and future research should include more extensive preschool classroom observations and qualitative analyses of teacher-child interaction, in particular, reflective discourse and shared or dialogic book-reading, in relation to children's narrative skills. In addition to shedding further light on children's narrative development, such work could also form the basis for evidence-based pedagogical practices. Efforts should be made to recruit children from diverse backgrounds with regard to SES.

Conclusion

In line with earlier work, the 4–6-year-old children in the current study were not inclined to spontaneously explain a fictional false belief. The level of explicitness was linked to children's ability to talk about story actions and events and their use of mental vocabulary, whereas syntactic complexity, overall ability to provide relevant information in the story, aspects of EF, and emotional comprehension were not statistically significant. Family SES predicted higher levels of explicitness, indicating that socioeconomic background may be relevant to understand variation in subtle aspects of discourse-level language use. Multimodal analysis would increase the ecological validity and further methodological advancements should also include constructing narrative tasks of varying complexity, ensuring that internal states of protagonists are vital for the story outcome. The importance of supporting narrative ability could be further highlighted in preschool language and literacy practices.

Acknowledgments

The current data came from a study lead by principal investigators professor Hillevi Lenz-Taguchi, and Dr. Tove Nilsson Gerholm. I am very grateful for the possibility to use the data set for further analysis. I wish to especially thank Dr. Tove Nilsson Gerholm and professor Bernhard Wälchli for invaluable feedback during manuscript preparation and to professor Gebrenegus Ghilagaber Yebio for advice regarding statistical analysis.

Conflict of Interest Disclosure

The authors do not have any conflicts of interest to report.

Funding

The study was funded by The Swedish Research Council, DNR nr: 721-2014-1786.

Research Ethics Statement

All participating adults and parents of participating children have signed an informed consent form allowing to publish results on the group level. In addition, great care was taken to ensure children's verbal and non-verbal assent in the data collection procedure, so in cases where parents had provided written consent, children's own wish to decline participation was respected at all times. No analyses of individual children have been performed and individual scores cannot be released, not even to parents. All data is coded and depersonalized. All data is kept in accordance with the regulations of data handling from the Swedish Research Council.

Ethics approval was obtained from the Regional Ethical Review Board (DNR nr: 2015/1664–31/5) according to national principles aligning with the Declaration of Helsinki regarding research on/with human subjects, including identifiable human data.

References

Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Review of Educational Research, 80*(2), 207–245. https://doi.org/10.3102/0034654310368803

Akaike, H. (1998). Information theory and an extension of the maximum likelihood principle. In E. Parzen, K. Tanabe, & G. Kitagawa (Eds.), *Selected papers of Hirotugu Akaike* (pp. 199–213). Springer.

Aksu-Koç, A., & Tekdemir, G. (2004). Interplay between narrativity and mindreading. A comparison between Turkish and English. In S. Strömqvist &. Verhoeven, L. (Ed.), *Relating events in narrative: Typological and contextual perspectives*. Lawrence Erlbaum Associates.

Austin, G., Groppe, K., & Elsner, B. (2014). The reciprocal relationship between executive function and theory of mind in middle childhood: A 1-year longitudinal perspective. *Frontiers in Psychology, 5*, 655–655. https://doi.org/10.3389/fpsyg.2014.00655

Bamberg, M., & Damrad-Frye, R. (1991). On the ability to provide evaluative comments: Further explorations of children's narrative competencies. *Journal of Child Language, 18*(3), 689–710. https://doi.org/10.1017/S0305000900011314

Barac, R., Moreno, S., & Bialystok, E. (2016). Behavioral and electrophysiological differences in executive control between monolingual and bilingual children. *Child Development, 87*(4), 1277–1290. https://doi.org/10.1111/cdev.12538

Barbu, S., Nardy, A., Chevrot, J.-P., Guellaï, B., Glas, L., Juhel, J., & Lemasson, A. (2015). Sex differences in language across early childhood: family socioeconomic status does not impact boys and girls equally. *Frontiers in Psychology, 6*, 1874. https://doi.org/10.3389/fpsyg.2015.01874

Berglund, E. E., Eriksson, M. &. Westerlund, M. (2005). Communicative skills in relation to gender, birth order, childcare and socioeconomic status in 18-month-old children. *Scandinavian Journal of Psychology, 46*(6), 485–491. https://doi.org/10.1111/j.1467-9450.2005.00480.x

Berman, R. A. (1988). On the ability to relate events in narrative. *Discourse Processes, 11*(4), 469–497. https://doi.org/10.1080/01638538809544714

Berman, R. A., & Slobin, D. I. (1994). *Relating events in narrative: A crosslinguistic developmental study.* Lawrence Erlbaum Associates.

Bohnacker, U., Lindgren, J., & Öztekin, B. (2016). Turkish- and German-speaking bilingual 4-to-6-year-olds living in Sweden: Effects of age, SES and home language input on vocabulary production. *Journal of Home Language Research, 1*, 17–41.

Bruce, B., Thernlund, G., & Nettelbladt, U. (2006). ADHD and language impairment. *European Child & Adolescent Psychiatry, 15*(1), 52–60. https://doi.org/10.1007/s00787-006-0508-9

Buckner, J. P., & Fivush, R. (1998). Gender and self in children's autobiographical narratives. *Applied Cognitive Psychology, 12*(4), 407–429. https://doi.org/10.1002/(SICI)1099-0720(199808)12:4<407::AID-ACP575>3.0.CO;2-7

Burdett, E. R. (2018). Theory of mind, development and cross-cultural variation. In H. Callan (Ed.), *The international encyclopedia of anthropology* (pp. 1–9). Wiley. https://doi.org/10.1002/9781118924396.wbiea1643

Burnham, K. P., & Anderson, D. R. (2002). *Model selection and multimodel inference. A practical information-theoretic approach.* Springer.

Calero, C. I., Salles, A., Semelman, M., & Sigman, M. (2013). Age and gender dependent development of Theory of Mind in 6- to 8-years old children. *Frontiers in Human Neuroscience, 7*, 281–281. https://doi.org/10.3389/fnhum.2013.00281

Calvo, A., & Bialystok, E. (2014). Independent effects of bilingualism and socioeconomic status on language ability and executive functioning. *Cognition, 130*(3), 278–288. https://doi.org/10.1016/j.cognition.2013.11.015

Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development, 4*, 1032–1053. https://doi.org/10.1111/1467-8624.00333

Charman, T., Ruffman, T., & Clements, W. (2002). Is there a gender difference in false belief development? *Social Development, 11*(1), 1–10. https://doi.org/10.1111/1467-9507.00183

Chasiotis, A., Kiessling, F., Hofer, J., & Campos, D. (2006). Theory of mind and inhibitory control in three cultures: Conflict inhibition predicts false belief understanding in Germany, Costa Rica and Cameroon. *International Journal of Behavioral Development, 30*(3), 249–260. https://doi.org/10.1177/0165025406066759

Chen, L., & Yan, R. (2011). Development and use of English evaluative expressions in narratives of Chinese–English bilinguals. *Bilingualism: Language and Cognition, 14*(4), 570–578. https://doi.org/10.1017/S1366728910000362

de Villiers, J. G., & Pyers, J. E. (2002). Complements to cognition: A longitudinal study of the relationship between complex syntax and false-belief-understanding. *Cognitive Development, 17*(1), 1037–1060. https://doi.org/10.1016/S0885-2014(02)00073-4

Demir, Ö. E. C. E., Levine, S. C., & Goldin-Meadow, S. (2014). A tale of two hands: Children's early gesture use in narrative production predicts later narrative structure in speech. *Journal of Child Language, 42*(3), 662–681. https://doi.org/10.1017/S0305000914000415

Devine, R. T., & Hughes, C. (2014). Relations between false belief understanding and executive function in early childhood: A meta-analysis. *Child Development, 85*(5), 1777–1794. https://doi.org/10.1111/cdev.12237

Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Duñabeitia, J. A., Hernández, J. A., Antón, E., Macizo, P., Estévez, A., Fuentes, L. J., & Carreiras, M. (2014). The inhibitory advantage in bilingual children

revisited: Myth or reality? *Experimental Psychology, 61*(3), 234–251. https://doi.org/10.1027/1618-3169/a000243

Eaton, J. H., Collis, G. M., & Lewis, V. A. (1999). Evaluative explanations in children's narratives of a video sequence without dialogue. *Journal of Child Language, 26*(3), 699–720. https://doi.org/10.1017/S0305000999003967

Eggum, N. D., Eisenberg, N., Kao, K., Spinrad, T. L., Bolnick, R., Hofer, C., Kupfer, A. S., & Fabricius, W. V. (2011). Emotion understanding, theory of mind, and prosocial orientation: Relations over time in early childhood. *The Journal of Positive Psychology, 6*(1), 4–16. https://doi.org/10.1080/17439760.2010.536776

Eriksson, M. (2017). The Swedish Communicative Development Inventory III: Parent reports on language in preschool children. *International Journal of Behavioral Development, 41*(5), 647–654. https://doi.org/10.1177/0165025416644078

Eriksson, M., Marschik, P. B., Tulviste, T., Almgren, M., Pérez Pereira, M., Wehberg, S., Marjanovič-Umek, L., Gayraud, F., Kovacevic, M., & Gallego, C. (2012). Differences between girls and boys in emerging language skills: Evidence from 10 language communities. *British Journal of Developmental Psychology, 30*(2), 326–343. https://doi.org/10.1111/j.2044-835X.2011.02042.x

Fernández, C. (2013). Mindful storytellers: Emerging pragmatics and theory of mind development. *First Language, 33*(1), 20–46. https://doi.org/10.1177/0142723711422633

Fisher, E., L., Barton-Hulsey, A., Walters, C., Sevcik, Rose, A., & Morris, R. (2019). Executive functioning and narrative language in children with dyslexia. *American Journal of Speech-Language Pathology, 28*(3), 1127–1138. https://doi.org/10.1044/2019_AJSLP-18-0106

Frank, C. K. (2018). Reviving pragmatic theory of theory of mind. *AIMS Neuroscience, 5*(2), 116–131. https://doi.org/10.3934/Neuroscience.2018.2.116

Frank, C. K., Baron-Cohen, S., & Ganzel, B. L. (2015). Sex differences in the neural basis of false-belief and pragmatic language comprehension. *NeuroImage, 105*, 300–311. https://doi.org/10.1016/j.neuroimage.2014.09.041

Friend, M., & Bates, R. P. (2014). The union of narrative and executive function: Different but complementary. *Frontiers in Psychology, 5*, 469. https://doi.org/10.3389/fpsyg.2014.00469

Fuhs, M. W., & Day, J. D. (2011). Verbal ability and executive functioning development in preschoolers at head start. *Developmental Psychology, 47*(2), 404–416. https://doi.org/10.1037/a0021065

Gamannossi, B. A., & Pinto, G. (2014). Theory of mind and language of mind in narratives: Developmental trends from kindergarten to primary school. *First Language, 34*(3), 262–272. https://doi.org/10.1177/0142723714535875

Gathercole, S. E., Service, E., Hitch, G. J., Adams, A.-M., & Martin, A. J. (1999). Phonological short-term memory and vocabulary development: Further

evidence on the nature of the relationship. *Applied Cognitive Psychology, 13*(1), 65–77. https://doi.org/10.1002/(SICI)1099-0720(199902)13:1<65::AID-ACP548>3.0.CO;2-O

Gershon, R. C., Wagster, M. V., Hendrie, H. C., Fox, N. A., Cook, K. F., & Nowinski, C. J. (2013). NIH Toolbox for Assessment of Neurological and Behavioral Function. *Neurology, 80*(11 Supplement 3), S2–S6. https://doi.org/10.1212/WNL.0b013e3182872e5f

Gerholm, T., Hörberg, T., Tonér, S., Kallioinen, P., Frankenberg, S., Kjällander, S., Palmer, A., & Taguchi, H. L. (2018). A protocol for a three-arm cluster randomized controlled superiority trial investigating the effects of two pedagogical methodologies in Swedish preschool settings on language and communication, executive functions, auditive selective attention, socioemotional skills and early maths skills. *BMC Psychology, 6*(1), 29. https://doi.org/10.1186/s40359-018-0239-y

Gerholm, T., Kallioinen, P., Tonér, S., Frankenberg, S., Kjällander, S., Palmer, A., & Lenz-Taguchi, H. (2019). A randomized controlled trial to examine the effect of two teaching methods on preschool children's language and communication, executive functions, socioemotional comprehension, and early math skills. *BMC Psychology, 7*(1), 59. https://doi.org/10.1186/s40359-019-0325-9

Gestsdottir, S., Birgisdottir, F., von Suchodoletz, A., Gunzenhauser, C., Wanless, S. B., Hubert, B., Guimard, P., & McClelland, M. (2014). Early behavioral self-regulation, academic achievement, and gender: longitudinal findings from france, germany, and iceland. *Applied Developmental Science, 18*(2), 90–109. https://doi.org/10.1080/10888691.2014.894870

Goodman, R. (2001). Psychometric properties of the Strengths and Difficulties Questionnaire. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*(11), 1337–1345. https://doi.org/10.1097/00004583-200111000-00015

Grissom, N. M., & Reyes, T. M. (2019). Let's call the whole thing off: Evaluating gender and sex differences in executive function. *Neuropsychopharmacology, 44*(1), 86–96. https://doi.org/10.1038/s41386-018-0179-5

Gunnerud, H. L., ten Braak, D., Reikerås, E. K. L., Donolato, E., & Melby-Lervåg, M. (2020). Is bilingualism related to a cognitive advantage in children? A systematic review and meta-analysis. *Psychological Bulletin, 146*(12), 1059–1083. https://doi.org/10.1037/bul0000301

Kloo, D., & Perner, J. (2003). Training transfer between card sorting and false belief understanding: Helping children apply conflicting descriptions. *Child Development, 74*(6), 1823–1839.

Küntay, A. C., & Nakamura, K. (2004). Relating events in narrative: Typological and contextual perspectives. In S. Strömqvist &. L. Verhoeven. (Ed.), *Linguistic strategies serving evaluative functions* (2nd ed., pp. 329–358). Lawrence Erlbaum Associates.

Labov, W., & Waletzky, J. (1967). Narrative analysis: Oral versions of personal

experience. In I. Helm (Ed), *Essays on the verbal and visual arts. Proceedings of the 1966 Annual Spring Meeting of the American Ethnological Society* (pp. 12–44). University of Washington Press.

Leaper, C., Anderson, K. J., & Sanders, P. (1998). Moderators of gender effects on parents' talk to their children: A meta-analysis. *Developmental Psychology, 34*(1), 3–27. https://doi.org/10.1037/0012-1649.34.1.3

Malmberg, M., Rydell, A.-M., & Smedje, H. (2003). Validity of the Swedish version of the Strengths and Difficulties Questionnaire (SDQ-Swe). *Nordic Journal of Psychiatry, 57*(5), 357–363. https://doi.org/10.1080/08039480310002697

Mayer, M. (1969). *Frog, where are You?* Dial Press.

Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding. *Child Development, 78*(2), 622–646. https://doi.org/10.1111/j.1467-8624.2007.01018.x

Mulder, H., Hoofs, H., Verhagen, J., van der Veen, I., & Leseman, P. P. M. (2014). Psychometric properties and convergent and predictive validity of an executive function test battery for two-year-olds. *Frontiers in Psychology, 5*, 733. https://doi.org/10.3389/fpsyg.2014.00733

Noble, K. G., McCandliss, B. D., & Farah, M. J. (2007). Socioeconomic gradients predict individual differences in neurocognitive abilities. *Developmental Science, 10*(4), 464–480. https://doi.org/10.1111/j.1467-7687.2007.00600.x

OECD. (2017). *OECD Economic Surveys: Sweden 2017*. https://doi.org/10.1787/eco_surveys-swe-2017-en

Peristeri, E., Andreou, M., & Tsimpli, I. M. (2017). Syntactic and story structure complexity in the narratives of high- and low-language ability children with autism spectrum disorder. *Frontiers in Psychology, 8*(2027). https://doi.org/10.3389/fpsyg.2017.02027

Pons, F., Harris, P. L., & de Rosnay, M. (2004). Emotion comprehension between 3 and 11 years: Developmental periods and hierarchical organization. *European Journal of Developmental Psychology, 1*(2), 127–152. https://doi.org/10.1080/17405620344000022

Pons, F., Lawson, J., Harris, P. L., & de Rosnay, M. (2003). Individual differences in children's emotion understanding: Effects of age and language. *Scandinavian Journal of Psychology, 44*(4), 347–353. https://doi.org/10.1111/1467-9450.00354

Puskás, T., & Björk-Willén, P. (2017). *Flerspråkighet och andraspråksutveckling* [Multilingualism and second language learning]. The Swedish National Agency for Education. https://larportalen.skolverket.se/LarportalenAPI/api-v2/document/path/larportalen/material/inriktningar/5-las-skriv/F%C3%B6rskola/035-flera-sprak-i-barngruppen/del_01/Material/Flik/Del_01_MomentA/Artiklar/M35_fsk_01A_01_flersprakighet.docx

R Core Team. (2017). *R: A language and environment for statistical computing (3.4.4)*. [Computer software]. R Foundation for Statistical Computing.

https://www.R-project.org/

Renfrew, C. E. (1995). *The Bus Story Test: A test of narrative speech (3rd ed.)*. Speechmark Publishing.

Rubio-Fernández, P., & Geurts, B. (2013). How to pass the false-belief task before your fourth birthday. *Psychological Science, 24*(1), 27–33. https://doi.org/10.1177/0956797612447819

SCB. (2017). *Vanligare med låg ekonomisk standard bland utrikes födda* [Low economic standard more common among those born abroad]. https://www.scb.se/hitta-statistik/artiklar/2017/Vanligare-med-lag-ekonomisk-standard-bland-utrikes-fodda/

Shatz, M., Diesendruck, G., Martinez-Beck, I., & Akar, D. (2003). The influence of language and socioeconomic status on children's understanding of false belief. *Developmental Psychology, 39*(4), 717–729. https://doi.org/10.1037/0012-1649.39.4.717

Siller, M., Swanson, M. R., Serlin, G., & George, A. (2014). Internal state language in the storybook narratives of children with and without autism spectrum disorder: investigating relations to theory of mind abilities. *Research in Autism Spectrum Disorders, 8*(5), 589–596. https://doi.org/10.1016/j.rasd.2014.02.002

Skolverket. (2016). *Barn och grupper i förskolan* [Children and groups in preschool]. The Swedish National Agency for Education. https://www.skolverket.se/statistik-och-utvardering/statistik-i-tabeller/forskola/barn-och-grupper

Skolverket. (2018). *Curriculum for the preschool Lpfö 18*. https://www.skolverket.se/publikationsserier/styrdokument/2019/curriculum-for-the-preschool-lpfo-18

St. John, A. M., Kibbe, M., & Tarullo, A. R. (2019). A systematic assessment of socioeconomic status and executive functioning in early childhood. *Journal of Experimental Child Psychology, 178*, 352–368. https://doi.org/10.1016/j.jecp.2018.09.003

Sundqvist, A., Holmer, E., Koch, F.-S., & Heimann, M. (2018). Developing theory of mind abilities in Swedish pre-schoolers. *Infant and Child Development, 27*(4), e2090. https://doi.org/10.1002/icd.2090

Tallberg Broman, I. (2017). Utbildningsvetenskap för förskolan (Andra utgåvan) [Educational science for preschool. (Second edition)]. In B. Riddersporre & P. Riddersporre S. (Ed.), *Svensk förskola i kontinuitet och förändring* [Swedish preschool: Continuity and change]. Natur & Kultur.

Tomasello, M. (2018). How children come to understand false beliefs: A shared intentionality account. *Proceedings of the National Academy of Sciences, 115*(34), 8491. https://doi.org/10.1073/pnas.1804761115

Tomasello, M., & Rakoczy, H. (2003). What makes human cognition unique? From individual to shared to collective intentionality. *Mind & Language, 18*(2), 121–147. https://doi.org/10.1111/1468-0017.00217

Tonér, S., Kallioinen, P., & Lacerda, F. (2021). Selective Auditory Attention

Associated With Language Skills but Not With Executive Functions in Swedish Preschoolers. Frontiers in Psychology, 12(1686). https://doi.org/10.3389/fpsyg.2021.664501

Tonér, S., & Nilsson Gerholm, T. (2021). Links between language and executive functions in Swedish preschool children: A pilot study. *Applied Psycholinguistics, 42*(1), 207–241. https://doi.org/10.1017/S0142716420000703

Trabasso, T., & Nickels, M. (1992). The development of goal plans of action in the narration of a picture story. *Discourse Processes, 15*(3), 249–275. https://doi.org/10.1080/01638539209544812

Veneziano, E., Albert, L., & Martin, S. (2009). Crosslinguistic approaches to the psychology of language: Research in the tradition of Dan Isaac Slobin. In J. Guo (Ed.), *Learning to tell a story of false belief. A study of French-speaking children* (pp. 277–289). Routledge.

Walker, S. (2005). Gender differences in the relationship between young children's peer-related social competence and individual differences in theory of mind. *Journal of Genetic Psychology, 166*(3), 297. https://doi.org/10.3200/GNTP.166.3.297-312

Weintraub, S., Dikmen, S. S., Heaton, R. K., Tulsky, D. S., Zelazo, P. D., Bauer, P. J., Carlozzi, N. E., Slotkin, J., Blitz, D., Wallner-Allen, K., Fox, N. A., Beaumont, J. L., Mungas, D., Nowinski, C. J., Richler, J., Deocampo, J. A., Anderson, J. E., Manly, J. J., Borosh, B., … Gershon, R. C. (2013). Cognition assessment using the NIH Toolbox. *Neurology, 80*(11 Supplement 3), S54–S64. https://doi.org/10.1212/WNL.0b013e3182872ded

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development, 72*(3), 655–684. https://doi.org/10.1111/1467-8624.00304

Whitehouse, A. J. O., & Hird, K. (2004). Is grammatical competence a precondition for belief-desire reasoning? Evidence from typically developing children and those with autism. *Advances in Speech Language Pathology, 6*(1), 39–51. https://doi.org/10.1080/14417040410001669 48

Zelazo, P. D., Anderson, J. E., Richler, J., Wallner-Allen, K., Beaumont, J. L., &., & Weintraub, S. (2013). II. NIH Toolbox cogntition battery (CB): Measuring executive function and attention. *Monographs of the Society for Research in Child Development, 78*(4), 16–33. https://doi.org/10.1111/mono.12032

Appendix

Table A1. Descriptive Statistics for Language, Executive Function, and Socioemotional Measures

Measure	*M*	Range (*SD*)	Max (when applicable)
Morphosyntactic accuracy (proportion of correct utterances)	0.79	0.04–1 (0.1)	1
Syntactic complexity (number of subordinate clauses)	4	0–18 (3.5)	
Unified predicates	35	10–101 (14.2)	
Event structure score	18	3–39 (6.7)	51
Mental verbs	0.5	0–5 (0.9)	
PPVT receptive vocabulary	97	43–133 (20.4)	144
SCDI thought words	25	8–30 (4.4)	30
SCDI emotion words	23	11–28 (4.1)	28
Forward digit span	5	2–10 (1.6)	10
Backward digit span	2	0–5 (1.4)	8
DCCS	4.9	0.4–8.1 (1.4)	
Fish Flanker Task	5.1	0.5–8.6 (1.8)	
HTKS	20	7–24 (4)	24
SDQ composite (low is good)	13	8–21 (2.4)	40
TEC	5	0–8 (1.5)	9

Figure A1. *Distribution of Nonverbal Communication Score and Executive Function Composite Score*

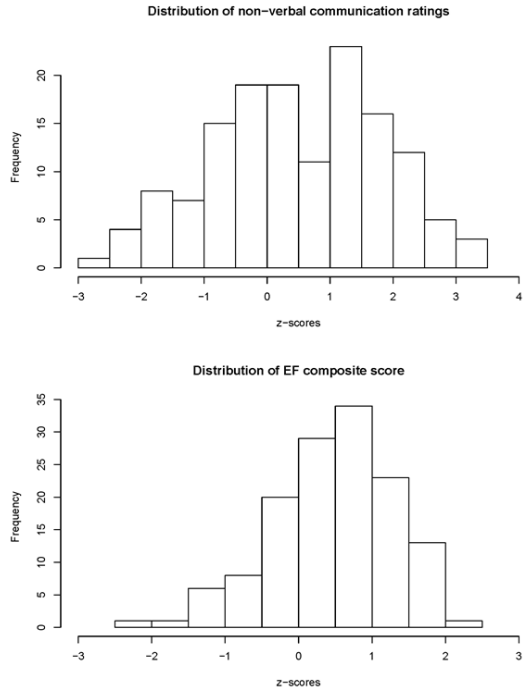

Table A2. Scoring Scheme for Event Structure Score (Adapted from Berman, 1988)

Picture	Scene	Score	Comment
1	Boy and dog look at frog in jar	2	2 points if the child explicitly mentions all 3 story characters. 1 point if the child explicitly mentions 2/3 of story characters, for instance "A boy sat and looked at his frog".
2a	Boy and dog asleep,	1	
	frog exits from jar	1	
2b	Boy and dog awaken,	1	
	discover frog is gone	1	
3a	Search starts,	1	
	boy looks in boots,	1	
	dog's head sticks in jar	2	2 points if the child explicitly mentions dog + sticks + jar/container 1 point if the child mentions dog + stick, for instance "The dog got stuck there"
3b	Dog looks out,	1	1 point is given if the child says "the dog looks out" OR the "boy and the dog looks out" OR "they look out"
	boy calls	1	
4a	Boy looks out,	-	See above
	dog falls from window	1	
4b	Dog in boy's arms,	1	
	jar shattered	1	
5	Boy calling out,	1	
	dog looking around	1	
6a	Boy looks down gopher hole	2	2 points if the child mentions looks and hole, 1 point if child mentions one or the other, for instance using direct speech: "What's in that hole"
	Dog barks at beehive	2	2 points if child mentions bark + bee hive/wasp's nest; 1 point if bark OR bee hive is mentioned
6b	Gopher jumps out	1	
	Dog shakes tree	1	
7a	Hive falls down,	1	
	dog looks around	1	
7b	Boy climbs up,	1	
	peers inside hole in tree	1	
8a	Owl appears,	1	
	boy falls down	1	
8b	Bees chasing,	1	
	dog running away	1	
9a	Owl swooshes off,	1	
	boy cowering	1	
9b	Boy on top, calling, holding on	2	2 points if child mentions on rock/climbs up + calling + holding, 1 point if 1-2 elements are mentioned. For instance "He climbed up on the rock. He held on to two sticks" OR "He climbed on the rock even further and said: whoohoo!"

10a	Boy caught on antlers	2	2 points if caught + antlers are mention, 1 point if only caught/stuck is mentioned, for instance “He got stuck on the reindeer”
10b	Deer carries boy,	1	
	dog runs with	1	
11	Boy and dog fall down,	1	
	deer watching	1	
12a	Boy and dog plunge into water below	2	2 points if both boy and dog are referred to + some reference to water/lake/swamp etc. for instance “They ended up in the water with a big splash”; 1 point if only water is mentioned, for instance: “There was water down there”
12b	Boy attends to sound,	1	
	dog on his shoulder	1	
13	Boy signals for quiet,	1	
	follows sound	1	
14	Boy and dog climb log,	1	
	see frogs	1	
15	Boy has a frog,	1	
	waves goodbye to others	1	