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Narrative competence and *internal state language* of children with Asperger Syndrome and ADHD

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ABSTRACT

The central question of the present study was whether there are differences between children with Asperger Syndrome (AS), children with attention deficit hyperactivity disorder (ADHD) and healthy controls (HC) with respect to the organization of narratives and their verbalization of internal states. Oral narrations of a wordless picture book produced by 31 children (11 with AS, 9 with ADHD, 11 HC, aged 8–12) were analyzed regarding the following linguistic variables: story length, sentence structure and sentence complexity, coherence and cohesion of the stories, verbalization of the narrator's perspective, as well as *internal state language* (verbal reference to mental states). Considerable similarities were noted between the two clinical groups, which deviate from HC children. Narratives of the children with AS and ADHD were shorter than the narratives produced by the HC children. The children of both clinical groups failed to point out the main aspects of the story. In particular, children with AS did not refer to cognitive states as often as the other groups. With respect to narrative coherence, they produced fewer pronominal references than HC children and children with ADHD. In conclusion, the two clinical groups differed from the HC group on a number of features, and a less frequent reference to cognitive states was identified for the children with AS.

1. Introduction

1.1. Autism spectrum disorders and ADHD

Autism spectrum disorders (ASD) are complex neurodevelopmental disorders characterized by marked deficits in three domains: social interaction, communication and repetitive, stereotyped behavior (American Psychiatric Association, 1994). Linguistic impairments are frequently involved in ASD (Geschwind, 2009; Kanner, 1943; Kjellmer, Hedvall, Fernell, Gillberg, & Norrelgen, 2011; Paul, Chawarska, Cicchetti, & Volkmar, 2008; Skovgaard et al., 2008; Tager-Flusberg & Caronna, 2010; Tager-Flusberg, Paul, & Lord, 2005; Tager-Flusberg et al., 2009). These impairments refer to phonology, semantics, syntax and pragmatics. Whereas phonology deals with the perception and production of sound units whose concatenation generates words, semantics deals with the meaning of lexical items, syntax with the structure of words in sentences, and pragmatics with the conventions and rules governing the use of language for communication (Groen, Zwiers, van der Gaag, & Buitelaar, 2008).

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Currently, there is a lively debate about the similarities and differences between ASD and ADHD (Gargaro, Rinehart, Bradshaw, Tonge, & Sheppard 2011; Goldstein & Schwebach, 2004; Holtmann, Bolte, & Poustka, 2007; Mulligan et al., 2009; Nijmeijer et al., 2010; Nyden et al., 2010; Rommelse, Franke, Geurts, Hartman, & Buitelaar 2010; Rommelse, Geurts, Franke, Buitelaar, & Hartman 2011; Sinzig & Lehmkuhl, 2007). ADHD, one of the most common neurodevelopmental disorders, is characterized by symptoms of inattention, and/or hyperactivity and impulsiveness, which must be present before the age of seven (American Psychiatric Association, 1994). In an overview, Rommelse et al. (2011) demonstrated that in clinical samples, between 20% and 50% of children with ADHD met criteria for ASD and between 30% and 80% of ASD children met criteria for ADHD. While the diagnostic guidelines highlight social deficits as especially evident in ASD, the cardinal symptoms of ADHD are deficits in attention and impulsivity as well as, in many cases, increased hyperactivity (Adrien et al., 1993; American Psychiatric Association, 1994). However, a critical number of subjects diagnosed with ASD are found to show deficits in their attention function (Frazier et al., 2001; Goldstein & Schwebach, 2004; Leyfer et al., 2006; Sinzig, Morsch, & Lehmkuhl, 2008), and on the other hand, children with ADHD are frequently found to exhibit social difficulties to a comparable degree to disorders of the autistic spectrum (Clark, Feehan, Tinline, & Vostanis, 1999; Greene et al., 1996; Luteijn et al., 2000; Mulligan et al., 2009; Santosh & Mijovic, 2004). On the one hand there is a debate about the discrimination of autism and ADHD, on the other hand there is no doubt that a high comorbidity of autism and ADHD exists (Gargaro et al., 2011; Gjevik, Eldevik, Fjaeran-Granum, & Sponheim, 2011; Leyfer et al., 2006; Simonoff et al., 2008), thus, the investigation of differences between the disorders is important.

While some individuals with ASD never develop functional language (Tager-Flusberg & Caronna, 2010), others present a profile of normal IQ, well-developed language form (i.e., phonology, syntax and morphology), and large productive vocabularies. Subjects with Asperger Syndrome (AS) do not have a history of language delay, but they exhibit qualitative impairments of social interaction, play, and communication, as well as intense circumscribed interests or obsessions, and some motor delay and clumsiness (American Psychiatric Association, 1994; Klin, Volkmar, & Sparrow, 2000; Woodbury-Smith & Volkmar, 2009).

First studies regarding the neuronal correlates of linguistic deficits in ASD demonstrate abnormal high-level linguistic processing in the frontal and temporal language association cortices, indicating more self-reliant and less connected neural subsystems (Groen et al., 2008, 2010; Mason, Williams, Kana, Minshew, & Just, 2008). Psychological theories which attempt to explain the linguistic deficits especially in high-functioning ASD are: weak central coherence (WCC) (Frith, 1996; Noens & van Berckelaer-Onnes, 2005) and impaired theory of mind (ToM) and empathy (Baron-Cohen, 2000; Tager-Flusberg, 1999). Central coherence describes the ability to integrate separate pieces of information into meaningful wholes. In relation to autism, the WCC theory postulates a domain-general tendency to favor processing of local stimulus properties due to a reduced ability in processing global context. WCC occurs at both "low" and "high" levels of information processing. Low-level WCC refers to the tendency to neglect context in the sensory (e.g., visual, acoustic) domain, favoring the processing of individual stimulus features, whereas high-level WCC concerns impairments of more abstract contextual processes (Happé, 1996; Jolliffe & Baron-Cohen, 1997; Rondan & Deruelle, 2007). Recent research has demonstrated a reduced ability to infer global meaning from sentences (Booth & Happé, 2010; Lopez & Leekam, 2003) and stories (Nuske & Bavin, 2011), yielding empirical evidence that the WCC accounts for at least the semantic and pragmatic language deficits in ASD. The importance of WCC for social-cognitive processes (Loth, Gomez, & Happé, 2008, 2010) as well as for the symptoms of ASD (Noens & van Berckelaer-Onnes, 2005; Pellicano, 2010; Pellicano, Maybery, Durkin, & Maley, 2006) has also been documented.

ToM refers to the specific cognitive ability to infer other people's mental states and to understand that others have beliefs, desires and intentions that are different from our own (Frith & Frith, 2005). It has been claimed that persons with ASD in part fail to recognize and respond appropriately to the emotional experiences of others (Baron-Cohen & Wheelwright, 2004; Gauthier, Klaiman, & Schultz, 2009; Golan, Baron-Cohen, & Hill, 2006). Gillberg (1992) described autistic disorders as "empathy disorders", stressing the relevance of this specific deficit in the emotional domain. It has been suggested that many aspects of the observed problems in social interaction can be explained by an ASD-specific deficit in ToM (Baron-Cohen, 2000). Even ASD subjects with high cognitive abilities show impairments in various tasks with ToM demands (Happé, 1994; Senju, Southgate, White, & Frith, 2009). Some studies have also demonstrated that performance on ToM tasks, such as the false belief task, are closely related to language ability (Happé, 1994; Tager-Flusberg, 1999; Tager-Flusberg & Caronna, 2010). The deficits in ToM are also important in the interpretation of the language and communicative impairments in ASD (Tager-Flusberg, 1999).

1.2. Internal state language

In order to communicate about feelings, desires, beliefs, intentions and other internal states, adequate linguistic devices are required. Linguistic expressions that refer to these internal and mental states of the speaker or of others are subsumed under the term *internal state language* (ISL, Bretherton & Beeghly, 1982). ISL covers all verbal expressions of internal and/or mental states concerning the self or others. Terms describing internal states can be classified into the following subgroups: emotion (e.g., "anger, sorrowful, lucky"), cognition (e.g., "thinking, wondering"), evaluation (e.g., "good, bad, nice"), modality (e.g., "have to, can, should"), physiology (e.g., "hungry, tired"), and affective particles (e.g., "actually, maybe") (Kauschke & Klann-Delius, 1997), which convey the speaker's perspective towards the reported events.

1.3. Narrative competence

Narratives are "among the earliest powers of mind to appear in the young child and among the most widely used forms of organizing human experience" (Bruner, 1990, p. 9), i.e., by telling a story, children organize their experience. Through these narratives, speakers bring order to "otherwise disconnected events by sequencing them in time and rendering them from a particular point of view" (Capps, Losh, & Thurber, 2000, p. 193). Narrating a story that is understandable for the listener requires the narrator to structure the story in an intelligible manner, making use of certain linguistic devices. These so-called *narrative competences* refer to the ability to produce a coherent story, which allows the listener to understand the setting, the characters, the sequence of events and the complications and resolution of a story. Furthermore, narrative competence involves linguistic and pragmatic language skills as well as an appreciation of the role of mental states for predicting and explaining behavior. Moreover, speakers should be able to explain a character's sad face, and not merely say: "The frog is making a sad face". Besides basic linguistic skills (phonology, grammar, vocabulary), the narrator requires an ability to organize the ongoing course of events so that a coherent story arises. The story should be told chronologically and the respective events should be linked in order to make the story coherent, and not just a listed series of events. Essential components of narrative competence are:

- an adequate length of the narration (important aspects should not be missing, irrelevant aspects should not needlessly protract the story)
- flexibility of sentence structures (not only main clauses)
- verbal means in order to establish coherence and cohesion (i.e., linking sentences together, primarily through the use of anaphoric reference)
- the use of stylistic devices and the ability to infer and adequately verbalize the mental states of the story's characters (ISL).

1.4. Internal state language in ASD and ADHD

Previous studies have examined narrative competence and ISL in children and adolescents with ASD. Most of these studies used a story elicitation task to assess narrative competence. The participants were presented with a wordless picture book ("*Frog, Where are You*?", Mayer, 1969, in most studies), and were asked to look at the pictures and tell the story. Narratives were video- and audio-taped, and stories were transcribed and subsequently coded for various aspects of narrative complexity, structure and coherence of the story and other features. For the most part, children with the diagnosis of (high-functioning) ASD have been compared with healthy controls or with children with developmental or language impairments. To the best of our knowledge, no comparisons with other clinical groups have been undertaken to date.

Capps et al. (2000) compared children with autism, children with developmental delays and a control group with respect to story lengths, morphosyntactic competence, story complexity and narrative evaluation (such as causality, emotion, cognition, negatives, hedges, character speech, onomatopoeia, sound effects, intensifiers and attention-getters). It was found that the groups did not differ in their use of causal language or internal state terms. Children with autism as well as children with developmental delays were less likely to identify the causes of the internal states of the characters in comparison with healthy controls. Losh and Capps (2003) confirmed the finding that the underlying causal relationships were difficult to understand and to express for children with AS.

Norbury and Bishop (2003) examined children with AS, children with SLI (specific language impairment) and a control group, but did not identify any group differences with respect to global structure or evaluation. However, children with AS and children with SLI produced more syntactic errors than typically developed children. In addition, children with AS made more ambiguous references.

Diehl, Bennetto, and Young (2006) compared children with high-functioning ASD with typically developing children matched for age, gender and language, and examined narrative length and syntactic complexity, causal connection and causal chain identification, memory for story elements and narrative coherence. No group differences were found with respect to story length or syntactic complexity, the use of the gist of a story to aid recall or sensitivity to the importance of story events. However, the narratives produced by children with ASD were significantly less coherent than the narratives of controls. Children with ASD were less likely to use the gist of the story to organize their narratives coherently.

Colle, Baron-Cohen, Wheelerright, and van der Lely (2008) were the first to look at narrative competences in adults with high-functioning AS. They analyzed the length of the stories and episodes, pronominal references, temporal relations and mental state expressions. The results showed that adults with AS had no difficulties in using appropriate phonology and syntax. Moreover, there were no significant differences in general narrative abilities between adults with AS and controls. However, the individuals with AS demonstrated specific pragmatic deficits by using fewer personal pronouns, fewer temporal expressions and fewer referential expressions that require theory of mind abilities.

Altogether, the results of previous research are divergent: In particular, children with high-functioning ASD perform similarly to healthy controls, but they exhibit deficits in the deeper understanding of the story. For example, more ambiguous references (i.e., poorly defined references that could refer to two different characters) and limited story coherence point to impairments in inferring and verbalizing the underlying causal relationships.

While previous research suggests that aspects of narrative competence are impaired in ASD, it is still unclear whether the use of ISL differs between ASD and comparison groups, especially other clinical groups. Regarding ISL in children with ASD, Capps et al. (2000) as well as Losh and Capps (2003) did not report impairments in the use of internal state terms, but did find impairments in motivating cognitive states. In contrast, Tager-Flusberg (1992) found fewer references to cognitive states by children with ASD than by TD children.

Few studies have examined narrative competence and ISL in children with ADHD (Rapport, Friedman, Tzelepis, & Van Voorhis, 2002; Renz et al., 2003; Tannock, Purvis, & Schachar, 1993). The results point to less coherent narrations of ADHD children compared to healthy controls and limited performance in affect recognition of adults with ADHD. So far, a comparison of the diagnostic groups of ASD and ADHD concerning these competences is lacking.

The aim of the current study was to analyze narrative competence and the use of ISL during one part of a standardized diagnostic assessment. In order to focus specifically on internal state aspects of language and narrative competence, we examined only children with ASD without language delay and with good verbal abilities, namely children with AS. We addressed the following questions: Are there differences between children with AS, children with ADHD and typically developing children (healthy controls, HC) with respect to their narrative competence? Do the three groups differ with respect to their use of terms that refer to internal states? We hypothesized that there are qualitative and quantitative differences in narrative competence and in the use of ISL between participants with a diagnosis of AS or ADHD and typically developing HC, with minor differences between AS and ADHD. Since ADHD is a common comorbidity of AS (Gargaro et al., 2011), the study included participants with AS with and without comorbid ADHD. These two subgroups were compared in order to investigate whether the performance of the AS children was influenced by co-morbid ADHD.

2. Material and methods

2.1. Participants

Three groups participated in the study: the group AS comprised 11 children (all males) with a diagnosis of AS. They were diagnosed by qualified clinicians, using ICD-10 (World Health Organization, 1992) and DSM-IV criteria (American Psychiatric Association, 1994), on the basis of the German version of ADI-R (Bölte, Rühl, Schmötzer, & Poustka, 2006) and ADOS (Rühl, Bölte, Feineis-Matthews, & Poustka, 2004) (see below) as well as a further neuropsychological examination. The group of children with ADHD comprised nine children (one female) who initially presented with the suspicion of an ASD. However, in the course of the diagnostic procedure, the diagnosis of ASD was not confirmed, whereas the children did fulfill the diagnostic criteria for ADHD. The children with ADHD were diagnosed by qualified clinicians, using ICD-10 criteria, and additionally on the basis of a standardized German questionnaire for ADHD Symptom Checklist for Attention Deficit Hyperactivity Disorders (FBB-HKS) (Doepfner & Lehmkuhl, 2003). The third group (*healthy controls, HC*) consisted of 11 children (one female) with normal development and intelligence scoring within the normal range. The HC children were recruited from a regular primary school. Their parents completed a German screening questionnaire for AS (Kamp-Becker, Mattejat, Wolf-Ostermann, & Remschmidt, 2005), in order to exclude an AS, and an informal questionnaire about the language acquisition of their children. To exclude an ADHD, the teachers completed the Symptom Checklist for Attention Deficit Hyperactivity Disorders (FBB-HKS) (Doepfner & Lehmkuhl, 2003). In order to estimate the level of cognitive functioning, the Wechsler scales for children in the German adaptation (Petermann & Petermann, 2007; Tewes, 1993; Tewes, Rossmann, & Schallberger, 1999) or the German version of the Culture Fair Intelligence Test (Weiss, 1998) were administered.

Participants were matched according to age and IQ and had a comparable MLU (mean length of utterances in words), i.e., the overall language abilities did not differ significantly between groups. The age range for all groups was 8.0–12.11 years (group AS: mean = 10.5 years, SD = 16.9 months; ADHD: mean = 9.9 years, SD = 20.9 months; HC: mean = 9.11 years, SD = 11.8 months). The groups did not differ with respect to chronological age (Mann–Whitney *U* test, $p = .474$) and total IQ (AS: mean = 109.4; ADHD: mean = 104.4, Mann–Whitney *U* test, $p = .265$). All participants were monolingual native German speakers and had no speech disorders.

2.2. Materials, measures and procedure

The Autism Diagnostic Observation Schedule (ADOS) (Lord, Rutter, DiLavore, & Risi, 1999), in combination with the Autism Diagnostic Interview-Revised (ADI-R) (Rutter, Le Couteur, & Lord, 2003), are widely used diagnostic tools for ASD. The ADOS is a semi-structured, standardized assessment of communication, social interaction, play and imagination designed for use in the diagnostic evaluation of individuals with a suspected possible ASD. The ADOS includes four modules with different activities to observe the behavior of participants with various developmental and language levels: ranging from those without expressive language to verbally fluent; from profound mental retardation to cognitively high-functioning children and adults. Activities are designed to provide systematic opportunities to elicit behaviors associated with ASD. One activity of module 3 (and also module 4) is "Telling a story from a book". The purpose of this activity is "to assess the participant's ability to recount a sequential story from a book of pictures and to provide a context for comments about social relationships and affect" (Lord et al., 1999, p. 59). The focus of the observation is – among other things – to provide an opportunity to evaluate the understanding of the depicted social context, especially what the characters in the story do and how they feel.

For the story elicitation task, the picture book "Tuesday" (Wiesner, 1991) was used, which is a 28-page wordless picture book. The pictures illustrate that frogs are suddenly able to fly on water lilies. They fly around all Tuesday, but when the next day comes, they are no longer able to fly and fall down. The policemen are astonished to find many water lily leaves on the street. The following Tuesday, the same wondrous thing happens again, but now pigs are able to fly. The story begins with the text "Tuesday evening, around eight" and on the following pages, no more text is given.

The participants were asked to look at the pictures and tell the story. The instruction was as follows: "Have a look at this book. It tells a story about frogs. Can you tell me the story as we go along?" The experimenter did not intervene during the narration. The task was video- and audio-taped and the stories were transcribed following the Codes for Human Analysis of Transcripts (CHAT) (MacWhinney, 2000).

2.3. Coding scheme

Grammatical complexity was examined in order to explore the participants' syntactic skills and their flexibility in using different syntactic structures. Therefore, simple main clauses, passive sentences, clauses with non-canonical word order, subordinate clauses and questions were counted. The number of these different syntactic structures was compared between groups. In addition, the relation of simple main clauses to more complex clauses was calculated in order to estimate syntactic complexity.

Story length was analyzed by counting propositions (the core meaning that is expressed by a sentence; interjections, interruptions and simple utterances like *yes* and *no* were excluded), tokens (total number of words) and types (number of different words). Additionally, we assessed the MLU (mean length of utterances in words) and the TTR (type-token-ratio). These measures were investigated in order to assess story length and lexical diversity.

Cohesion and coherence were measured in order to assess the macrostructure of the stories and the children's narrative abilities in detail. Regarding cohesion, different connectors between sentences were counted: Temporal connectors such as *before*, causal connectors such as *because* and other connectors such as *and*, *or*, *but*, etc. were counted and compared between groups. In order to assess the coherence of the stories, the narrator's global orientation was assessed, i.e., how did the narrator introduce new characters? How did he/she refer to time and space? To this aim, the total number of references to characters, space and time was counted and divided into explicit and implicit references. Examples of explicit references to characters were *the grandmother*, *the frog*, etc. Implicit references to characters comprised pronouns such as *he*, *she*, *it*, *they*, etc. Explicit references to space were, for example, *the road*, *in the sky*, etc., while implicit references to space included *here*, *there* etc. Finally, explicit time references included *4.38 p.m.*, *in the morning*, etc., and implicit references to time were *then*, *now*, etc. In addition, comprehension and coherent verbalization of the main events of the story were examined. For this purpose, the number of recognized core events (0–2) and the number of propositions used for the description of these events were counted.

The *speaker's perspective* was examined in line with Losh and Capps (2003). Negation particles were included here, as negations express that events happen contrary to someone's expectations (Losh & Capps, 2003). Furthermore, the number of adverbs that convey the speaker's degree of certainty (e.g., *perhaps*) was counted.

Narrative style was examined in order to detect stylistic differences between groups. This variable comprised the number of adjectives, the number of expressions on direct speech, the number of onomatopoeia (e.g., *flufluflu* to express the frogs' flight), the number of intensifiers (e.g., *and they went on and on and on*) and the number of attention-getting devices (e.g., *ey!*) and interjections (e.g., *ohje!*).

Table 1 shows an overview of the variables measured in this study. With regard to ISL, all lexical items that express internal states were identified and classified. The classification scheme was based on Kauschke and Klann-Delius (1997). We included the category *affective particles* because particles convey the speaker's perspective or attitude towards events. Table 2 summarizes the ISL categories.

2.4. Reliability

All video-taped narratives were transcribed by the first author. A second trained transcriber who was blind to the children's diagnoses transcribed 10% of all narratives of the clinical populations. An agreement of 92% was achieved (percentage of concordantly transcribed tokens). Two independent raters classified all terms that referred to internal states according to the categories listed in Table 3. Inter-rater agreement for the coding of ISL was 88%.

2.5. Data analysis

The statistical analysis of the data was undertaken using SPSS, version 17. A Kruskal–Wallis one-way analysis of variance – a non-parametric method for testing equality of population medians among groups – was conducted for comparison of the three groups. To avoid discounting trends towards significant values ($p < .1$) found in the Kruskal–Wallis test, for all p-values in this range ($p < .1$) Mann–Whitney U tests were applied for post hoc pairwise group comparisons. Following Bonferroni correction for multiple comparisons, the significance level for the post hoc tests was lowered from $p = .05$ to $p < .017$. In order to compare the number of participants who verbalized the main aspects of the story (see Table 2: coherence), Fisher's exact test was used.

Table 1
Variables for the determination of narrative skills.

	Dependent variables			Remarks
Grammatical complexity	- Number of simple main clauses			
	- Number of passive constructions			
	- Number of clauses with non-canonical word order			
	- Number of subordinate clauses			
	- Number of questions			
	Measure of syntactic complexity and flexibility:			
	- Relation of simple main clauses to more complex clauses			
Story length	- Number of propositions			Proposition = the core meaning that is expressed by a sentence; interjections, interruptions and simple utterances like *yes* and *no* were not included
	- Tokens (total number of words)			
	- Types (number of different words)			
	- MLU (mean length of utterance in words)			
	- TTR (type-token-ratio)			
Cohesion	- Number of temporal connectors (e.g., "before")			
	- Number of causal connectors (e.g., "because")			
	- Number of other connectors (e.g., "and", "but", "or", etc.)			
Coherence	Narrator's global orientation (introduction of characters, references to time and space):			
	- Total number of references to characters, space and time			
	- Relation of explicit to implicit References			
	Characters	**Space**	**Time**	
	- *Explicit*: the grandmother, the frog	- *Explicit*: on the road, in the sky	- *Explicit*: 4.38 p.m., in the morning	Definition of the two main events in the *Tuesday*-story:
	- *Implicit*: he, she, it	- *Implicit*: here, there	- *Implicit*: then, now	- Starting point: frogs are not able to fly in reality
	Comprehension and coherent verbalization of the main events of the story:			- Turning point: frogs lose their capability to fly on water lily leaves, the police are wondering where the water lily leaves on the street come from
	- Number of recognized core events (0–2)			
	- Number of propositions used for the description of these events			
Speaker's perspective	- Number of adverbs that convey the speaker's degree of certainty (e.g., "perhaps")			Negations express that events happen contrary to someone's expectations (Losh & Capps, 2003)
	- Number of negation particles ("not")			
Narrative style	Stylistic devices:			
	- Number of adjectives			
	- Number of expressions in direct speech			
	- Number of onomatopoeia (e.g., *flufluflu* to express the frogs' flight)			
	- Number of intensifiers (e.g., "and they went on and on and on")			
	- Number of attention getting devices (e.g., *ey!*) and interjections (e.g., *ohje!*)			

Table 2
Categories for the classification of internal state language.

Category	Description	Example
Emotion	Labeling discrete emotions Terms referring to expressive behavior	*fear, cry*
Physiology	Labeling subjective, physical sensations and perceptions	*tired*
Modality	Terms for volition, obligation and intentions	*want, must*
Evaluation	Terms that denote moral or emotional judgments	*good*
Cognition	Terms for mental, cognitive states, expressions of knowledge, belief, remembrance	*think, know*
Affective particles	Particles that convey the speaker's perspective or attitude towards events	*actually*

3. Results

3.1. Story length

With respect to mean length of utterance in words (MLU), children with ADHD tended to produce shorter utterances than children with AS or HC (see Table 3). There were significant group differences with respect to the number of utterances, the number of word types and word tokens produced in the narratives (see Table 3). HC children used the highest number of words, followed by children with ADHD. Children with AS used a limited number of words. Post hoc comparisons show that HC children produced significantly more types and tokens than children with AS. There were no group differences with

Table 3
Measures of story length and sentence complexity.

	AS	ADHD	HC	*p*-value: ANOVA	*p*-values: *U*-test		
					AS-ADHD	AS-HC	ADHD-HC
Story length mean (SD)							
Utterances	35.9 (11.1)	47.3 (11.4)	60.7 (17.9)	.030	.039	.008*	.287
Types	91.2 (20.1)	105.4 (35.8)	134.4 (35.4)	.016	.518	.018	.205
Token	200.4 (58.4)	242.6 (87.5)	365.5 (110.9)	.010	.254	.004*	.086
MLU	5.6 (0.4)	5.1 (0.9)	6.0 (0.6)	.080	.020	.167	.011*
TTR	0.5 (0.1)	0.4 (0.1)	0.4 (0.1)	.034	.591	.018	.131
Sentence complexity raw scores (SD) and %							
Main clauses	23.8 (6.6) = 79%	31.3 (9.4) = 78%	41.9 (8.8) = 77%	.800			
Non canonical word order	0.0 (0.0) = 0%	0.0 (0.0) = 0%	0.1 (0.3) = 1%	.403			
Passive clauses	0.9 (1.0) = 3%	1.1 (1.2) = 3%	1.1 (1.4) = 1%	.668			
Subordinate clauses	3.4 (2.1) = 11%	3.4 (2.7) = 9%	9.0 (7.6) = 15%	.226			
Questions	0.4 (0.9) = 1%	1.4 (1.7) = 4%	0.8 (0.9) = 2%	.135			

Note. Post hoc testing only for ANOVA results $p < .1$. AS: children with Asperger Syndrome; ADHD: children with attention deficit hyperactivity disorder; HC: healthy controls; MLU: mean length of utterance; TTR: type-token-ratio.
* Significant after Bonferroni correction.

respect to sentence complexity and grammatical flexibility. Table 3 shows that all children used a variety of sentence structures (main clauses, subordinate clauses, questions, passive constructions and main clauses with non-canonical word order) with approximately the same frequency (relative to the respective story length).

3.2. Narrative competence–coherence

With regard to coherence, the results revealed both similarities and differences between the groups. First, there were no statistically significant differences with respect to the overall references to characters, time and space. However, when referring to the characters of the story (persons or animals), children with AS used more explicit references (noun phrases) and fewer implicit references (pronouns) than the typically developing children. The relation between explicit and implicit references differed between groups (Kruskal–Wallis test: $p = .037$). The pairwise comparison revealed that the HC and the AS group differed significantly ($p = .002$), while the other group differences were not significant (HC-ADHD: $p = .676$, AS-ADHD: $p = .048$).

A further difference emerged concerning the verbalization of the core aspects of the story. Only three out of eleven children with AS (27%) and only one child out of nine with ADHD (11%) conveyed the two main aspects adequately, i.e., they mentioned the main aspects in a manner that proved their understanding of these two aspects. These aspects mirrored entities that were not real and therefore required some extra explanation, such as "frogs are not able to fly in reality". By contrast, nine out of the eleven typically developing children (82%) were able to describe the main aspects in an adequate way. This difference in frequencies was significant ($p = .003$, two-tailed Pearson's χ^2 test). In addition, we calculated the number of propositions which the children used to refer to the main aspects of the story. The Kruskal–Wallis test showed a significant group effect ($p = .003$). Post hoc tests (Mann–Whitney) clarified that children with AS and children with ADHD did not differ from one another, while the HC group produced more propositions with reference to the main aspects than children with AS ($p = .003$) and children with ADHD ($p = .007$).

3.3. Narrative competence—cohesion

There were no differences between the groups regarding the use of temporal or causal conjunctions. Likewise, no differences were found for any dependent variables assessing narrative style and speaker's perspective.

Table 4
Usage of internal state language.

	AS mean (SD)	ADHD mean (SD)	HC mean (SD)	*p*-value: ANOVA	*p*-values: *U*-test		
					AS-ADHD	AS-HC	ADHD-HC
ISL total	16.3 (7.3)	24.4 (15.0)	46.9 (25.2)	**.002***	.182	**.001***	.025
Emotion	1.8 (1.7)	2.2 (2.4)	2.8 (2.2)	.491	.749	.271	.395
Cognition	3.4 (2.2)	5.2 (3.7)	12.4 (8.0)	**.001***	.232	**.000***	**.007***
Rating/judgment	2.7 (3.0)	3.1 (3.6)	6.2 (3.2)	**.017***	.698	**.014***	**.016***
Modality	1.0 (1.4)	2.0 (2.1)	2.8 (2.1)	.072	.191	.030	.258
Physiology	1.1 (1.2)	2.9 (2.1)	3.5 (2.4)	**.011***	**.010***	**.011***	.397
Affective particles	6.2 (4.8)	9.0 (6.6)	20.1 (13.2)	**.006***	.234	**.003***	.027

Note. AS: children with Asperger Syndrome; ADHD: children with attention deficit hyperactivity disorder; HC: healthy controls.
* Significant after Bonferroni correction.

3.4. Internal state language

Table 4 shows the number of ISL terms in total and in the respective subcategories. For the total number of ISL terms as well for all categories, children with AS used the fewest terms of ISL, the HC used the most terms referring to internal states, and children with ADHD fell between the other two groups (see Fig. 1). Significant differences were found for the total number of ISL terms and for the subcategories cognition, judgment, physiology and affective particles.

Since the groups differed with respect to the total number of words produced, we calculated the proportion of ISL terms on all tokens produced in the narrative. Table 5 shows the percentages of internal state terms relative to all tokens. Following these calculations, the groups still differed with respect to the total number of ISL terms and cognitive terms. In both cases, children with AS used significantly fewer terms for expressing internal or cognitive states than the typically developing children. Fig. 2 illustrates the differences between the groups.

There were no significant differences between the groups with respect to the ISL category emotion, i.e., the groups used a similar proportion of emotion words. In addition, we analyzed whether the valence of the emotional terms differed between groups. All children produced more terms expressing negative (e.g., "afraid", "spooky") than positive emotions (e.g., "to enjoy", "happy"), and the ratio of positive and negative emotional words was comparable between the groups. The mean ratio of positive and negative emotion terms was 1:8 in children with AS, 0:6 in children with ADHD and 1:7.5 in HC.

3.5. Effect of comorbidity

In view of the high rate of comorbidity of ADHD in children with AS (Gjevik et al., 2011), we divided the group of children with AS into two groups (AS with and without comorbid ADHD). Six of the children with AS also fulfilled the diagnostic

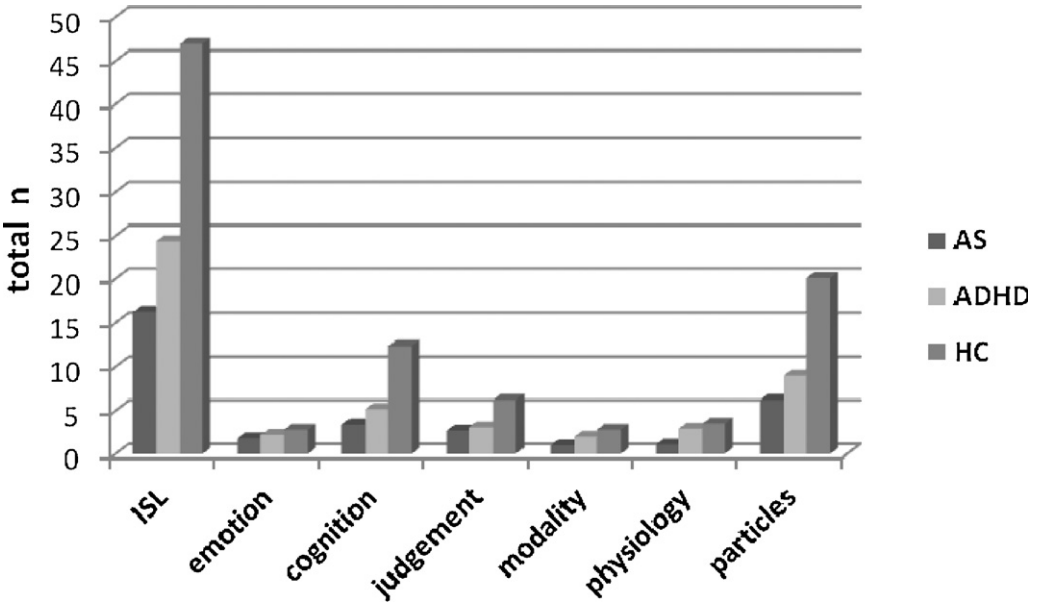

Fig. 1. Use of internal state language (raw scores). *Note.* ISL: internal state language, AS: children with Asperger Syndrome, ADHD: children with attention deficit hyperactivity disorder, HC: healthy controls.

Table 5
Usage of internal state language, in relation to tokens.

	AS% (SD)	ADHD% (SD)	HC% (SD)	*p*-value: ANOVA	*p*-values: *U*-test		
					AS-ADHD	AS-HC	ADHD-HC
ISL total	8.1% (2.6)	9.5% (3.2)	12.1% (3.8)	.043	.043	**.018***	.095
Emotion	0.9% (0.8)	0.8% (0.7)	0.8% (0.6)	.996	.939	.947	.970
Cognition	1.8% (0.9)	2.0% (1.2)	3.3% (1.6)	.037	.879	**.016***	.052
Rating/judgment	1.5% (1.5)	1.7% (0.9)	1.6% (0.6)	.301	.909	.469	.062
Modality	0.4% (0.7)	0.9% (1.1)	0.7% (0.4)	.259	.181	.138	.939
Physiology	0.6% (0.9)	1.1% (0.5)	0.9% (0.6)	.052	**.014***	.098	.675
Affective particles	3.0% (1.7)	3.5% (1.8)	5.0% (2.5)	.093	.568	.030	.184

Note. AS: children with Asperger Syndrome: ADHD: children with attention deficit hyperactivity disorder; HC: healthy controls.
* Significant after Bonferroni correction.

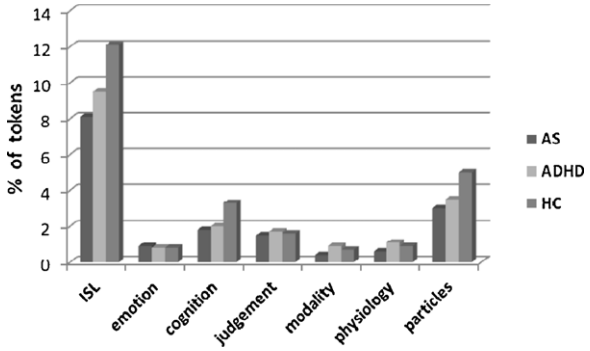

Fig. 2. Use of internal state language (percentages). *Note.* ISL: internal state language, AS: children with Asperger Syndrome, ADHD: children with attention deficit hyperactivity disorder, HC: healthy controls.

criteria for ADHD according to the ICD-10 criteria (World Health Organization, 1992); there was a slight difference with respect to MLU (the utterances of AS children with comorbid ADHD were slightly longer, $p = .035$). Apart from this marginal difference, all variables that investigated linguistic and narrative competencies as well as ISL did not differ between the two subgroups of AS. Thus, the results for children with AS are not affected by comorbid ADHD.

4. Discussion

The present study aimed to compare children with AS, ADHD and healthy controls with respect to general linguistic competence, narrative skills, and ISL. We investigated 8–12-year-old children from the three groups using a story-telling task. Results suggest some similarities as well as significant differences between the groups. First, overall syntactic abilities were comparable across the groups. All children produced a variety of different syntactic structures and a comparable mean length of utterances. Regarding the verbalization of the global setting of the story, children of all three groups were able to introduce the main characters and describe the setting of the story. In terms of cohesion, children did not differ with respect to their use of temporal and causal connectors or regarding other connectors. Finally, they also did not differ in their narrative style, indicated by the use of direct speech, adjectives, and adverbs that refer to the speaker's perspective. Regarding ISL, the children produced a similar number of emotional terms.

Besides these similarities, our results point to some specific characteristics of the children with a diagnosis of AS or ADHD: First, the results suggest that the narratives of children with AS and those with ADHD were shorter and less coherent than the narratives produced by the typically developing children. The fact that children with AS or ADHD did not adequately convey the main aspects of the story indicates limited coherence. Additionally, the children with AS produced fewer pronominal references than the other groups. With respect to ISL, children with AS produced fewer references to internal, especially mental states. We will discuss these findings below.

Regarding the length of the story, children with AS narrated in a characteristic manner. They told much shorter stories than children in the healthy control group, but also told shorter stories than children with ADHD. This result is not consistent with previous research about narratives in autism (Diehl et al., 2006; Norbury & Bishop, 2003; Tager-Flusberg & Sullivan, 1995). It could be argued that this discrepancy may be due to the fact that the children with AS and the HC children were asked to narrate the story under different circumstances. The clinical group was tested in a diagnostic setting in clinical surroundings, whereas the typically developing children were interviewed in school settings, which are more familiar to them. However, if we accept this as an explanation for the reduced length of the stories, the children with ADHD should act in the same way, since they were tested in the same clinical setting, but there were only minor differences in story length between children with ADHD and HC (see Table 3).

Results concerning coherence are striking for both clinical groups (AS and ADHD). The normally developed healthy control children pointed out the main aspects of the story in a better way than both clinical groups. In the present study, only the verbalized aspects were counted. This does not necessarily mean that a child did not comprehend the aspects that were not verbalized. Thus, we cannot conclude that the two main aspects were not understood by children with AS and children with ADHD; it is possible they were considered not worth telling. These results support the WCC theory of ASD: The children preferred the verbalization of local stimulus properties (aspects or details of the story) to refer to the global context (core aspects of the story). However, the sample is too small to undertake further considerations of whether WCC is influenced by deficits in attention, hyperactivity and/or impulsivity. In a recent study (Booth & Happé, 2010), it was demonstrated that performance on a test of coherence requiring global sentence completions (Sentence Completion Task) was not related to inhibitory control. Interestingly, the children with ADHD showed the same pattern. This confirms the results of Renz et al. (2003), who report similar deficits with respect to coherence in ADHD.

Another finding concerning coherence is that the children with AS used fewer implicit references to persons than the healthy controls. HC children used anaphoric pronouns as substitutions for nominal phrases (NPs), because there is no

reason to express the full NP again when pronoun and NP have the same reference. Children with AS did not make use of this possibility as often as the normally developed children. Colle et al. (2008) also reported a limited use of personal pronouns by adults with AS/high functioning autism (HFA).

The significant differences between children with AS and healthy controls regarding the use of internal state language in general and of cognitive terms in particular are in line with the findings of Tager-Flusberg (1992) and Happé (1994), but they do not converge with those of Tager-Flusberg and Sullivan (1995) and Losh and Capps (2003). Tager-Flusberg and Sullivan (1995) as well as Losh and Capps (2003) criticize previous research for inaccurate matching with respect to linguistic competence. By matching more accurately, they discovered that the children with AS were capable of referring to cognitive mental states equally as successfully as the HC children. In the present study, the groups were comparable with regard to age, IQ and MLU. There were no significant differences between the children with AS and the HC with regard to length of utterance and syntactic complexity. Hence, it cannot be argued that the problems which the children with AS have in referring to mental states are due to general linguistic difficulties. The difference with respect to the use of cognitive terms seems to be more typical of AS, as it was not found between the ADHD and HC groups. Concerning the ISL category "emotion", the present results confirm the findings of Tager-Flusberg (1992), who also did not detect any difficulties with emotional language in children with autism, and on average found two emotional nominations per story. In the present study, children in the AS group uttered an average of 1.8 words with emotional content. Children with ADHD mentioned 2.2 words on average in their stories, while children in the typically developing group mentioned 2.8 terms expressing emotions. An ascending tendency can be seen here, but no statistically significant difference. This could be due to the large interindividual variances that were also found in the control sample. One child referred seven times to emotional states, while another did so only once. Norbury and Bishop (2003) also noticed such a huge variance in their sample.

A general disability in AS children to motivate emotions, as postulated in the literature (Capps et al., 2000; Tager-Flusberg & Sullivan, 1995), could not be confirmed by the present results. Rather, children with AS and ADHD recognized and labeled emotions spontaneously to the same amount as typically developing children. Emotion recognition refers to the ability to infer an emotional state of another individual, mainly from acoustic and visual features such as vocalization and facial expression. This ability is a crucial part of empathy and ToM. There is recent consensus that empathy as well as ToM are multidimensional constructs that comprise both affective aspects, referring to the emotional response and the sharing of emotions, as well as cognitive aspects, such as intellectual understanding of another person's emotional experiences (Decety, 2010; Dziobek et al., 2008; Shamay-Tsoory, 2011). Some studies (Dziobek et al., 2008) found that while individuals with AS are impaired in cognitive aspects of empathy or ToM, they do not differ from controls in emotional aspects. In line with this discussion, our results support the hypothesis that the deficits of children with AS are more pronounced for cognitive aspects of ToM than for emotional aspects. In particular, the spontaneous attribution of cognitive states such as "belief", "to think", "to realize" to characters of a story appears to be difficult.

In addition, Losh and Capps (2003) postulated a lacking general capacity of children with autism to motivate their statements. In the present study, the usage of causal connections was the same for all three groups. This can be seen as confirmation of the results of Norbury and Bishop (2003), who also found no differences with respect to causality.

In contrast to the children with AS, the group of children with ADHD did not differ from TD children in their use of ISL. To date, the use of ISL in children with ADHD has rarely been studied. Although previous literature (Rapport et al., 2002; Renz et al., 2003) gives reason to assume that children with ADHD might also be impaired in the use of ISL, this assumption cannot be confirmed by our results.

The current state of research suggests a high similarity of AS and ADHD with respect to their narrative competence and their use of ISL. These similarities can also be seen in diagnostic settings, where it is sometimes hard to distinguish these two impairments. ADHD is often found as a comorbidity of AS (Gjevik, Eldevik, Fjaeran-Granum, & Sponheim, 2011; Leyfer et al., 2006; Simonoff et al., 2008). In the present study, 54% of the children with AS showed a comorbid ADHD. However, we found no support that this comorbidity of ADHD influences narrative competence; hence, there were no significant differences between the children with and without comorbidity of ADHD.

The use of the picture book "Tuesday" for the narrative elicitation is worthy of discussion since its plot is not comparable to that of the stories used in previous research on children's narratives (e.g., the Frog Story, see above). However, "Tuesday" is one fragment of the standardized diagnostic assessment ADOS, which is one part of the diagnostic investigation of ASD and therefore used in many cases (Kamp-Becker et al., 2011; Molloy, Murray, Akers, Mitchell, & Manning-Courtney, 2011). To our knowledge, this is the first study to present exploratory results of a systematic analysis of this ADOS activity. The current findings suggest that a special focus should be placed on specific aspects of the "Tuesday" narratives: Besides the aspect of coherence, reference to mental states should also be taken into account, which is important for clinical practice. Certainly, studies describing and comparing the linguistic competencies of children with ASDs are of current interest to the field, as difficulties in this domain impact many aspects of children's functioning.

The present sample size of approximately ten children per group is small, but in the context of a first exploratory analysis, the presented study is of interest for clinical practice as well as for further research.

5. Conclusions

In conclusion, the present study demonstrates that despite their good grammatical abilities, children with AS show limitations in narrative competence, especially with regard to coherence: Children with AS produced shorter stories, fewer

pronominal references, and they were less able to convey the main aspects of the story. Concerning ISL, we found marked differences between children with AS and the healthy control group, especially in naming cognitive aspects. The clinical group of children with ADHD fell between the children with AS and the healthy controls. Geurts and Embrechts (2008) report similar findings: Children with AS and ADHD showed pragmatic difficulties, but the difficulties in children with ADHD were less profound than those observed in children with autistic disorders. Larger sample size studies are needed to confirm our findings in order to draw general conclusions about AS and ADHD.

The results of the present study are also of importance for the diagnostic value of the ADOS, of which the task used is part. It is of great interest not only to observe comments about social relationships and affect, but also what the characters in the story do and how they feel – as stated in the manual. Further attention should also be paid to cognitive aspects of ISL and to the length and coherence of the narrative.

Disclosures

K. Becker is/has been involved in research/clinical trials with Eli Lilly and Shire, is on the advisory board of Eli Lilly/Germany, and has been paid for public speaking by Eli Lilly and Shire. I. Kamp-Becker has been paid for public speaking by Medice. There is no conflict of interest for all other authors.

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