Language and pragmatic abilities in children with ADHD and/or Autism Spectrum Disorder –

The importance of Speech and Language Pathologists in neurodevelopmental assessment

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SAMMANFATTNING


Nyckelord: Språk, pragmatik, ASD, ADHD, logoped, narrative förmåga

ABSTRACT

Children with neurodevelopmental disorders like Attention Deficit Hyperactivity Disorder (ADHD) and/or Autism Spectrum Disorder (ASD) often suffer from variable impairments in language and pragmatic abilities. The purpose of this study was to investigate language and pragmatics in children with ADHD and/or ASD (D-group) compared with a control group with no diagnose (ND-group). 22 children with diagnose, 4 girls and 18 boys aged 9:4–13:6, and 26 children with typical development, 10 girls and 16 boys, aged 10:5–13:4 were tested with a battery of tests concerning language and pragmatics. Their parents filled in a questionnaire regarding pragmatic abilities. The D-group performed poorer than the ND-group in all tests. Correlations were found between several pragmatic and language tests results in the D-group, and a few correlations were found in the ND-group. Some tests were particularly difficult for the D-group. An attempt was made to find subgroups in the D-groups test results via cluster analysis, but without success. The results emphasize the need of routine speech-language pathologist assessment during diagnostic evaluation of children with neurodevelopmental disabilities.

Keywords: Language, pragmatics, ASD, ADHD, SLP, narrative ability
## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADD</td>
<td>Attention Deficit Disorder</td>
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<tr>
<td>ADHD</td>
<td>Attention Deficit Hyperactivity Disorder</td>
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<tr>
<td>ASD</td>
<td>Autism Spectrum Disorder</td>
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<tr>
<td>BeSS/TBSS</td>
<td>Bedömning av Subtila Språkstörningar, Assessment of Subtle Language Deficits</td>
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<tr>
<td>BNT</td>
<td>Boston Naming Test</td>
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<td>CAH</td>
<td>Child and Adolescent Habilitation</td>
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<td>CAP</td>
<td>Child and Adolescent Psychiatry</td>
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<td>CP</td>
<td>Cerebral Palsy</td>
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<td>CELF</td>
<td>Clinical Evaluation of Language Fundamentals</td>
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<td>DSM</td>
<td>Diagnostic and Statistical Manual of Mental Disorders</td>
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<td>EF</td>
<td>Executive Functions</td>
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<td>ERRNI</td>
<td>Expression Reception and Recall of Narrative Instrument</td>
</tr>
<tr>
<td>ESSENCE</td>
<td>Early Symptomatic Syndromes Eliciting Neurodevelopmental Clinical Examinations</td>
</tr>
<tr>
<td>FAS</td>
<td>Phonetic word fluency test (testing F, A and S)</td>
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<td>FB</td>
<td>False Belief</td>
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<td>HFA</td>
<td>High Functioning Autism</td>
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<tr>
<td>HLL</td>
<td>Higher Level Language</td>
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<tr>
<td>KR-list</td>
<td>The short Kent Rosanoff-list</td>
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<td>LFA</td>
<td>Low Functioning Autism</td>
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<td>LI</td>
<td>Language Impairment</td>
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<td>NAP</td>
<td>Narrative Assessment Protocol</td>
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<td>PLI</td>
<td>Pragmatic Language Impairment</td>
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<td>PP</td>
<td>Pragmatic Profile</td>
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<td>SLI</td>
<td>Specific Language Impairment</td>
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<td>SLP</td>
<td>Speech and Language Pathologist</td>
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<tr>
<td>ToM</td>
<td>Theory of Mind</td>
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<tr>
<td>TROG</td>
<td>Test for Reception Of Grammar</td>
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<tr>
<td>USP</td>
<td>Understanding Spoken Paragraphs</td>
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1. Introduction

When diagnosing Attention Deficit Hyperactivity Disorder (ADHD), the neurodevelopmental assessment must cover and examine as many of the child’s abilities as needed to make a reliable diagnostic evaluation, according to recent national Swedish guidelines in Child and Adolescent Psychiatry (CAP) (Svenska föreningen för barn- och ungdomspsykiatri, SFBUP, 2016). According to SFBUP’s statistics 85% of all children with ADHD also suffer from at least one coexisting developmental disability, like Language Impairment (LI). However, referral to a speech and language pathologist (SLP), is not further mentioned than in terms of an optional addition in the third phase of the diagnostic routine. In regional Swedish guidelines for assessing Autism Spectrum Disorder (ASD), in Skåne, coexisting language difficulties at various levels are well described (Barn- och ungdomspsykiatrin, BUP, Skåne, 2014). The importance of a specialized, multidisciplinary team is stated. Further, the addition of an SLP in this type of multidisciplinary team is supported, if needed already during the introductory part of the neurodevelopmental assessment. It is stated that an SLP is an obligatory team member when assessing children with additional language difficulties. They also note that many children first were assessed by an SLP before referral to CAP, indicating an overlap in developmental disorders regarding language and neuropsychiatry.

There are many features in the criteria for ADHD and ASD that concerns disabilities in language and pragmatics (American Psychiatric Association APA, 2013). Despite this fact and knowledge of language difficulties in ADHD and ASD, there are few SLPs working in multidisciplinary teams in CAP assessing language in Sweden. Studies have shown poorer language outcome in children with LI combined with ADHD and/or ASD, for example Miniscalco (2007). This would suggest careful early SLP-language intervention in CAP. Some language problems regarding pragmatic abilities in ASD, ADHD and LI can fruitfully be captured by assessing narratives, described as “a good predictor of long-term language skills” (Miniscalco, 2007, p. 44). Comprehension and communication was also found to be more impaired than structural expressive language aspects in ADHD, suggesting the need for extensive language assessment in order to detect more subtle difficulties (Bruce, Ternlund & Nettelbladt, 2006). Brown (2005) noted that speech and language impairments in children with ADHD are often overlooked since psychologists and psychiatrists in general have a less specific knowledge in this discourse. A comprehensive language assessment as part of a diagnostic routine when suspecting ADHD is also stated in Cohen et al. (2000); “speech-language pathologists have an important role to play in the multidisciplinary assessment and treatment of ADHD” (p. 79).

1.1. Language abilities

A traditional way of describing language is in three different levels or intersecting areas. The area of form includes phonology and grammar. The semantic area refers to language content and includes lexical aspects. In the pragmatic domain, or the interpersonal area, different aspects of verbal and non-verbal interaction are in focus.
1.1.1. Language development in children

At the time of school start, phonology, grammar and lexicon basically should be fully developed in Swedish children (Nettelbladt & Salameh, 2007). Lexicon size continues to develop during school age and over the lifetime (Bruce, 2007). Reorganization within a child’s lexicon occurs at 5–9 years, words are associated in a different way (Nelson, 1977). The new pattern of association is the within-class, paradigmatic association like cold – warm, unlike the outside-class syntagmatic association cold – ice cream, that younger children make (Holmström, 2015). This so called syntagmatic-paradigmatic shift is manifested when the word’s semantic features are more established and the child masters a higher level of language abstraction. Pragmatics contains many features. One of them is the narrative ability concerning how to tell and understand stories (Holck, 2009), which is developing during school years (Magnusson, Naucér & Reuterskiöld, 2008).

1.1.2. Pragmatic abilities

There are a number of various suggested definitions of pragmatic abilities aiming to illustrate the connections between linguistic form contra the messages effect on the listener. Perkins (2007) defines pragmatics as communication by the use of linguistic and nonlinguistic capacities. He emphasizes interaction, and claims that meaning is created as a combination of language and expressive modalities. From a psychiatric perspective, Brown (2005) includes nonverbal aspects like facial expression, body language and tone of voice as part of pragmatic abilities. One way of describing pragmatics is in the social sphere containing abilities like Theory of Mind, turn-taking and inference, and on in the language domain including for example figurative language, narrative ability, reference, coherence and cohesion (Nettelbladt & Salameh, 2013).

It is a cognitively demanding task to interact in conversation, and different theories describing the process in terms of intention contra interpretation have emerged. The speaker has an intention with their utterance, and the listener is to interpret, not only the actual words, but also contextual and non-literal factors to grasp the message. In order to clarify this process, Austen (1962) suggested a dimensional approach. He called the intention of the message the *illocutionary force*, the actual utterance the *locution*, and the effect on the listener the *perlocutionary effect* (Grundy, 2000; Leinonen, Letts & Smith, 2000). These three dimensions in communication might not fully correspond to each other, and misunderstanding can easily arise. Utterances aiming to practical results or actions were described by Austen as *speech acts* (Grundy, 2000; Leinonen et al., 2000; Verschueren, 1999). In order to be polite, a response action from other persons is usually implied in *indirect speech acts* when saying for example “Can you close the door?”, when meaning “Close the door” (Leinonen et al., 2000). If this message was interpreted by its literal meaning instead of its pragmatic meaning, the listener might answer “Yes”, instead of actually closing the door. The listener must make an inference, otherwise the speaker’s intention fails. The importance of context in speech acts is emphasized in “I declare you man and wife” uttered by a priest at a wedding, compared with other contexts where the utterance would not perform an action changing marital status (Grundy, 2000). The wider concept *communicative acts* is a term suggested by Edmondson (1981), describing nonverbal communicative behaviour in on-going conversation, also applicable on communication without speech (Leinonen et al., 2000).
Non-literal or figurative language usually included in pragmatics are irony, understatement, and formulaic language like proverbs (concrete sayings like “ignorance is bliss”), idioms (phrases or fixed expressions like “piece of cake” meaning “easy task”), metaphors (conventionalized expressions referring to one thing but saying something else suggesting they are the same, like “I am heartbroken” meaning “I am feeling sad”), hyperbole (exaggerations like “a thousand times” meaning “many times”). In all these types of language figures the separate words are not intended to be interpreted individually due to their standard semantical representation. The phrase has to be interpreted as a unit that means something else than the actual meaning of each single word (Cummings, 2014). Metaphors demand higher cognitive functioning combined with pragmatic ability. Familiar metaphors are lexicalized, learned as meaningful phrases and stored as units in the mental lexicon, amongst words and concepts whose meanings we are familiar with (Mashal & Kasirer, 2011). Metaphors are the non-literal language figure most researched, and in ASD metaphors are well known to be problematic to understand (Cummings, 2014; Mashal & Kasirer, 2011).

The context is utterly relevant in pragmatics because of its interactional base. One totally context-dependent linguistic feature is deixis. It refers to entities in spatio-temporal, social or discourse context. Different word classes can serve as deictic expressions; personal pronouns e.g. I, demonstratives e.g. this, adverbs e.g. here, adjectives e.g. next and verbs e.g. come (here). Individuals with ASD tend to make reversal of pronouns saying you instead of I when referring to themselves, which have been argued to be associated with echolalia (APA, 2013; Cummings, 2014).

There are different reasons for pragmatic ability to be impaired, and in Pragmatic Language Impairment (PLI) the impaired pragmatic abilities are the main focus. ASD is one of the most common diagnoses including pragmatic disabilities, but also Specific Language Impairment (SLI), behavioral disorders like ADHD, or intellectual disability can be a cause of impaired pragmatic ability in children (Cummings, 2014). In other patient groups, like individuals with right hemisphere damage, pragmatic abilities like word retrieval and turn-taking might be damaged, leading to several repairs, which rarely leads to referral to an SLP since the disabilities are perceived to be subtle and difficult to pinpoint (Saldert, 2006). Also, early onset damage like Cerebral Palsy (CP) is a reason for pragmatic disabilities with literal story comprehension and narratives (Holck, 2009).

In pragmatic understanding Theory of Mind (ToM), or mentalization, is often regarded as a fundamental cognitive capacity (Perkins, 2007). ToM is a paradigm concerning what a person believes about another person’s beliefs, “an understanding that other people (and oneself) have thoughts, desires and beliefs /…/ these mental states govern behavior” (Dahlgren, 2002, p. 2). In understanding and telling narratives, ToM is a crucial component. For example; one must be able to take the listeners point of view and understand what story elements needs to be told for the listener to grasp the content of the narrative (Holck, Dahlgren Sandberg & Nettelbladt, 2011; Norbury & Bishop, 2003). ToM is impaired in people with ASD (Dahlgren, 2002; Happé, 1994). Happé (1994) investigated a set of ToM-tasks including a so-called second order ToM-task of false belief (FB). FB means understanding that one person can act on false premises (Nettelbladt, 2013, p. 113), which children at the age of 7–8 years usually master (Dahlgren, 2002; Nettelbladt, 2013).
1.1.3. Narrative ability

Creating and understanding a narrative or story is a demanding task requiring high-level language operations and different pragmatic skills. Narratives require planning, integration of information and the ability to judge the listeners needs, but also the cognitive ability to “shift” between the present, the past, the future and an imaginary world (Leinonen et al., 2000). Narratives can be of different types, and classic narrative is in focus in the present study. One common denominator in classic fictional narratives is the linguistic shape and story structure with a beginning, middle and end, as well as the importance of cause-effect relations in the narrative plot (Leinonen et al., 2000). These ingredients represent different types of coherence, or how the content is connected as a whole. When creating coherence discourse, relations between ideas like “X causes Y”, maintaining the same topic or goal in the narrative, and reflecting order of events in an intelligible way, are relevant competences. Leinonen et al. (2000) describes these main features of coherence as the linking of propositions or ideas in an orderly manner.

The structural connections in a narrative are referred to as cohesion. The most evident sign of cohesion in a narrative are words that link series of events together, for example “then” and “hence”. Cohesion can further be made by referring to a person (e.g. she), or a thing or event earlier mentioned (e.g. it). Coherence and cohesion are important aspects in narratives that develop during the pre-school years (Nettelbladt, 2013). At the age of 6 children can produce a narrative similar to adult narratives, containing the relevant features, but the ability of producing extended and more complex narratives with several or embedded elements develops over time (Leinonen et al., 2000).

Dodwell and Bavin (2008) describe understanding of narratives as “achieved by decoding the literal meaning of what is heard and using contextual information and general knowledge, inferring what is not directly stated” (Dodwell & Bavin, 2008, p. 204). This states that there are things not fully expressed in narratives, and in order to understand all events one must be able to make inferences or “read between the lines”. In this so called pragmatic inference (Verschueren, 1999), or inductive inference (Leinonen et al., 2000), usage of the context will be needed to gain understanding of the underlying meaning by “making connections between pieces of information” (Leinonen et al., 2000, p. 130). There are also different types of inference used when answering questions. Norbury and Bishop (2002) define two different types; text-connecting inference, when integrating information from different parts of the narrative, and gap-filling inference that integrate general knowledge with information from the text.

Different narrative tasks as part of language assessment are common in clinical practice and research regarding several patient groups, analysed in several ways. Botting (2002) argued that narratives are one of the most ecologically valid measures of communicative competence; normative data is provided, narrative ability is associated with literacy ability, and narratives involve pragmatic elements which could distinguish different diagnostic groups. Two types of narrative tasks often studied are story recall when the subject retells a story they heard, and story generation where the subject without any model generates their narrative from a series of pictures. For story recall the Bus Story Test (BST) is a well-known test used in e.g. Åsberg Johnels, Hagberg, Gillberg and Miniscalco (2013) examining children with neurodevelopmental disabilities, and Holck (2009) examining children with CP and PLI. Regarding story generation Expression Reception and Recall of Narrative Instrument, ERRNI is used in studies examining narratives in children with for example SLI (Dodwell & Bavin, 2008). Botting (2002) compared generating and retelling a narrative in
children with SLI and PLI, aged 7:7–8:8. Her conclusion was that story generation is to be preferred before story recall. The generated narratives were longer, and errors in tense were fewer. Leinonen et al. (2000) also suggested that generating narratives is a more spontaneous type of narrative that reflects the child’s ability to organize and monitor the listener’s needs and be creative.

When making a narrative, different types of hesitations and self-repairs like repetitions often occur (Plejert, 2004). These phenomena are natural and can be described as conversational competence striving to correct and clarify utterances (Plejert, 2004). Depending on frequency and content, these phenomena might on the other hand make narratives more difficult to understand. Mazes is a term for these “extra materials” that does not contribute meaning when planning and coordination of complex utterances fails, studied in for example Fiestas, Bedore, Peña and Nagy (2005). They studied and defined different kinds of mazes in narratives generated by bilingual children aged 4–7 years. They found more immature types of mazes like filled pauses (e.g. uhm) and repetitions, and more mature types like connectors (e.g. and then between series of events), and phonological, lexical and grammatical revisions (Fiestas et al., 2005). No significant difference between the groups was found in amount of mazes, but the bilingual group used significantly more repetitions than the monolingual children.

When analyzing narratives one can focus on the global or local structure, like Norbury and Bishop (2003) examining children with ASD. Global structure refers to organization of the narrative in hierarchical sequence of events. The local structure, on the other hand, concerns analyzing sentences according to syntactic complexity, number of words, and the linking of events via referential cohesion such as anaphoric referencing like “he”. Norbury and Bishop (2003) note, that in ASD the global structure of narratives have been reported more impaired than the local structure. In their study, core language abilities (receptive grammar and language, vocabulary and sentence recall), rather than pragmatic skills or diagnose, tended to influence narrative ability (Norbury & Bishop, 2003). A structured measurement of narratives is Narrative Assessment Protocol (NAP) (Bliss, McCabe & Miranda, 1998) which can be used examining narratives at a macro level resembling the global structure, or a micro level similar to the local structure. Holck (2009) and Holck et al. (2011) for example, used the macro level in NAP to assess ERRNI in children with CP.

1.2. Other cognitive abilities

1.2.1. Executive functions

When discussing neurodevelopmental disorders like ADHD and ASD, executive functions (EF) are a field of interest. There have been different ways of describing EF, and one definition refers to “cognitive management functions of the brain” helping to “prioritize, integrate, and regulate other cognitive functions” (Brown, 2005, p. 10). Abilities included in EF are for example activation, focus, effort, emotion, memory, action (Brown, 2005), inhibition, visual working memory, planning, cognitive flexibility, and verbal fluency (Geurts, Verte, Oosterlaan, Roeyers, & Sergeant, 2004). Many of these abilities are more or less affected when having ADHD, and others are more dominant in ASD (Guerts et al., 2004). There is no contradiction between having problems in EF combined with good cognitive skills. Two metaphors often used describing EF is in terms of the conductor of a symphonic orchestra or the operating system of a computer. Without organizing the instruments actions or integrating software there will be obvious dysfunction. Brown (2005)
further discusses EF, suggesting that lack thereof is a large aspect in different learning and psychiatric disorders:

/…/ executive functions are basic and essential to the integrated operation of many diverse activities of the mind; consequently individuals with weaknesses in the development of their executive functions are likely to be more vulnerable to many other types of psychiatric impairment /…/ (Brown, 2005, p. 239).

1.2.2. Higher level language

More demanding language tasks like understanding of understated information and figurative language can be referred to as concerning higher level language (HLL). In 1998, Brunnegård and Laakso suggested a definition of HLL as “the ability to use complex linguistic and cognitive processing” (p. 26). Saldert (2006) studied right- and left hemisphere damage, adding that the subtle language deficits associated with HLL “can often be related to the lexical and syntactic aspects of language and communication, although the impairment becomes noticeable when one considers the pragmatic aspects of language” (2006, p. 5). Brunnegård and Laakso (1998) studied Multiple Sclerosis (MS) and developed a test battery assessing higher level language, called BeSS and later developed into TBSS (Bedömning av Subtila Språkstörningar, Assessment of Subtle Language Deficits; Brunnegård & Laakso, 1998; Laakso, Brunnegård, Hartelius & Ahlsén, 2000; Laakso, 2007). Difficulties in all tasks in BeSS, but also working memory tasks, were found in their sample with MS-patients. Despite the initial use, the test was not designed with a specific patient group in mind but for people suffering from subtle language deficits, but they suggest HLL being impaired in patient groups with Parkinson's disease or right hemisphere damage (Laakso et al., 2000; Laakso, 2007). HLL depend on cognitive abilities like memory (Laakso et al., 2000), thus adequate pragmatic abilities might be considered as required when computing more demanding language tasks and processing language on a higher level.

1.3. Language disorders

Depending on used cut-off, the amount of children with Language Impairment, LI, varies between 3 to 10% (Nettelbladt & Salameh, 2007), or approximately 5% (Ek, 2015). Internationally the amount of severe language problems in children is 1–2% over time (Leonard, 2014). More boys than girls have LI, but the prevalence differs due to the severity of the impairment, and whether referring to already diagnosed or unselected groups of children (Leonard, 2014).

Different developmental language impairments have been a subject for discussion during several years, since the interpretation of the diagnose criteria is rather complex. This “mayhem in diagnostic labels” is discussed for example by Bishop (2014, p. 381). The need for a more “pure” diagnose than LI, with strict criteria for research purposes, lead to the diagnose Specific Language Impairment (SLI). SLI is a developmental disorder with significant language difficulties without hearing impairment, and with other cognitive abilities and neurological status matching the individual’s age (Leonard, 2014). If pragmatic difficulties are the main problem, then the diagnose Pragmatic Language Impairment (PLI) is suggested.

In order to reflect the heterogeneity of language difficulties, Bishop (2004b) suggests a dimensional approach rather than categorical in clinical practice to capture the specific
language profile in each child, not “a single diagnostic solution for a range of problems” (Bishop, 2004b, p. 309). Language difficulties also changes over time in that some children might still have various symptoms during childhood and adolescence, and others might develop a language matching their mental age in all aspects (Nettelbladt & Salameh, 2007). In this perspective the term LI is a better option in clinical practice, since it is more flexible and can be used to describe different type of language difficulties, including pragmatic disabilities, more in full.

Comorbidity is common in children with language diagnoses, but one problem with the strict SLI-criteria is that it negates other diagnoses like intellectual disability, ASD or ADHD. Ek (2015) stresses that language difficulties might constitute an early marker for neurodevelopmental disorders, and therefore suggests multidisciplinary assessment. Despite the frequent coexistence of LI and neurodevelopmental disorders, there are children with severe LI as the main and only diagnose (Nettelbladt & Salameh, 2007, p. 18). These children might undergo neurodevelopmental assessment because of coexisting deficits, and are at risk of being underdiagnosed with LI, since their language difficulties are interpreted as part of ADHD or ASD (Nettelbladt & Salameh, 2007).

1.4. Neurodevelopmental disorders

ADHD and ASD are both neurodevelopmental, behavioral diagnoses, and there are many features in their criteria that concerns language abilities. The current manual used when assessing ADHD and ASD is Diagnostic and Statistical Manual of Mental Disorders 5th ed., DSM-5 (APA, 2013). The former diagnose manual DSM-IV and DSM-IV-TR was released in 1994, and 2000 respectively (DSM-IV, APA, 1994; DSM-IV-TR Text Revision, APA, 2000), and there are some changes in both diagnoses and criteria between the manuals.

1.4.1. Autism

1.4.1.1 Definition of Autism

In earlier diagnostic manuals ASD was referred to as one category, but in DSM-5 the idea of a spectrum of disorders constituting autism is presented, hence the definition autism spectrum disorder. ASD criteria are divided into the spheres social communication, respectively repetitive behaviors and interests. Deficits in social-emotional reciprocity, nonverbal communicative behaviors and developing, maintaining, and understanding relationships constitute the first sphere, where language ability is crucial. Inadequate usage of speech like echolalia, idiosyncratic phrases, ritualized patterns or verbal behavior are traits in restricted, repetitive patterns of behavior using language. The severity of the disorder will be graded at a scale from 1 to 3 depending on the amount of support needed. A specification to the ASD whether accompanied with an LI or not is to be done as part of the diagnostic routine. ASD can also occur with or without cognitive disabilities. The prevalence of autism in children is 1–1.4%, but “autism like traits” that does not fulfill criteria for ASD, can be found in about 3–7% of all school-aged children (Gilberg, 2015).

1.4.1.2 Language and Autism

Communicative abilities in children with ASD vary much within the spectrum (APA, 2013; Bruce & Thernlund, 2008). Pragmatic problems can concern prosody, difficulties grasping the conversation-partners perspective, talking excessively about own special interests, or
only using language in an instrumental way in order to achieve something from others (Bruce & Thernlund, 2008). Some children talk very sparse and display a clearly deviant communication profile, while others talk more like their peers, but with pragmatic deficits that might cover other underlying language problems. In 1997, Rapin and Dunn wrote an article often cited on language deficits in ASD, emphasizing the pragmatic difficulties, but widening the communicative discourse by exemplifying different levels of language possibly impaired in ASD. The lower levels of language processing like phonology and syntax might be equally impaired as the higher levels of complex syntax, semantics and formulation of discourse, forming a spectrum of more or less severe communicative impairments. The less language impaired type of ASD is sometimes referred to as high functioning autism (HFA) in literature, as opposed to low functioning autism (LFA) with poorer functioning level in all areas, language included. The terms HFA and LFA are not used in DSM-manuals, and do not constitute actual diagnostic subcategories of ASD. Functioning profiles in HFA resemble the former diagnose Asperger’s Disorder (AS), which in DSM-5 has been incorporated under the ASD-spectrum. The main diagnostic criteria separating AS from autism in DSM-IV-TR (DSM-IV-TR Text Revision, APA, 2000) was normal language development and cognitive development in childhood. Rapin and Dunn (1997) described AS in terms of late developed but eloquent speech, combined with deviant lexical organization, prosody and pragmatics, as an example of what they call an higher order semantic/formulation processing disorder. The idea of AS as a discrete subtype of autism is controversial, Boucher (2003) notes in a review-article. Boucher (2003) further makes a comparison between the diagnoses, suggesting AS is the least language impaired one, but language acquisition might be mildly impaired in HFA, and moderately to severely impaired in LFA. Macintosh and Dissanayake (2004) also discuss the similarities in AS and HFA, but in terms suggesting an autism spectrum.

1.4.1.3 Pragmatic and narrative abilities in Autism

Pragmatic disabilities are well known and described in ASD, and are discussed in Leinonen et al. (2000) for example. A longitudinal study by Miniscalco, Rudling, Råstam, Gillberg and Åsberg Johnels (2014) investigated pragmatic skills in young children with ASD. The mean age of the children was 41 months at the first assessment, and 54 months during follow up. They found that pragmatic ability at later ages could be predicted, not by core language features like expressive language and grammar, but through the ability to imitate the gestures of adults.

Related to pragmatic disabilities, children with ASD have been reported to have difficulties disambiguating nonliteral language like metaphors (Mashal & Kasirer, 2011). Understanding of conventional metaphors was clearly impaired in 13-year old children with ASD or learning disability compared with age-matching controls, indicating that the expressions were more familiar and accessible in the control group. Made up novel metaphors were as difficult for the control as for the ASD group. This finding implicates that children with ASD do have the ability to connect seemingly unrelated concepts in a new semantically meaningful way (Mashal & Kasirer, 2011).

Narrative ability in ASD has been assessed in various perspectives, concerning for example inference and referencing, referring to specific objects or persons. Arnold, Bennetto and Diehl (2009) examined numbers and types of references in narratives elicited from a cartoon told by 9–17 years old children with HFA. Both groups used adult-like patterns in processing conditions and connection to discourse, when choosing references. There was a
tendency that the children with HFA did not use as many references as the controls. 9–12 years old children with HFA used fewer pronouns (she and it) or zeros (and ø ran) than older children with HFA and controls, showing a developmental trend in HFA, but not in controls. Explanations might be that their activation of uttered pronouns faded more quickly, or that their threshold for interpreting pronouns or zeros was higher (Arnold et al., 2009). Norbury and Bishop (2002) studied inference ability in 8–9 years old children with SLI, PLI and HFA. The subjects were asked literal questions about spoken narratives. Some questions concerned text-connecting inference; integrating information from different parts of the narrative, and some tested gap-filling inference; ability to integrate general knowledge with information from the text. They found that the groups with HFA, SLI and PLI received lower scores in all questions than the control group, and that the gap-filling questions were more difficult. Children with HFA had the highest number of inadequate answers. A tendency found in the results was that HFA had the lowest scores in inferential questions. This was more related to their presence of autistic behaviors rather than connected with SLI. Story recall and inference ability were linked to each other, “inferencing supports comprehension, which in turn aids recall by enabling listeners to build a more stable representation of the story” (Norbury & Bishop, 2002, p. 248). Botting (2002) studied narratives in children with PLI or SLI, and she suggested a questionnaire regarding pragmatics to distinguish SLI from PLI or ASD, as a complement to language assessment.

Other inference disabilities have been reported in ASD. In a study by Saldaña and Firth (2007), adolescents with ASD and poor reading comprehension were tested regarding inference ability in written text. The results showed that questions evoked by the preceding text were easier to read and answer more quickly if semantic inference were possible, than if the question was contextually irrelevant. Saldaña and Firth (2007) suggests that inferencing at an automatic level might be the underlying problem in ASD in understanding texts combined with the ability to make inferences possible. One other study compared novelty word learning in 5–9 year old children with ASD versus typically developed 2-year olds (Preissler & Carey, 2005). The results showed that novelty word learning failed in the ASD-group when the test leader made inferences by naming and referring to an object held by the adult only. If the adult referred to the object held by the child, novelty words were easier to obtain in the ASD-group.

1.4.2. ADHD

1.4.2.1 Definition of ADHD

According to DSM-5 (APA, 2013), the main characteristics in ADHD are inattentiveness, respectively hyperactivity and impulsivity. Difficulties can be observed in particularly one of these domains; predominantly inattentive or hyperactive/impulsive type of ADHD; or as a combined type of ADHD including all domains. In the diagnostic manual International Classification of Diseases, 10th ed. (ICD-10), symptoms, predominantly within the inattentive domain, would be referred to as Attention Deficit Disorder (ADD). In ADHD criteria language is mentioned within both the inattentive and hyperactive/impulsive domain. These examples of inattentive markers in conversations and reading regarding difficulties listening when spoken to, following instructions and reviewing lengthy papers, all include a language component. Within hyperactive/impulsive symptoms traits such as excessive talking, problems with turn-taking in conversations, blurring out answers in advance, filling in others utterances disruptively, or otherwise interrupting or intruding on others talk are directly linked with language problems in the pragmatic domain. In Europe and Northern
America, percentages of ADHD in children and youth were 3–6% in 2008 (Bruce & Thernlund, 2008).

As earlier mentioned, several of the core symptoms in ADHD and ADD can be described as problems in EF, including activation, focus, effort, emotion, memory and action (Brown, 2005). During complex interaction heavy demands are placed on these abilities, especially since there are different functional processes that operate simultaneously. Poor working memory will complicate the reciprocal communication situation where concurrent functions must be used for understanding the conversation partner and formulate a response. EF plays a great role in listening, speaking and mastering pragmatically related issues. All links in organizing and selecting obvious and implicit communicative information, making sense of the information, forming a coherent output and interpret the listeners’ reaction, are supported by EF.

Brown (2005) preferred viewing ADD not as a single disorder, but “as a cluster of impairments that cuts across other diagnostic categories” (2005, p. 238). He underscored that all impairments seen in ADD or ADHD are not specific to the particular disorder, but also occurs in many other diagnoses, like various types of EF deficits in communicative impairments or Asperger’s Syndrome. Brown (2005) suggests that overlap in ADD and other disorders regarding reading, writing, mathematics, and psychiatric disorders might occur due to lack in EF. Brown (2005) further discuss that children with ADHD are six times more likely to have a coexisting psychiatric or learning disorder, and two to three times more likely to have a reading or writing disorder compared to their peers. According to Brown (2005) many children with ADHD suffer from unidentified impaired communication deficits. Behavioral problems are more likely to be recognized than language problems, and Brown (2005) suggests that both deficits are manifestations of EF impairment. Also Dodwell and Bavin (2008) suggest that children with LI are more likely to show difficulties with attention. Because of the overlap in symptoms between different neurodevelopmental diagnoses, there is support behind the idea of continuums of disability rather than strict categories.

1.4.2.2 Language and ADHD

Not all children diagnosed with ADHD were initially referred to a psychiatric clinic. According to Oram, Fine and Okamoto (1999) 20–60% of all children with ADHD have additional LI, suggesting that many children with ADHD primarily will be found in SLP-clinics. Their study investigated different language tasks trying to distinguish subtests from CELF-R for example of particularly difficulty in ADHD. They found that some, but not all tests were more difficult for ADHD without LI, but Listening to Paragraphs did not differ in ADHD compared with the control group, but were difficult for ADHD and LI. They also found that Formulated sentences were difficult in ADHD without LI, contrary to Cohen et al. (2000), who found that LI plus ADHD or other psychiatric diagnoses had greater language difficulties than ADHD in that task.

Martinussen (2015) examined oral language skills combined with ADHD and reading disabilities in an educational context. He stated that “it is important for all involved in promoting academic success for children and youth with ADHD to recognize the potential for overlap between ADHD and reading and language impairments and to design instruction accordingly” (Martinussen, 2015, p. 12.).
Cohen, Barwick, Horodezky, Vallance and Im (1998a), studied LI in psychiatric samples of children in several studies. In one study they assessed language in 380 children, aged 7–14 years, and referred to a psychiatric clinic regarding externalizing behavior and/or emotional symptoms, ASD excluded. They found that 40% of the children also had additional unsuspected language impairment (USLI) prior to their study. Together the children with a previously identified LI (PILI) and the ones with a previously unsuspected LI amounted to 63.6%, thus a high rate of LI is likely to be found in a psychiatric population (Cohen et al., 1998a; Cohen et al. 2000). Reasons why there was such a large USLI group are unclear, but the results indicate that their LI was slightly less severe than in the PILI group. The authors also found that the mothers of the USLI group had a lower level of education and might be language impaired as well, taking the genetic aspect of LI into account (Cohen et al., 1998a). 46% of the children with USLI or PILI had a comorbid condition of ADHD (Cohen et al., 1998a; 2000). Children with PILI were more likely to be diagnosed with ADHD, and displayed more severe problems than children without LI but with other psychiatric diagnoses (OPD) (Cohen, Menna, Vallance, Barwick, Im, & Horodezky, 1998b). Further the PILI children did show more difficulties in pragmatically related contexts of social cognitive processing like emotion decoding and social problem solving, especially tasks with linguistic elements, than the OPD children (Cohen et al., 1998b). Cohen and colleagues (1998a; 2000) assessed structural language, narrative discourse, pragmatics, intelligence, achievement and EF. In aspects of structural language, narrative discourse and pragmatics, LI + ADHD likewise LI + OPD, got lower results in all these subtests than only ADHD, and narrative discourse was by far most difficult for LI + ADHD. Differentiated in subgroups also distinguishing reading disabilities (RD), narrative discourse got lowest scores in LI + ADHD + RD, better in ADHD + LI, and best in ADHD. Pragmatics were only negatively affected in ADHD + LI + RD but got the same values in ADHD + LI and ADHD. Their results implicate an overlap in structural language and pragmatics, as well as an association between poorer pragmatic abilities and comorbid conditions in LI, ADHD and RD. Despite the psychiatric diagnosis, children with comorbid LI are at greater disadvantage, Cohen and colleagues (1998a; 1998b; 2000) also conclude.

1.4.2.3 Pragmatic and narrative abilities in ADHD

Various aspects of pragmatic skills have been under examination in several studies related to ADHD. Constructing narratives is a demanding task occupying working memory, which is discussed by Brown (2005), and he suggests that story recall tests is an effective measure of working memory when assessing ADHD. In Mathers (2006), 11 children with ADHD without LI, 8–11 years, were assessed in three different text tasks; written and oral presentation. Functional analysis studied, amongst other features, their ability of formulation through features like mazes, pauses and abandoned utterances. Only one of these aspects, amount of abandoned utterances, was significantly higher in the ADHD-group. Furthermore, errors in spelling and punctuation were more frequent in the ADHD-group. Despite no LI or RD, the ADHD-group displayed these types of phenomena in oral and written texts, maybe as a result of inability to sustain attention, the author suggests. Initially there were 25 children in the ADHD-group, but 14 were excluded because of their deficits in language, which is a striking example of the comorbidity in LI and ADHD. As suspected, children 5–12 years old with ADHD were reported having more pragmatic problems compared to a control group without any diagnose in a Finnish study (Väisänen, Loukusa, Moilanen, & Yliherva, 2014). None of these 19 children were diagnosed with LI of any kind, implicating that many children with ADHD suffers from undetected subclinical LI and therefore need further assessment and intervention regarding language and pragmatic abilities. Väisänen
and colleagues (2014) stated that there is a need for routine evaluation of language and communication skills in every child in whom ADHD is suspected.

1.5. Comorbidity between language, ASD and ADHD

There is a documented comorbidity between language difficulties, ADHD and ASD. A review found that the rate of overlap in ADHD and ASD varies between 14–78% in different studies (Gargaro, Rinehart, Bradshaw, Tonge, & Sheppard, 2011). They also discuss that the diagnostic manuals prior to DSM-5 did not accept coexistence between the diagnoses, but DSM-5 does. According to Simonoff et al. (2008), ADHD is the second most common coexisting diagnose in ASD at a percentage of 28.2%, the rates of one coexisting diagnose in ASD was 70%, and rates of two or more comorbid diagnoses was 41%. Gillberg (2015) says that LI is found in 30% of ASD, and that ADHD is found in 40% of ASD. Keen and Ward (2004) studied ASD in children with “unusual behaviors” in different types of special education need, compared with main schools in England. They found that the number of recorded ASD diagnoses in these children doubled in a four-year period. The age of receiving diagnosis fell from 11:7 to 3:4 years if diagnosed in 1997 compared with 2001. There was also an increasing overlap of ADHD in the children diagnosed with ASD, the comorbidity rose from 5.2% to 13.7% in four years. Keen and Ward (2004) therefore suggest that the higher rates of comorbid ADHD and ASD is due to a greater recognition of ASD in cognitive able children and in children who were earlier only diagnosed with ADHD.

Gillberg and Fernell (2014) suggest that the reported increasing rates in diagnosed ASD are due to the so called “Autism Plus” discourse, referring to ASD in comorbidity with intellectual disabilities, LI and ADHD. Earlier the comorbid diagnoses were given priority, and the diagnostic summary might therefore include an addition of autistic features. Gillberg and Fernell (2014) argue that one reason diagnosing ASD in these children at a greater degree nowadays is connected with the support obtained in school and from the community, which seems to be available in larger amounts when diagnosed with ASD versus solely the “Plus” diagnoses mentioned – despite the fact that children with needs, regardless of diagnose, have the right to get the help they need in school. As an attempt to receive a more overlapping continuum-based view on different neurodevelopmental problems in young children, their research team initiated the ESSENCE-concept: Early Symptomatic Syndromes Eliciting Neurodevelopmental Clinical Examinations (Gillberg & Fernell, 2014). Included diagnoses in the ESSENCE-concept are ASD, ADHD, LI, intellectual developmental disorder (IDD), developmental coordination disorder (DCD), tics and Tourette's disorder, reactive attachment disorder and behavioral phenotype syndromes. In ESSENCE, there is a focus on both epidemiologic and clinical evidence. Children experiencing difficulties within the ESSENCE-sphere are often diagnosed only with ASD, likewise “Autism Pure” might be missed in children not showing other difficulties than those stated in diagnostic criteria for ASD (Gillberg & Fernell, 2013). Gillberg (2015) underscores that ASD discovered in pre-school-age almost always is “Autism Plus” with a comorbidity of equally important LI, ADHD or other ESSENCE-features.

Fernell, Norrelgen, Bozkurt, Hellberg and Löwing (2002) studied developmental profiles in 25 preschoolers, 5–7 years old, with LI. They found that 87% of the children with moderate to severe LI had associated developmental problems regarding attention, impulsivity, hyperactivity, ASD-symptoms, motor performance, cognitive level and auditory perception.
A multidisciplinary approach assessing and treating children with LI is therefore suggested (Fernell et al., 2002).

Geurts et al. (2004), studied EF in 6–12 years old children with ADHD (both combined and inattentive type, ADD) and HFA using word fluency tasks based upon phoneme or initial letter, and semantic categories like animals. They found that both children with ADHD and HFA performed similar on these tasks, at a significantly lower level than their peers. They also noted that the measures concerning EF in the groups with ADHD and HFA became even more difficult to separate, when the inattentive type of ADHD, ADD, was excluded from the analysis.

A person can have both LI and ADHD, but it can be difficult to distinguish LI in ADHD due to the overlap in diagnoses that often occur, and because of the possible similarities in expression. Suggested methods measuring language difficulties, with or without coexisting ADHD, is non-word repetition, repetition of sentences, and ability to inflect verbs. Studies have also investigated the ability of non-word repetition and sentence repetition in children with ASD (Harper-Hill, Copland & Arnott, 2013).

Helland Lundervold, Heimann and Posserud, (2014) found that children with behavioral problems (BP), at 7–9 years do have more language problems than their peers. Their problems with peer-relations and language at the age of 7–9 years predicted pragmatic difficulties at 12–15 years, but the authors also conclude that the relationship is bidirectional; pragmatic difficulties also cause peer problems. One third of the children with BP primarily display pragmatic problems, and another third primarily had problems in their structural language. These findings implicate that the lack of overt speech problems in the BP-group may mask more severe underlying communication problems vital to recognize via language assessment as an integral part of diagnostic routine in BP (Helland et al., 2014). Harper-Hill, Copland and Arnott (2013) emphasize the need of targeted intervention concerning coexistence of language difficulties and hyperactivity in children with ASD.

Harper-Hill et al. (2013) found two clusters comparing 9–16 year old children with and without ASD; 6 children had moderate difficulties in non-word and sentence repetition combined with more severe ASD, and 29 children had no difficulties in non-word and sentence repetition combined with less severe or no ASD. Spoken non-word and sentence repetition did discriminate a cluster of children with a combination of more severe ASD, oral language impairment, deficits in attention and reading, suggesting that the more severe the ASD, the more likely the occurrence of comorbidity with LI and hyperactivity. The results also indicate that profiles in ASD related to language can be very heterogeneous, and that poorer performance in non-word and sentence repetition might be predictive for ASD.

There are many referred studies that show a substantial overlap and comorbidity between ADHD, ASD and different language difficulties, suggesting multidisciplinary teams with SLPs included assessing neurodevelopmental disabilities. The comorbidity in the diagnoses is bidirectional, and studies also show importance of broader multidisciplinary assessments in children with LI (Ek, 2015; Fernell et al., 2002). Since disabilities in social communication or pragmatics constitute one of the core areas in ASD-criteria, connections between PLI and ASD have been studied. Bishop and Norbury (2002) studied children with SLI, PLI and ASD, using questionnaires for the parents and assessments for the children. They found that some children scored positive for both PLI and ASD, some only for PLI, and some children who were previously diagnosed with ASD did not meet criteria for ASD.
in any diagnostic instrument used. Worth noting is that according to DSM-5 (2013), these children still would be considered having ASD because of their anamnestic history of ASD, if they need help and support onwards. In the combined group with PLI and ASD excessive interest in objects and over-activity was higher than in the PLI-group. Pragmatic disabilities in the PLI-group were for example odd intonation and prosody. They conclude that PLI is not underdiagnosed ASD, and that the lines between PLI and ASD, as well as PLI and SLI are fuzzy. Kelley, Paul, Fein and Naigles (2006) found that children with former ASD-diagnose that no longer met ASD-criteria, had persisting difficulties in pragmatics abilities like narratives and ToM, and in semantic abilities. Due to this overlap, Bishop (2004b) concludes that pragmatic problems are best assessed by multidisciplinary teams in order to be able to detect possible ADHD or ASD.

1.6. **Purpose of the study**

The present study had a purpose to increase knowledge about the pragmatic competence and language abilities in children with ADHD and/or ASD recruited from CAP or Children and Adolescent Habilitation (CAH). Features and traits of language difficulties are most often applicable in these children in varying domains, severity and extent. The reason they are referred to CAP might be their irregular functioning profile, which makes diagnostic differentiation taxing (BUP Skåne, 2014). Because of this pattern of overlapping difficulties, language problems and more subtle pragmatic deficits will be at focus in the present study.

Originally the aim for the present study was to compare two groups of children with diagnoses; one with ADHD and one with ASD. Due to difficulties recruiting subjects via CAP and CAH with “pure” diagnoses, which will be further discussed in the Method chapter, all children with neuropsychiatric diagnoses were analyzed as one group. The children in this somewhat heterogeneous diagnose group obtained their diagnose/-s prior to or during participating in the present study. Also this matter will be thoroughly explained in the Method chapter.

2. **Hypotheses**

The hypothesis in the present study was that connections might be found between tests measuring pragmatic and language abilities in children with neurodevelopmental diagnoses like ADHD and ASD. One further hypothesis was that some or several of the tests in the testing battery from the present study would cause more problems in the diagnose-group (D-group). It was also hypothesized that the D-group’s responses in the test battery would make it possible to differentiate subgroups with different patterns of pragmatic or linguistic strengths and difficulties.

2.1. **Research questions**

1. Does the test battery in the present study reliably distinguish the diagnose-group from the non-diagnose group?
2. Is there a correlation between language tests and tests regarding pragmatic ability in the diagnose-group, and how is that potential connection manifested?
3. Is the test battery in the present study adequate for assessing language in children with ASD and/or ADHD, or are some of the subtests sufficient?
4. Can subgroups in the diagnose-group be found, based on all test results, using cluster analysis?

3. Method

3.1. Participants

In the present study two groups of children were tested for language and pragmatic abilities, all in all 48 children. There was one group with diagnosis ADHD and/or ASD (D-group) and one age matched control group of children with no diagnose of our knowledge (ND-group). Ages in both groups ($n = 48$) were 9:4–13:6 years ($M = 11:7$ and $SD = 0:11$ years). The D-group consisted of 18 boys and 4 girls ($n = 22$), aged 9:4–13:6 years ($M = 11:5$, $SD = 1:2$). In the ND-group there were 16 boys and 10 girls ($n = 26$) aged 10:5–13:4 years ($M = 11:9$, $SD = 0:8$). Initially there were 27 children in the ND-group, but one subject was excluded due to low test-results indicating an LI, therefore the ND-group eventually came to consist of 26 subjects.

There were different patterns of comorbidities in the D-group, but the core diagnoses were ADHD ($n = 14$) and ASD ($n = 8$), with a total of 22 children ($n = 22$). All diagnoses in the D-group were distributed as follows: ADHD ($n = 7$), ADHD + depressive episode ($n = 1$), ADHD + Tic Disorder ($n = 1$), ADHD + Tic Disorder + Oppositional Defiant Disorder (ODD), moderate grade ($n = 1$), ADD or ADHD with primarily attention deficits ($n = 4$), ASD ($n = 2$), ASD + ADD or ADHD with primarily attention deficits ($n = 2$), ASD + ADHD ($n = 2$) and ASD + LI ($n = 2$).

3.1.1. Inclusion- and exclusion criteria

The primary aim of the present study was to observe differences in language and pragmatic ability in children with ADHD or ASD related to typical development. Included in the study were children with ADHD and/or ASD in the D-group. The suggested ages for inclusion were 10:0 to 12:11 years in both groups. Intellectual disabilities, and disabilities regarding vision or hearing, were excluded, due to the primary aim of the study. Subjects with other primary language than Swedish and subjects with a history of language diagnoses and/or previous contact with a speech-language pathologist, SLP, were also to be excluded. These exclusion criteria were set early in the process of the study, but had to be slightly adjusted in order to gain a reasonably large sample of children. A few children in the remaining D-group were therefore bilingual or had a history of sparse SLP-contact. In the ND-group the exclusion criteria remained as specified above.

3.2. Instruments

The tests used in the present study investigating language abilities were Test for Reception Of Grammar (TROG-2, Bishop; Swedish manual, Garsell, 2009), the short Kent Rosanoff-list, KR-list (Gustavsson & Liljegren, 2011; Johansson & Wahlstrand, 2010; Mikoczy &
Nyman, 2008; Salameh, 2011), *Words* from the testing battery BeSS/TBSS (Laakso, 2007), Boston Naming Test, *BNT* (Kaplan, 1983), the phonetic word fluency test *FAS* and the semantic word fluency test *Animals* (Swedish standardization by Carlsson, 2009). For measures of pragmatic abilities *Metaphors* from the testing battery BeSS/TBSS (Laakso, 2007), *Understanding Spoken Paragraphs, USP*, and *Pragmatic Profile, PP*, from the testing battery CELF-4, Clinical Evaluation of Language Fundamentals, Fourth Edition (Semel, Wiig & Secord; Swedish manual, Garsell, 2013) and Expression Reception and Recall of Narrative Instrument, *ERRNI* (Bishop, 2004a) were used.

### 3.2.1. Assessment of language

**Receptive grammatical comprehension.** The Test for Reception Of Grammar, *TROG*, is a test measuring the subject’s understanding of grammatical constructions retrieved from spoken sentences accompanied by multiple-choice pictures (*TROG-2*, Bishop; Swedish manual, Garsell, 2009). *TROG-2* was released 2003 in English, and the Swedish translation and norms were released in 2009. *TROG-2* consists of 80 tasks in 20 blocks with different types of sentence constructions. There are four sentences in each block and four multiple-choice pictures per sentence. The subject is told to choose the picture that most correctly represents the sentence by pointing or saying the digit 1–4 written on the pictures. The subject will only hear the sentences. All four sentences must be correctly answered for the block to be considered passed. If the subject answers at least one task per block in five blocks in a row incorrectly, the test is discontinued. The complexity of sentence constructions increases throughout the blocks in the test according to English norms (*TROG-2* Swedish manual, Garsell 2009).

**Defining words.** This is a subtest from the test battery BeSS (Bedömning av Subtila Språkstörningar), developed by and revised into TBSS (Test för Bedömning av Subtila Språkstörningar) by Laakso (2007), investigating difficulties in higher level language. In the subtest *Defining words*, there are ten words like “generous” and “distance” that the subject will hear and is encouraged to describe and define using own words. The score is 3 points for right answer, 1 point for slightly deviant answer, and 0 points for wrong answer or answer given outside the time limit of 30 seconds per question, giving a maximum raw score of 30 points. If the subject only formulates a sentence containing the given word, but not describes the word using a synonym, other words or sentence, 0 point is given. If needed some help could be given: “Can you think of anything else it could mean? Could you be more specific?”, but then maximum score is 1 point despite correct answer. There are Swedish standardizations for some ages. The youngest age-span is 14–16 years, with a medium of 19.1 (Olsson-Bolonassos & Sundfors, 2008), and for ages 16–19 years, medium is 25.6 (Andersson & Wieslander, 2012). Because of the lack of Swedish norms in the studied ages, the ND-group constituted a norm-group the D-group was measured against. Laakso’s instructions from 2007 were used in the present study.

**Word-retrieval.** Boston Naming Test, *BNT*, was originally created for assessing patients with aphasia and is a test measuring the subject’s capability of confrontation picture naming (*BNT*; Kaplan, Goodglass & Weintraub, 2001). *BNT* is a test with 60 black and white hand drawn pictures representing words of increasing difficulty. The subject is told to name each picture, giving a maximum raw score of 60 points. According to the manual, if the subject names eight pictures consecutively incorrectly, the test should be discontinued. If the subject does not name the picture within 20 seconds the answer will be considered incorrect regardless what answer the subject might give. Stimulus cues can be given if the subject
does not recognize the picture or misinterprets the picture visually, for example calls a *mushroom* an *umbrella*. The subject is then given the stimulus cue “something you can eat” for *mushroom*. If the subject does not respond correctly within 20 seconds after the stimulus cue a phonemic cue is given. The subject will then hear the word initial phonemes as a cue, often represented by the first letters. For example “the word starts with *mu*...” for *mushroom*. Correct answers given aided by one or two cues are noted in the protocol when adding the results.

First normative data for adult Swedish speakers with 16 answering categories and translation of the target words was made by Tallberg (2005). Normative data for Swedish speaking children, 6–15 years old, was made by Brusewitz and Gómez-Ortega (2005). Both studies did chose to accept *Target words*, *Synonyms* and *Subordinated words* as correct answers, and all other answers were classified in other categories due to type of error, and were all considered incorrect. The subjects in the present study were given all the 60 pictures according to the scoring manual and norms from Brusewitz and Gómez-Ortega (2005). All subjects in the present study got stimulus and phonemic prompting when misinterpreted visually or giving no a

**Word fluency.** Phonemic and semantic word fluency was assessed in the present study using *FAS*. *FAS* is a test measuring phonemic word fluency. It is commonly used by SLPs as well as psychologists, and is easy to administer. The subject is encouraged to say as many words as possible starting with the given target letters F, A and S, during one minute per letter. Assessing both phonemic and semantic category based word fluency is common. In the present study the semantic category used is *Animals*. The instructions for *FAS* and *Animals* were inspired by Laakso (2007), only encouraging the subject to say other words than personal names during *FAS*. Carlsson (2009) made the Swedish norms and standardization used in the present study regarding *FAS* and *Animals* for children aged 6–15 years. When scoring *FAS*, the number of correct words emerged from all three letters are added. According to Carlsson (2009) neologisms and perseverations are considered incorrect in *FAS* and *Animals*. Words in other languages than Swedish were also considered incorrect. *Animals* considered incorrect when scoring were variations of species like *chicken*, *hen* and *rooster*, the word *human* and fantasy-animals like *Pokémon*.

**Lexical organization.** One method for investigating lexical organization derives from a discrete word association test made by Kent and Rosanoff (1910), translated into Swedish by Namei in 2002 (referred in Gustavsson & Liljegren, 2011; Johansson & Wahlstrand, 2010; Mikoczy & Nyman, 2008; Salameh, 2011). Kent and Rosanoff made a list of 100 words for the subject to hear one time each and associate from, initially aiming to assessing patients with schizophrenia. Mikoczy and Nyman (2008) suggested shortening the list when investigating lexical organization related to language comprehension in bilingual children speaking Arabic and Swedish. A shorter version with only 50 of the original words, more suitable for SLPs measuring depth of lexical organization, was made by Johansson and Wahlstrand (2010). Since their purpose of the test was measuring lexical depth rather than lexical width, Johansson and Wahlstrand (2010) chose the 50 most frequent words from the original list and excluded words that in Mikoczy and Nyman (2008) got the lowest amounts of answers. In their shorter list there were 35 nouns and 15 verbs, but the verb *light*, “ljus”, were considered both noun and verb. More abstract words and other words considered both
noun and verbs, such as *salt* were excluded. Cultural or socio-cultural influenced words such as *bible* and *whiskey* were also excluded. These word choices for the short Kent-Rosanoff-list was made in order to be able to capture all different aspects of reorganization during a child’s lexical learning.

In the present study this short Kent-Rosanoff-list, from now on referred to as the *KR-list* is used, and instructions were inspired by those Mikoczy and Nyman used in 2008. The scoring system was presented in Johansson and Wahlstrand (2010), and further developed by Salameh (2011) and Gustavsson and Liljegren (2011). The subject’s answers were categorized as: *Paradigmatic, Syntagmatic, Phonologic, Other* or *No answer*. When calculating the scores a formula was used computing whether the paradigmatic answers are greater than 60% the subject’s lexical organization is considered to be more adult-like (Gustavsson & Liljegren, 2011; Salameh, 2011). The syntagmatic-paradigmatic shift is considered to be completed if the number of the paradigmatic answers (P) is 60% or more than the syntagmatic ones (S) added to the paradigmatic ones. This formula was used: $P / S + P \geq 60\%$.

### 3.2.2. Assessment of pragmatic abilities

*Narrative generation and recall.* *ERRNI* stands for Expression Reception and Recall of Narrative Instrument, and was developed by Bishop (2004a) as an instrument measuring narrative expression and understanding via story generation. Translation to Swedish was made by Gustafsson, Kristoffersson and Åkesson in 2009. *ERRNI* is standardized in monolingual English speaking subjects from the age of four and upwards, but recommended usage is from the age of six. The test includes two different narrative tasks, the Fish story and the Beach story, consisting of 15 pictures each. Only one of these narratives is administered during one assessment in order to be able to make follow-up assessment in the same individual using the other narrative. Initially there is a “warming-up-picture” for the subject to describe. During the narrative assessment, the subject is told to carefully look at all the pictures in the narrative quietly, and then once again look at all the pictures from the start and generate a narrative based on the series of pictures. Then there is a break for 10–30 minutes when other tests can be administered. After the break the subject is without any previous information told to recall the narrative telling it once again, this time without looking at the pictures. After retelling the generated narrative, the subject is once again shown the pictures and given 9 comprehension questions regarding the content of the pictures, 6 of them concerning inference. The instructions the subject got were similar to those Gustafsson and colleagues translated into Swedish in 2009. In the present study the Fish-story is used since it contains a false-belief task, and since Gustafsson et al. (2009) found that the Fish story gained a higher score in Comprehension questions than the Beach-story. In the scoring procedure for *ERRNI* there are four different measurements: *Idea scores* (relevancy of information), *Comprehension questions* (understanding of the narrative), *MLUw* (Mean Length of Utterance word; complexity of grammatical structures), and *Forgetting score* (forgotten information from first to second time telling the story). The measurements *Idea scores, Forgetting score* and *Comprehension questions* will be used in the present study. Maximum *Idea score* and *Forgetting score* are 48 for each story, based on 24 “ideas” scored as 2, 1 or 0 points. There is one warm-up question followed by nine *Comprehension questions*, scored with 2, 1, 0 or –1 points. The minus-score will be given when the subjects answer is irrelevant in the context of the narrative, or if the subject totally misunderstood the question.
In the present study, the narratives emerging from ERRNI was also analyzed using measurements at a macro level from NAP, Narrative Assessment Protocol (Bliss et al., 1998), in order to evaluate a fuller range of narrative discourse. Following six dimensions were examined aided by NAP: Topic maintenance, Event sequencing, Explicitness, Referencing, Cohesion and Fluency. According to NAP-guidelines all six dimensions are defined in terms of “appropriate”, “variable”, “impaired” or “inappropriate”, and further described in words. The NAP model was used in Holck, et al. (2011) assessing narrative ability in children with cerebral palsy. They presented a scoring model: 3 points = “appropriate”, 2 points = “variable” and 1 point = “inappropriate”, which is also used in the present study. The author of the present study counted occurrences of inaccuracies in all six dimensions, and thereafter classified what amount of occurrences that corresponded to 3, 2 or 1 point in each dimension. The cut off demarcations was based upon the average performance in the ND-group. In Topic maintenance, Event sequencing and Cohesion this was the scoring cut off: 0 inaccuracies = 3 points, 1–2 inaccuracies = 2 point, 3 < inaccuracies = 1 point. In Explicitness and Referencing these were the numbers: 0–2 inaccuracies = 3 points, 3–5 inaccuracies = 2 points, 6 < inaccuracies = 1 point. Fluency was scored like this: 0–5 inaccuracies = 3 points, 6–11 inaccuracies = 2 points, and 12 < inaccuracies = 1 point.

Understanding spoken paragraphs. The subtest Understanding spoken paragraphs, USP, from the test battery CELF-4 (Semel et al.; Swedish manual, Garsell, 2013) was used to capture the subjects’ ability to understand orally presented narratives and make inferences. The subject heard three spoken paragraphs and answered five comprehension questions about each paragraph, which gives 15 points as a maximum raw score. Three of the questions concerned the main idea and details of the narrative, one question was an inferential one, and the last question concerned predictive information. The questions regarding inference can be described as gap-filling, also used in Norbury and Bishop (2002), suggesting that general knowledge integrated with information from the narrative is required to solve the question. The subject could only hear the narrative once, but the questions more than once if needed. The subtest understanding spoken paragraphs comes in two sets with different paragraphs depending on the subject’s age, 9–10 years or 11–12 ages. In each set there is one warming-up task followed by three tasks. Instructions from the Swedish manual were used in the present study.

Comprehension of metaphors. Metaphors is another original subtest from BeSS/TBSS (Laakso, 2007), as well as Defining words. There are ten metaphorical sentences that the subject will hear and read in written text. There is a warming-up sentence prior to the ten metaphors, and the subject also will get the correct interpretation of that metaphor. The metaphors could be: “Everything was built on air”, for example. A correct explanation gives 3 points, 1 point if the answer is vague or deviant but could be a possible interpretation of the metaphor, and 0 points if the answer is incorrect, no answer is given, for an answer given outside the time limit of 30 seconds per question, or if there is only a literal interpretation. Maximum raw score is 30 points. Laakso (2007) gave a few examples of correct answers, but several suggested wording of responses defined as 3, 1 or 0 points emerged from SLP-master’s theses by Einald and Hallberg (2015), Larsson and Nilsson (2015) and Kurt (2015). If the subject’s answer is sparse there is a possibility to give further instructions: “Can you think of anything else it could mean?”, but a correct definition of the metaphor after aid only gave 1 point. There are no Swedish norms for the studied ages, hence the ND-group constituted a norm-group comparing the D-group with. For ages 14–16 years the medium score is 19.3 (Olsson-Bolonassos & Sundfors, 2008), and for 16–19 years of age the medium
sore is 25.5 (Andersson & Wieslander, 2012). The instruction was the one suggested by Laakso (2007).

**Pragmatic profile.** The assessment was supplemented with the questionnaire *Pragmatic profile, PP*, from CELF-4 (Semel et al., 2013), answered by the parents in order to get a measure of the subjects pragmatic abilities. The questionnaire consists of 50 questions or claims regarding the subject’s communicative abilities, ways to handle and interpret information and non-verbal communication. The caregiver is to estimate how often the asserted phenomenon is observed in the everyday life on a scale from “Never” = 1 point, “Sometimes” = 2 points, “Often” = 3 points, to “Always” = 4 points. There is also an option to answer “Not observed” or “Not relevant”, which both gives 0 points. Maximum raw score is 200 points. Example of claim: “Remains eye contact in conversations (e.g. does not look at the floor)”, “Tells something congruent, so that other people can understand” and “Understands facial expressions”.

### 3.3. Procedure

All subjects were recruited from a smaller town in Sweden. In the group where children were diagnosed with ADHD and/or ASD (D-group) subjects with the main diagnose ADHD were recruited via CAP, via colleagues of the author. Subjects with ASD with or without a comorbidity of ADHD were recruited from CAP or CAH. Some of the children received their diagnose/ -s as a result of a complete neuropsychiatric assessment the subjects had undergone, in which the testing battery from the present study constituted one part. The order of the test battery was fixed for all subjects, but subjects undergoing a full neuropsychiatric assessment later came to additional follow-up language assessment where other tests were administered. Other subjects were already diagnosed when participating in the present study, and since some of them were diagnosed prior to 2013 in accordance with DSM-IV (APA, 2000) different types of ASD like Childhood Autism occurred. All autistic diagnoses in the D-group will be referred to as ASD regardless diagnosed using DSM-IV or DSM-5. ADD will still be used as a diagnostic name in the present study when referring to subjects with ADHD with predominantly inattentive difficulties. None of the subjects medicating regarding their ADHD had taken their medication at the day of the assessment.

Subjects with no diagnoses (ND-group) were recruited from two schools with pupils in ages 10–12 years. Initially principals for three schools were contacted and given information regarding the study, eventually two of the schools participated. Information meetings were arranged with teachers, written information regarding the study was distributed to the pupils via the teachers, and the answers were distributed to the author. All parents willing to participate were contacted and testing dates were set. All pupils who wanted to participate were tested. One of them were later on excluded from the ND-group material in the study according to exclusion criteria regarding low results in the tests at a level indicating LI. Pilot tests were made prior to the study with 6 adults and 3 children in order to adjust the assessment procedure and test order.

All parents agreed to answer the questionnaire Pragmatic profile, *PP*. In the ND-group *PP* was sent to their home with a pre-stamped envelope in order to return, and in the D-group it was administered for the parents to answer in the waiting room during the assessment. All parents initially accepted to answer the questionnaire, but parents to one subject in the ND-group did not answer the questionnaire. During the statistical analyses mean score regarding raw score and standard score matching the age of the subject was used.
The assessment took 1–1.5 hours and the tests were administered in the same fixed order for all subjects. Before testing, all subjects were given an introduction to the test types, testing procedure and were encouraged to ask questions if necessary. They also were informed that some of the tests would be recorded, that there would be a break and that they could ask for additional pauses at any time. All test instructions were read from a manuscript in order to ensure that all subjects were given the same information. When subjects asked for more or several instructions, they were given that help prior to the test. The tests were given in the following sequence: ERRNI, TROG-2, Metaphors from BeSS/TBSS, KR-list, Words from BeSS/TBSS, Understanding Spoken Paragraphs from CELF-4, BNT, FAS and Animals. A short break with biscuits and lemonade took place after the KR-list. All tasks were read aloud to the subjects, associated pictures were given with ERRNI, TROG-2 and BNT, and all sentences in Metaphors were also given in written text. Answers were documented by handwriting, except ERRNI which was audio-recorded and orthographically transcribed afterwards. The ND-group was assessed in their schools in a smaller study room, or a relaxation room. During the assessments some noise from outside the room like other pupils going to the canteen or practicing music occurred, and a few times teachers or parents entered the room during testing. All D-subjects assessments took place at CAP at the author’s office.

### 3.3.1. Scoring procedure

*TROG* was very straightforward to administer, and was scored in standard scores. *Defining words* was a bit subjective to score. Since only few examples of correct answers were given, the author of the present study had to make a consistent decision about the correctness in each answer. When scoring *BNT* the author compared two different translations (Laakso, 2007; Tallberg, 2005). Their Swedish target words differed in *dominoes, knocker, latch* and *scroll*. The author considered the suggested translations to these four words to be either target word, synonyms or subordinated, hence they all did count as correct responses. In *FAS* and *Animals* there could be decisions in considering “Fantomen” (“the Phantom”) as a trademark for example, so these decisions were made consistently in all subject answers. Also in the *KR-list* there was an element of subjectivity when deciding if answers were to be considered as paradigmatic or syntagmatic, and here the author made a consistent decision based upon the scoring manual used. There were some issues with the wording of the questions and correct answers according to the manual in *USP*. When scoring *Metaphors*, the author were aided by suggested definitions in the manual as well as in three SLP-master’s theses (Einald & Hallberg, 2015; Larsson & Nilsson, 2015; Kurt, 2015), but several wordings still had to be defined consequently. Since the *Pragmatic profile* was answered by parents, the author simply had to summarize all scores the answers represented.

NAP enables diversified description of narratives in general, but is not developed and standardized based upon *ERRNI*. There are many aspects to elaborate simultaneously, which lead to several questions regarding scoring in NAP-categories. The false-belief component and the retell-part were examples of issues NAP did not take into account. Subjects not mentioning or misinterpreting the false-believe component obtained minus in the *Explicitness*-category. The *Topic maintenance*-dimension got negative score when the author had to elicit the first narrative. When the author had to ask if the subject remembered anything else, or encourage continued retelling, *Topic maintenance* was also considered affected. Concerning *Event sequencing*, some subjects first described the events in a reversed order but corrected themselves, which despite the correction were registered as incorrect.
3.4. Statistical analysis

Due to small sample sizes, nonparametric tests were used. Spearman rank correlation coefficient computed all associations between variables in-group and between groups. All Spearman ranks were two-tailed, $p < .01$ was considered strongly significant, and $p < .05$ as moderate significant. Mann-Whitney $U$-test was used computing between-group comparison and in-group-comparison. In order to create bottom-up clusters within the D-group, $z$-scores were computed to minimize arbitrary scale differences, and then a hierarchical cluster analysis was made using Euclidean distance measures and between-groups linkages. Differences in abilities of children belonging to different cluster subgroups were retrieved using ANOVA followed by a Tukey-Kramer post hoc test. Also the parametrical test K-means cluster was computed as a complementary method aiming to detect clusters in the D-groups. All statistics were made in IBM SPSS Statistics, Version 23.0. For measure of effect size, Cohen’s $d$ was used (https://www.psychometrica.de/effect_size.html#nonparametric), indicating the following effect sizes; 0.20 as small, 0.50 as medium, and 0.80 as large (Becker, 2000).

3.5. Ethics

No certain benefits or disadvantages were considered connected with participating in the present study. The subjects got no kind of payment for participating in the study. Biscuits and lemonade, which was served in the short break during the assessment, was the only type of reward given. Recruitment of subjects was approved by managers at CAP and CAH, and principals in the two schools prior to testing. Parents and subjects gave informed consent to participate. Participation was entirely voluntary, and any child or parent could at any time withdraw from the study. The Regional Ethics Committee gave approval to the study, reference number 2014/466-31.

4. Results

The main findings were that all tests but the KR-list were significantly more difficult in the D-group, showing that they are relevant when assessing ADHD and/or ASD. Tests of particularly difficulty in the D-group compared with the ND-group were Metaphors, Pragmatic profile, FAS and Inference questions from USP. Findings regarding correlating tests show strong positive correlation in the D-group between Metaphors and TROG (grammatical understanding), and Metaphors and Defining words. Inferential questions in USP also had a strong positive correlation to BNT (lexicon size). No subgroup-clusters could be retrieved from the test results in the D-group.

4.1. Descriptive statistics

Table 1 shows the distribution of all test results but ERRNI in the two groups compared to each other computed using Mann-Whitney $U$-test.
Table 1

Results from all tests but ERRNI in the ND-group and the D-group: mean (M), standard deviation (SD), between-group comparison using Mann-Whitney U-test (U-value), 2-tailed p-value of Spearman rank correlations (p-value) and effect size calculated as Cohen’s d (d-value).

<table>
<thead>
<tr>
<th>Test</th>
<th>ND-group (n = 26)</th>
<th>D-group (n = 22)</th>
<th>U-value</th>
<th>p-value</th>
<th>d-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TROG</td>
<td>100.73</td>
<td>92.73</td>
<td>185</td>
<td>.033*</td>
<td>0.633</td>
</tr>
<tr>
<td>Metaphors</td>
<td>15.81</td>
<td>9.73</td>
<td>158</td>
<td>.000**</td>
<td>1.255</td>
</tr>
<tr>
<td>Defining words</td>
<td>14.96</td>
<td>12.45</td>
<td>190.5</td>
<td>.047*</td>
<td>0.595</td>
</tr>
<tr>
<td>KR-list</td>
<td>57.1</td>
<td>52.66</td>
<td>229.5</td>
<td>.242</td>
<td>0.342</td>
</tr>
<tr>
<td>BNT</td>
<td>41.73</td>
<td>38.68</td>
<td>180.5</td>
<td>.029*</td>
<td>0.664</td>
</tr>
<tr>
<td>FAS</td>
<td>26.58</td>
<td>20.45</td>
<td>156.5</td>
<td>.007**</td>
<td>0.839</td>
</tr>
<tr>
<td>Animals</td>
<td>19.04</td>
<td>15.64</td>
<td>183.5</td>
<td>.033*</td>
<td>0.643</td>
</tr>
<tr>
<td>USP 1</td>
<td>7.88</td>
<td>7.82</td>
<td>190.5</td>
<td>.044*</td>
<td>0.595</td>
</tr>
<tr>
<td>USP 2</td>
<td>11</td>
<td>9.86</td>
<td>190.5</td>
<td>.044*</td>
<td>0.595</td>
</tr>
<tr>
<td>USP Inference questions</td>
<td>2.12</td>
<td>1.59</td>
<td>169.5</td>
<td>.004**</td>
<td>0.742</td>
</tr>
<tr>
<td>USP Predictive questions</td>
<td>3</td>
<td>2.73</td>
<td>221</td>
<td>.011*</td>
<td>0.396</td>
</tr>
<tr>
<td>Pragmatic profile 1</td>
<td>10.62</td>
<td>3.91</td>
<td>39</td>
<td>.000**</td>
<td>2.185</td>
</tr>
<tr>
<td>Pragmatic profile 2</td>
<td>171.35</td>
<td>39.17</td>
<td>36</td>
<td>.000**</td>
<td>2.245</td>
</tr>
</tbody>
</table>

* p < 0.05; ** p < 0.01

1 based on standard score, 2 based on raw score.

Table 1 shows that all test results were higher in the ND-group. Most test results show a strong significant difference between the groups. All these results were lower in the D-group than in the ND-group; Metaphors, PP, FAS and Inference questions from USP. PP, Metaphors and FAS also rendered a large effect size. The tests that got a significant level of discrepancy between the groups were Predictive questions from USP, BNT, TROG, Animals and Defining words, all in favor of the ND-group. Also USP computed in raw scores was significantly more difficult in the D-group. No significant correlation was found regarding the KR-list. In the ND-group, 11 children had undergone the syntagmatic-paradigmatic shift (defined as a score over 60% in the table), whereas the number was 9 children in the D-group.

Table 2 shows that all ERRNI-measures got higher scores in the ND-group than in the D-group. Measures with a strong significance level, all in favor of the ND-group, was Event sequencing 1, Explicitness 1 and 2, Referencing 1, Cohesion 1 and 2, Fluency 2, Comprehension questions, Idea score and Forgetting score. These tests also got a large effect size: Explicitness 2, Idea score, Cohesion 2, Referencing 1, Forgetting score, Explicitness 1, Cohesion 1, Fluency 2 and Comprehension questions. A significant difference was measured in Referencing 2. The ND-group had lesser flaws in Fluency and Referencing in particular, gave more detailed narratives the first and second time, and had a higher frequency correct answer to the questions. Topic maintenance was the same in the ND-group, 3 point for all the subjects. One measurement not included in Table 2 is the time length between story generation and story retell. This measure varied depending on the duration of TROG, which
Table 2

Results from ERRNI in the ND-group and the D-group: mean (M), standard deviation (SD), between-group comparison using Mann-Whitney U-test (U-value), 2-tailed p-value of Spearman rank correlations (p-value) and effect size calculated as Cohen’s d (d-value).

<table>
<thead>
<tr>
<th></th>
<th>ND-group (n = 26)</th>
<th>D-group (n = 22)</th>
<th>U-value</th>
<th>p-value</th>
<th>d-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic maintenance 1</td>
<td>2.91 (0.43)</td>
<td>2.36 (0.47)</td>
<td>273</td>
<td>.277</td>
<td>0.078</td>
</tr>
<tr>
<td>Topic maintenance 2</td>
<td>2.62 (0.5)</td>
<td>2.32 (0.57)</td>
<td>209</td>
<td>.069</td>
<td>0.473</td>
</tr>
<tr>
<td>Event sequencing 1</td>
<td>2.73 (0.53)</td>
<td>2.36 (0.49)</td>
<td>177</td>
<td>.009**</td>
<td>0.689</td>
</tr>
<tr>
<td>Event sequencing 2</td>
<td>2.62 (0.5)</td>
<td>2.32 (0.57)</td>
<td>209</td>
<td>.069</td>
<td>0.473</td>
</tr>
<tr>
<td>Explicitness 1</td>
<td>2.5 (0.65)</td>
<td>1.77 (0.69)</td>
<td>135</td>
<td>.001**</td>
<td>1.011</td>
</tr>
<tr>
<td>Explicitness 2</td>
<td>2.5 (0.58)</td>
<td>1.68 (0.57)</td>
<td>107.5</td>
<td>.000**</td>
<td>1.26</td>
</tr>
<tr>
<td>Referencing 1</td>
<td>2.38 (0.7)</td>
<td>1.55 (0.67)</td>
<td>121</td>
<td>.000**</td>
<td>1.133</td>
</tr>
<tr>
<td>Referencing 2</td>
<td>2.27 (0.78)</td>
<td>1.73 (0.83)</td>
<td>184.5</td>
<td>.026*</td>
<td>0.636</td>
</tr>
<tr>
<td>Cohesion 1</td>
<td>2.62 (0.57)</td>
<td>2 (0.62)</td>
<td>141.5</td>
<td>.001**</td>
<td>0.957</td>
</tr>
<tr>
<td>Cohesion 2</td>
<td>2.65 (0.49)</td>
<td>1.86 (0.71)</td>
<td>119.5</td>
<td>.000**</td>
<td>1.146</td>
</tr>
<tr>
<td>Fluency 1</td>
<td>1.81 (0.85)</td>
<td>1.59 (0.67)</td>
<td>250.5</td>
<td>.425</td>
<td>0.213</td>
</tr>
<tr>
<td>Fluency 2</td>
<td>2.31 (0.79)</td>
<td>1.55 (0.8)</td>
<td>149</td>
<td>.002**</td>
<td>0.897</td>
</tr>
<tr>
<td>Comprehension question</td>
<td>13.77 (1.82)</td>
<td>11.59 (3.02)</td>
<td>152.5</td>
<td>.005**</td>
<td>0.87</td>
</tr>
<tr>
<td>Info score</td>
<td>29.5 (3.74)</td>
<td>23.5 (5.1)</td>
<td>107.5</td>
<td>.000**</td>
<td>1.26</td>
</tr>
<tr>
<td>Forgetting score</td>
<td>27.5 (3.71)</td>
<td>21.5 (7.14)</td>
<td>123</td>
<td>.001**</td>
<td>1.115</td>
</tr>
</tbody>
</table>
*p < 0.05; **p < 0.01
1 based on standard score, 2 based on raw score.

was distributed in between, and differed between 11 and 24 minutes in the ND-group (M = 14.17). In the D-group the time differed between 11 and 19 minutes (M = 14.47). The manual suggest a break for 10–30 minutes assessing other tests (ERRNI; Bishop, 2004a). Compared with the standard scores based upon English speakers the results are lower in the Swedish ND-group in all aspects measured; Comprehension questions, Idea score and Forgetting score.

### 4.2. Language correlated to pragmatics

#### 4.2.1. D-group

Positive correlations between pragmatics and core language were found in the D-group at different levels of significance. No negative correlations between core language and pragmatics were found in the D-group.

*Strong correlation. Metaphors* had a high positive correlation with TROG ($r = .617; p = .002$) and *Defining words* ($r = .736; p = .000$). Inferential questions in *USP* had a strong positive correlation to BNT ($r = .654; p = .001$). When measuring *PP* in raw score all positive correlations with TROG, *Defining words* and *FAS* were strong, at a level of $p = .001$.  


Medium correlation. PP measured in standard score correlated positively with TROG \((r = .439; p = .041)\), Defining words \((r = .491; p = .020)\) and FAS \((r = .498; p = .018)\). Predictive questions in USP were positively correlated to TROG \((r = .442; p = .040)\). Metaphors correlated positively with FAS \((r = .480; p = .024)\). ERRNI Forgetting score correlated positively with Defining words \((r = .508; p = .016)\).

4.2.2. ND-group

There were both positive and negative correlations at different significance levels between pragmatics and core language in the ND-group as well.

Strong correlation. Metaphors had a high positive correlation with Defining words \((r = .558; p = .003)\).

Medium correlation. Metaphors correlated positively with BNT \((r = .472; p = .015)\). USP measured in raw score correlated positively with Defining words \((r = .410; p = .038)\). A negative correlation was found between ERRNI Fluency retell and Animals \((r = –.396; p = .045)\).

4.2.3. D-group and ND-group combined

The one correlation between pragmatics and language that was positive at a high \(p = .01\) significance level in all groups (ND + D, D and ND) was Metaphors and Defining words. In ND + D the following significance level was found: \(r = .687; p = .000\), compared with the D-group \((r = .736; p = .000)\) and the ND-group \((r = .558; p = .003)\).

In all three groups the two pragmatic ERRNI-scores Idea score and Forgetting score were also valid at a \(p = .01\) level, in ND + D as follows: \(r = .799; p = .000\).

4.3. Correlations in ERRNI

In addition to the correlations between ERRNI and language tests, several positive correlations were found between different measures in ERRNI in both groups. The Idea score and Forgetting score correlated to each other at a strong relevance level in both groups. Some negative correlations in ERRNI-measures were found in the D-group.

4.3.1. Qualitative findings

The number of subjects making literal interpretations in Metaphors was quite similar in both groups. The number of literal responses per subject was higher in the D-group, and varied between zero to nine, compared with between zero to six in the ND-group.

Since there was a crucial false belief-task in the narrative emerged from ERRNI, where the little girl switches places of the doll in their bag and the fish in the boy’s bag without the boy knows, the subjects interpretation of this specific event was relevant to investigate further. There were more subjects in the D-group \((n = 8)\) that misinterpreted or not mentioned this event in the generated narrative and/or retell, than in the ND-group \((n = 4)\). Some subjects in both groups interpreted the pictures like the little girl accidently swapped the fish and doll, incorrectly explained that the bags were swapped or made no mention of the swap. Also the
passage when the boy and girls switched back the fish and the doll is sometimes vaguely formulated or omitted in both groups. There were misinterpretations of the false belief-task in both groups. In the D-group there were explanations that the boy was robbed by the little sister, the bags were switched, and the boy got a doll. More vague explanations without mentioning the swap also occurred, like (she) took care of the fish and doll, the little girl was looking at the things, “the third one is watching”, or no mention of the swap at all. Subjects in the ND-group said that the boy took the wrong bag, the boy was giving or switching the fish, the little girl played with the things, or they did not mention the swap at all. One of the ND-subjects said that the boy recognized the doll as belonging to the girl, which also was a type of false belief-inaccuracy since the boy had never seen the doll earlier in the pictures.

There are nine comprehension questions in ERRNI, with a maximum score of 18 points. The false belief-component is addressed in two of the questions: “What did the girl think was in her yellow bag?” (correct answer is “a doll”), and “What did the boy expect to find in his bag when he got home?” (correct answer is “a fish”). These questions investigate the subjects’ insight in the persons’ beliefs in the narrative, and they were a bit difficult for some of the subjects. One of the ND-subjects gave incorrect answers on these two questions, responding “fish” instead of “doll” and vice versa, despite describing the swap adequately in the retell and quite vague in the initial narrative. One of the subjects in the ND-group started by giving the wrong answer but changed the answers when hearing the next question about the boy. More subjects gave incorrect answers to these questions in the D-group, than in the ND-group. Two subjects were replying “fish” on both questions, one replied “doll” on both questions, and two subjects were switching answers on the questions.

Some subjects elaborated the narrative by adding details. For example, some of the subjects in both groups described that the fish wanted a new fish-friend, that he was lonely, or concluded that the fish now swam together. One of the ND-subjects named the persons in the narrative; the oldest girl was named with the same name as the author of the study. Some subjects interpreted the girls as mother and child.

In the Fluency-measure several types of mazes occurred, such as false starts (abandoned utterances or incomplete sentences), repetitions, internal corrections or revisions (corrected utterances), and fillers like “eeh, mmh, like, what’s it called”. The D-group had much more disfluent occurrences or errors in Fluency, than the ND-group, and the lowest score obtained ranges in a very wide spectrum from 12 to 60 disfluencies in the D-group.

This is one example from the D-group, 10:11 years old, with different types of mazes:
“… so their mother had bou.. went eeeeee what’s it called called to she.. she eeeeh, they his chen.. her his cousins... not cousins but friends ...” (“… så deras mamma hade kö.. åkt eeeeh va heter det ringde till hon.. hon eeeeh, de hans kän.. hennes hans kusiner ... inte kusiner men vänner... ”).

Here lots of different disfluencies occur, but mainly fillers and lexical revisions like “their mother had bou.. went” and “not cousins but friends”. Another example from one of the least coherent generated narratives in the D-group, aged 12:4 years:
“… then what’s it called showed what’s it called he who stood in the pay desk the fish he wanted, and then he gaved that fish to what’s it called the boy eeh, he got his money he wanted-ed the money that he had ...”. (“… sen så vahetere visade vahetere han som stod i kassan den fisken han ville ha, och sen så gedde han den fisken till vahetere pojken ööh, han fick sina pengar han ville-le pengarna som han hade ...”).

This example has mazes like connectors, repetitions and fillers, but also errors in reference and one conjugation error. The Fluency and Referencing is impaired at a level that compromises the intelligibility in tangential aspects like Explicitness and Coherence.
Sometimes NAP-categories tended to interfere with each other in this manner. Also sequencing was wrong sometimes, but the subject corrected themselves. Despite that they knew they were wrong initially, this confusion in sequencing counted as incorrect, since it affected the intelligibility of the narrative.

There were features in the narratives that were somewhat difficult to describe in NAP-terms. Some of the D-subjects did not generate the first narrative on their own initiative, the author had to elicit by asking what happened in the pictures. Some subjects did not remember the entire narrative during retell. Subjects did also read the name of the pet shop wrong. Difficulties regarding words appeared in narratives from both groups. There were both incorrect use of words, omitted words, incorrect preposition, phonologic errors like “fiks” for “fisk” (“fish”), vague neologisms like “food-thing”, and incorrectly conjugated words. Also the syntax was incorrect sometimes with erroneous verb placement. Incorrect usage of words, exchange of concepts and word substitutions like “ice-cream…house” for kiosk were more frequent in the D-group.

4.4. Clusters in the D-group

There was no possibility to gain valid clusters from the D-group sample. A hierarchical cluster analysis was computed including all test results, but at no level in the dendrogram and icicle plot that derived from the analysis a minimum of two subjects constituted a cluster (see appendix 1 for one of the attempts). One outlier-subject constituting one own “cluster” in several clustering attempts was removed and the cluster analysis was computed again. Despite this the same result with “groups” consisting of one subject emerged. Also K-means cluster analysis was computed as a complementary method despite the fact that the analysis method is a parametrical one, to possibly gain valid subgroups. The K-means cluster analyses were computed with two to seven different clusters, but there were always some cluster with only one subject, despite excluding one outlier-subject.

5. Discussion

It was expected that correlations between tests would occur, and that the result in the D-group would be lower in general compared with the ND-group. Both social pragmatic abilities, language pragmatic abilities, and language abilities concerning grammar, lexicon was impaired in the D-group. The only subtest not showing any significant difference between the groups was the KR-list. The subjects with diagnose had strongly significant lower scores in the PP, Metaphors, Inference questions from USP, and FAS, with an large effect size on PP, Metaphors and FAS. However, the finding that so many tests were more difficult in the D-group highlights the sometimes more diffuse language difficulties in a neurodevelopmental sample. No subgroups could be found in the D-group using different cluster analyses. This was unexpected, but might reinforce the idea that neurodevelopmental disorders constitute a spectrum that is difficult to divide into specific “purer” groups without overlapping difficulties regarding language and pragmatics.
5.1. Result discussion

5.1.1. Language correlated to pragmatics

In the D-group Metaphors were significantly more difficult, $p < .000$, than in the ND-group, which was an expected result. Defining words was also a bit difficult in the D-group, $p < .05$, maybe due to the narrative component. There is no standardization of these two subtests in children aged as young as 9–13. Since standardization only has been made for children aged 14 years or older, the results in the present study were expected to be lower than existing norms. When Olsson-Bolonassos and Sundfors (2008) created the norms for Swedish speakers aged 13–16 years, they based their results on the answers from only 11 children. In the present study the ND-groups results were considered the norm, which the D-groups answers were compared with. Einald and Hallberg (2015) showed that the results for Metaphors in 20–39 year olds were significantly lower than for the groups 40–59 years and 60–80 years. Defining words showed no significant differences when comparing different age groups (Einald & Hallberg, 2015). This indicates that understanding of metaphors will continue to develop in adolescence and peak during the middle age, but the development of ability in Defining words is quite stable from adolescence through life. Einald and Hallberg (2015) found positive correlations between Metaphors and reading newspapers, and between Defining words and fiction books. They also found a positive correlation between completion of university studies, Metaphors and Defining words, but they suggest that higher age, rather than reading habits or education, might be the reason for the correlations. One suggested interpretation of these results might be that metaphors will be learned at a slower pace but that the knowledge in metaphors remains and develops through life when being exposed to them several times. There is also a possibility that the tested metaphors are well known by adults but might be somewhat obsolete and not that used or known in younger people in general.

In both the D-group and ND-group Metaphors and Defining words correlated positively at a strong level. One implication is that lexical knowledge is a necessary base for understanding figurative language like metaphors. Being exposed to metaphors and more complicated words might, for example, interact in a family setting. Another implication is that the ability to understand, define and explain is crucial in both tasks, and this somewhat narrative component might constitute a correlating factor. This result is consistent with other studies, it seems like the two subtests often have quite equal results at younger ages. In two studies Metaphors and Defining words is similarly demanding in norm groups aged 13–16 years (Olsson-Bolonassos & Sundfors, 2008) and 16–18 years (Andersson & Wieslander, 2012). This similarity seems to change over time since both Einald and Hallberg (2015), and Holmbro and Olsson (2000), found a slight tendency for Metaphors to be easier than Defining words in older adults.

In the ND-group there was a positive correlation between Metaphors and BNT. In general the D-group had significantly lower results in BNT than the ND-group. According to Brusewitz and Gómez-Ortega (2005) there is a possibility that the semantic network is impaired in children with ASD, which would lead to more incorrect answers in BNT. Bergström and Lubowa-Mubiru (n.d.) studied lexicon and semantic understanding in children with SLI or ASD, and found out that BNT was the only test that got higher score in the ASD-group than the SLI-group, but still lower than the controls. They suggest the reason to be that children with ASD tend to learn words as units, without necessarily grasping the
whole concept the word symbolizes, resulting in that they seem to understand language better than they actually do.

*FAS*, phonemic word fluency, correlated positively with *PP*. Further *FAS* and *Animals* were difficult in the D-group, *FAS* at a strong significance level. Both phonemic and semantic word fluency was correlated with age, but *FAS* increased more than *Animals* between 6 and 15 years in typically developed children (Carlsson, 2009). A higher level of discrepancy in *FAS* than *Animals* was also found in the present study depending on whether the subjects had diagnose-s or not. According to Einald and Hallberg (2015) there was no correlation between *FAS* and education, but with *FAS* and perceived reading skills and reading habits regarding fiction books. Separating education and age in school-ages is problematic but matureness in executive functions is a reason for generating more words during adolescence (Carlsson, 2009), which also is most likely to apply on the present study since executive functions in the D-group are impaired.

*TROG* is a test measuring grammatical knowledge, but can also be used as a baseline regarding language understanding, since the ability of understanding sentences with some contextual help (the four pictures) can be considered a basic component of language knowledge. There was a strong positive correlation between *Metaphors* and *TROG*, and a medium correlation between *Metaphors* and *FAS* in the D-group. If this ability is impaired, which is the case in many of the D-subjects, there is a great possibility that the ability of understanding more complex figurative language also is impaired. *FAS* and *Metaphors* correlated in the D-group, which might depend on the cognitive flexibility that is required in both tasks. In both tasks semantic knowledge is not in absolute focus but will be helpful solving the tasks.

According to Leonard and Deevy (2004), children with SLI do have weaker associations in their lexical networks, causing word-retrieval problems. If this also was the case in the D-group, it would seem reasonable that both *TROG* and the *KR-list* might have been affected negatively, which was not the case in any of the groups. Holmström (2015) studied lexical organization in bilingual school-aged children, and discuss that lexical organization and size is reported to be connected and bilateral, and that lexical organization benefit word-retrieval. She found that both lexical size and organization was impaired in mono- and bilingual children with LI. The quite equal performance between the groups and lack of connection between the *KR-list* and other tests is therefore somewhat surprising. It was also expected that more children in the TD-group would have undergone the syntagmatic-paradigmatic shift, since they are 9 years or older.

### 5.1.2. Results in ERRNI

The overall impression in *ERRNI*, was that the ND-group might have forgotten or omitted more information that was not totally crucial for the understanding of the narrative when retelling than the D-group. The ND-group did sometimes describe events in a different manner than suggested in the manual, but still sufficient for the listener to understand. This might implicate that the ND-group grasped the narrative and the listener’s perspective so that they could sort out the unnecessary information and tell a more condensed version of the narrative in the retell. There was only one subject, from the ND-group, introducing the narrative with “Once upon a time...”, and some other subjects did add other pragmatic cohesion details.
There are two examples from the D-group’s wordings in ERRNI (see 4.3.1.). They show different mazes, obvious errors in Fluency and Referencing, which clearly hampers the intelligibility for the listener. Both typically developed children and adults use mazes in order to clarify and correct, but in English speakers, more than 20–25% mazes is considered diagnostically significant (Fiestas et al., 2005). They note that false starts tend to peak in fourth grade in English children, which might be similar to Swedish children. Filled pauses and repetitions might also indicate rapid language growth (Fiestas et al., 2005). The many repetitions in the D-group might be due to difficulties in remembering and planning, or serve as a way of once again hear the speech output, like Fiestas et al. (2005) suggests. Children with CP assessed with the narrative recall test BST scored using NAP, had problems in the Explicitness-category, used fewer story elements and had more mazes than the control-group; but the Fluency-measure was almost the same as in the control-group (Holck et al., 2011). Explicitness correlated positively with Idea score in BST, which they suggest derive from shortage of information and cohesion. Mazes also had positive correlation with Idea score, implying that mazes were used as a strategy trying to recall relevant pieces of information and in word-finding. In the present study correlations between ERRNI-measures was not at focus, but the idea of mazes as a helpful strategy seems very plausible to apply. The difficulties in word retrieval and self-initiated repairs in ERRNI, resembles the ones Saldert (2006) found in persons with right- or left hemisphere damage. Mathers (2006) found many abandoned utterances in children with ADHD, which also resembles the results in the present study.

Linguistic errors in ERRNI, like incorrect use of words and word substitutions were more frequent in the D-group, which might be due to less developed language in general or marginally younger ages in the D-group. Confusion in “home/to them” and “here/there” were found in the D-group, but not in the ND-group, which is likely due to difficulties in referential deixis in ASD for example (APA, 2013). In the D-group there were also more conjugation errors \((n = 5)\) then in the ND-group \((n = 3)\). This might be connected with the slightly younger ages in the D-group, but it might also indicate a later grammatical development in general. The verb with incorrect conjugation from the second example; “gaved” (“gedde”), is comparable with the ones made by younger children when learning how to conjugate. This type of so-called overgeneralizing tends to peak in about 4–5 years of age and decline thereafter in Swedish speaking typical children (Håkansson & Hansson, 2007).

5.2. Methodological discussion

5.2.1. Recruitment and subjects

The recruitment of subjects with ADHD or ASD who matched all the original exclusion criteria rendered a very limited sample of children. As a consequence, some adjustments in criteria for the D-group had to be made, in order to get a reasonably large sample of children. These adjustments meant that some subjects with bilingualism or a history of language difficulties were included in the D-group, but not in the ND-group. For the D-group, inclusion criterion was diagnosed with, or under investigation concerning ADHD and/or ASD. The suggested age span of 10:0–12:11 years was also widened into 9:4–13:6. It is plausible that these slightly adjusted criteria might have affected the results in a negative way for the D-group. This fact was carefully balanced against how valuable a reasonable large D-group was considered to be.
The D-group and ND-group were only matched for age, and not according to gender. There were more boys in both groups, but the sex ratio was less even in the D-group, which might make comparisons less reliable. One can however argue that the gender distribution in the D-group is rather plausible, since it corresponds well with coherent research saying that more boys than girls have neuropsychiatric diagnoses. In the D-group male to female ratio is 4.5:1, which is very much alike sex ratio in pre-school children with ASD at a 5:1 or 4:1 in male to female ratio (Westman Andersson, Miniscalco, & Gillberg, 2013). In this perspective, the fact that there were more boys than girls in the ND-group, with a male to female ratio of 1.6:1, makes the ND sample less comparable with the population in general.

Children with LI were also included in the D-group, but not in the ND-group. This is a factor that might have affected the results. A combination of LI, ASD and/or ADHD is a rule rather than an exception, and the sample thereby reflects the common population of children in CAP.

All test manuals were based on data from monolingual Swedish speakers, no different manuals or definitions were used for the few bilingual subjects in the D-group. This might be a source of error.

The comparability between the D-group and ND-group might be affected given that all ND-subjects were recruited from two schools in the same suburb. The socio economic diversity in the ND-group might be small due to the geographical location of the schools, but the socio economic background in the D-group might differ more.

The pupils and parents willing to participate might have been more motivated than ND-pupils in general. Some of the parents or subjects might have read the information letter more briefly and interpreted participating in the study as obligatory since the information was given to them in a weakly mail from the school.

Unfortunately, there are no region SLPs working towards children aged 6–18 years with solely language difficulties in the catchment-area of the present study. Therefore some parents might also have assumed that participating in the study was a good way to find out if there was any problem regarding their children’s language development. This indicates that quite different pupils might have participated; the most highly performing and motivated children, the pupils who might have interpreted the study as an obligatory part of school activities, and those with presumptive language problems. The last two groups might therefore be less motivated than the first one. These three groups might also be considered corresponding to children with diagnose. The ND-subjects might at least have motivated parents, or they would not have participated in the study, which presumably would be the case regarding research comparison groups in general.

**5.2.2. Testing situation**

The context during the assessment was a bit diverse since ND-subjects were tested in their schools, and subjects with diagnose were tested at CAP at the hospital. Teachers and caregivers entered the testing room while testing some ND-subjects was an unavoidable aspect that might have affected the results. The acoustic environment was sometimes disturbing for the subjects, one of the ND-subjects expressed this during testing. The visual environment did also differ between the two schools. In one task, the KR-list, this became clear since some of the subjects made associations to things they saw in the testing room.
rather than the target word, for example mirror or painting, things that not occurred in all assessment rooms. In the middle of the assessments there was a break with biscuits and lemonade, when conversation of similar topics was held with all subjects.

In the D-group different approaches to the tests occurred, which was expected since the range of pragmatic abilities is wide in neuropsychiatric disorders. Some subjects were more reserved and cautious, talked with a weak voice and did not turn pages in the material themselves, and others had a more recalcitrant approach and pointed hard in the material during generating narratives. Their different styles reflected in their narratives in that one more cautious subject told one of the shortest narratives and needed a lot of elicitation from the author, and the same subject interpreted the swap as the boy had been robbed. This clinical observation of personal styles when interacting in a testing situation with a stranger, might serve as a complementary aspect describing different social pragmatic skills and expressions beyond test results in a neuropsychiatric sample of children.

5.2.3. Scoring of assessments

TROG. TROG was the only test where the subjects did not have to say anything, no element of expressive language skills or ability of formulating sentences was needed. TROG was therefore easiest to score. Despite the element of subjective interpretation of the subjects’ answers in all other tests, the language tests were in general easier to score than the pragmatic ones. This discrepancy in subjective interpretation load amongst the tests might give an impact on the reliability comparing the tests.

ERRNI. Narrative abilities were scored in terms of NAP-dimensions. The lowest score representing “inappropriate” was a very wide category in several dimensions, since some subjects had severe difficulties in these abilities. Fluency was the dimension causing most trouble in both groups. During story generation the highest number of disfluencies was 28 in the ND-group and 60 in the D-group. During retell the highest numbers of disfluencies in the ND-group was 35. In the D-group the highest number of disfluencies was 55, and the mean was 20.23 during retell. The breakpoint between 2 points and 1 point in Fluency were set to 12 or more occurrences, and obviously the span of disfluencies in this lowest score was very wide in the D-group in particular. With a wider more differentiated scale than 3 points these differences in the broad range of fluency skills would be more obvious. A different narrative task might have rendered fewer or other types of disfluencies. None of the other tests with verbal answers were scored according to NAP-categories, but it would be interesting knowing if other tasks also gave rise to disfluencies in the same proportions as ERRNI.

Metaphors and Defining words. There were no suggested answers matching certain ages, but some general correct definitions in each task defined by Laakso (2007). In 2015 three master’s theses in Göteborg, Sweden, developed the assessment battery BeSS/TBSS by standardizing it in 20–80 year olds (Einald & Hallberg, 2015; Larsson & Nilsson, 2015; Kurt, 2015). Einald and Hallberg (2015) found that Metaphors and Defining words were least easy to score, the Interrater reliability was the lowest in all subtests in BeSS/TBSS regarding these ones. They call for a more extensive scoring manual to ensure a fair judgement, something the author in the present study agrees with. The results from the ND-group might serve as norms for ages 10–12, but a standardization based upon a bigger sample of children would be of great clinical interest.
Understanding spoken paragraphs from CELF-4 was partly problematic to score, which also Christoffersson and Pihl (2015) noted. The manual is quite strict regarding accepted answers giving a few examples for each question. Many of the subject’s responses were in the authors opinion adequate and similar to those suggested in the manual, but did not give any points due to slightly different wording. Some of the questions were also slightly strangely formulated in relation to the manual’s suggested answers. Those specific questions also did render lower scores in many subjects. Therefore the scoring was somewhat problematic when the subject’s answers were close, or sometimes more correct according to the wording of the question, but not correct according to the manual. The author of the present study had to choose one way of scoring each question where this kind of ambiguousness occurred. In this way the scoring results might not respond completely with how other SLPs would have scored a similar response. This might be problematic regarding the reliability and validity of the results in this study, but also regarding the validity, reliability and usefulness of the subtest in CELF-4. Some problems with wording of the questions also affected the administration of the test since the first question in three paragraphs was supposed to be wide and target the main idea of the narrative, and therefore appeared a bit vague; “What is the story about?”, “Vad handlar berättelsen om?”. Several subjects responded this question by giving all the answers regarding a few following questions. The author did pose all the questions regardless the subjects response to the first question, but when relevant adding “In fact, the next question is …”, to let the subject know that the author knew that they already gave an answer to the following question. All these issues/problems might also have occurred when standardizing CELF-4 in Swedish, so in that perspective the results in the present study could still be considered to be comparable to the norms. According to the manual USP is the subtest with the lowest reliability of all the 13 subtests in CELF-4, only “acceptable” reliability coefficient (Semel et al., 2013).

Pragmatic profile. When answering the PP from CELF-4, some of the parents to ND-subjects scored “always” in all questions giving 200 in raw scores. This might suggest that they were provoked by the questions interpreting them as indicating that their child was poorly educated, they had not observed anything “wrong” with their child or that they gave the answers that they thought would please the author. There is also a possibility that the questions were difficult to understand, that they answered the same thing on several questions by accident, or that they simply did not care to fill in the questionnaire carefully. For an average result on the PP, a mix of answers varying from “always” (4 points) to “never” (0 points) is expected regardless of age. The older the age, the more “always” in general indicates average pragmatic abilities. These parents might either not have seen these shifting pragmatic abilities in their children, or did not want to admit anything odd. Some parents did answer the profile diversified, but wrote a note that it felt like we were trying to find inaccuracies in their children. Despite the oral and written information all parents were given, some parents also had understood the recruiting process incorrectly and thought that the ND-subjects were recruited via some hospital records. They were therefore not willing to answer the PP. These problems might have been avoided if explaining the purpose of the study and/or the PP in a different way, or if the parents and author had discussed the questions as an interview.

FAS. During the assessment, one of the ND-subjects were only given the phonological word fluency-test FAS, and not the semantic part naming animals. This mistake was discovered during the scoring procedure, and the animal naming-test was therefore performed via telephone a while after the initial testing. Scoring was then performed as per usual in this subject’s test. In the D-group some subjects had recently performed a phonemic word
fluency-test similar to FAS with a psychologist undergoing their neurodevelopmental assessment. It is not likely, but this might have affected their FAS-results in the present study in a positive way. In one of these D-subjects the results were good in both FAS and Animals, likewise in the previous psychologist assessment.

5.3. General discussion

The sample is rather small, which means that no general results in this regard can be drawn from the present study, only implications.

Initially the idea was to compare language abilities in children with the more “pure” forms of ADHD and ASD, excluding comorbid diagnoses. The recruitment was difficult, mainly because the overlap in diagnoses is wide within the neurodevelopmental spectrum. Hence the choice to create one group of all children with diagnoses. This was a fruitful way to describe the actual population in CAP or CAH in which most often, according to several studies referred, different patterns of overlapping diagnoses occurs. This choice to study a common group of children in CAP or CAH is also helpful for clinicians who in their clinical work most definitely meet these children.

Some of the subjects with ADHD or ASD experienced difficulties in several language tasks, but had never been referred to an SLP prior to this study. The results of the entire test battery indicate lower abilities in language and pragmatics in the D-group than in the ND-group. These results should further emphasize the need of a thorough language assessment as a natural and integrated part of neuropsychiatric diagnostic evaluation. All subjects with a coexisting LI got the LI-diagnose as a result of the language assessments the present study is built upon. This fact can serve as evidence that LI is often forgotten and not routinely examined in children with neuropsychiatric disabilities.

6. Conclusions

In the D-group, correlations were found between tests assessing language as well as pragmatic abilities. There is an obvious difference between pragmatic skills and language performance, in subjects with and without neurodevelopmental disorders in the present study. The D-group performed worse than the ND-group in all tests assessed in the present study. Positive correlations found between pragmatics and language, further suggest that these abilities tends to develop in a somewhat synchronized and plausibly slower pace in ADHD or ASD. In the ND-group, however, only Metaphors and BNT, and USP and Defining words correlated at a positive significant level – but Fluency retell and Animals correlated negatively, suggesting that other abilities tend to develop synchronized in children in general. The only strong positive correlation found between pragmatics and language in both groups, combined and separated, was Metaphors and Defining words, suggesting that lexical knowledge and ability to explain interact in these tasks regardless diagnose or not. Different pragmatic abilities are correlated in both groups, suggesting that pragmatic abilities interact in different ways with or without neurodevelopmental disabilities.
There were subjects in the D-group diagnosed with additional LI as a result of the present study, although inclusion criterion was no history of language deficits. In both groups, none of the subjects had earlier been assessed by an SLP for other reasons than intervention regarding phonology. Only a few of the subjects in the D-group would normally have been referred to an SLP during their neurodevelopmental assessment. This shows that there is a great risk that LI will remain undetected in children undergoing neurodevelopmental assessment.

Another finding in the present study is that the language profiles in the D-group were heterogeneous enough not to render any subgroups based upon language or pragmatic abilities. It seems plausible to draw the conclusion that language and pragmatic-profiles in fact are that heterogeneous in children with ADHD and/or ASD. There is always a possibility that there might have been different profiles in language and pragmatic abilities if other tests were chosen for the study, or if there were more or other children in the sample. The results might also suggest that ADHD and ASD constitute a complex continuum, whose functioning cannot be easily broken down into subcategories.

### 6.1. Clinical implications

The results from the present study indicate that most of the language tests used in the present study, the KR-list excluded, would be relevant to use when assessing children with neurodevelopmental disorders. The PP-questionnaire is a very good complement when assessing children, since sincerely answered it might help distinguishing ASD and ADHD, for example, with questions about nonverbal communication skills. The PP further gives information about areas suggested for intervention. In order to get valid results from the PP, a suggestion is to use it in interview-setting, allowing parents to discuss the questions with the examiner. Also poor results in TROG, Defining words and FAS combined with low score in the PP, might prove occurrence of ASD or ADHD. Many mazes in narrative tasks might serve as a clinical marker. Low results in language tests in general is of course indicating LI, but this specific pattern of lower results in these specific language tests might indicate ADHD or ASD, possibly masked as – or in addition to – an LI. When assessing a child that shows difficulties in Metaphors, TROG, Defining words, inferential questions and BNT, a suggestion would be to further assess neurodevelopmental disabilities. If there are equal results in Metaphors and Defining words, or in Animals and Fluency in ERRNI, there might be less suspicion of neurodevelopmental disorders, since the results in these tests resemble one another in the ND-group. Another way of putting it is that it is a very reasonable approach to always expect and evaluate language difficulties, not “only” pragmatic deficits, in children with neurodevelopmental disabilities.

There are language disabilities in ASD and ADHD that language assessment can distinguish. SLPs possess the required language expertise to perform these assessments, interpret the results in diagnostic evaluation, propose recommendations and implement adequate intervention. The results in the present study therefore calls for routine SLP assessment as an integrated part of neurodevelopmental investigation. The need of SLPs working in assessment teams in CAP avoiding to overlook language problems that might cause the children unnecessary suffering struggling to communicate is thereby stated.
6.2. Suggested research

The findings in the present study raise several future research questions. In order to get more generalizable results replicating the present study with a bigger sample would be suggested. For a wider understanding in differences in language and pragmatic functioning in neurodevelopmental disorders studies assessing and comparing “purer” samples of ADHD and ASD would be recommended. In order to gain more knowledge about possible subgroups with different language and pragmatic-profiles studies with more subjects comparing ADHD and ASD is needed. Assessing children in other age groups would also increase the knowledge in neurodevelopmental disorders related to language and pragmatics. Since children will grow older and there are persons getting diagnosed in older ages, studies focusing on language assessments in samples recruited from adult psychiatry and adult habilitation is also of interest. In assessing adolescents and adults, there is a possibility to find out whether pragmatic abilities and language continue to develop at the same pace, or if some of these abilities tend to develop faster or slower. The finding that disfluency and mazes were so frequent in the D-group is an aspect worth further study in a neurodevelopmental sample, but also comparing with other groups like individuals with right- or left hemisphere damage for example. Lexical organization would be of interest comparing in ASD, ADHD and LI since the results from the present study was unexpected in this perspective. There are recent studies examining language abilities in individuals with a relation to correctional treatment (Brorsson Feustel & Jakobsson, 2015) and in young offenders (Hopkins, Clegg & Stackhouse, 2015). Some of the 30 young offenders Hopkins and colleagues interviewed in UK about their language and literacy, had ADHD, but language skills had been measured in none of them, despite the fact that over 50% of young offenders have language difficulties. The fact that the prevalence of ADHD is higher in clients in correctional treatment than in the population in general (Lundholm, 2013), would suggest that more research in language abilities of individuals in correctional treatment is relevant (Brorsson Feustel & Jakobsson, 2015), and that a greater cooperation between SLPs and the youth justice system is required (Hopkins et al., 2015). Also, assessing pragmatic skills or higher level language in other patient groups and psychiatric diagnoses, would be fruitful in order to broaden the knowledge in the pragmatic discourse. A further subject for research directly linked to the present study, would be to compare assessments of children leading to diagnose ADHD and/or ASD performed with and without an SLP as part of the multidisciplinary team. There are many studies showing the relevance of SLP-knowledge and instruments during assessment in ADHD, and there is lots of further research in this field to be done.
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Article

Abstract

The main purpose of this study was to investigate language and pragmatic ability in children with neurodevelopmental disorders like Attention Deficit Hyperactivity Disorder, ADHD, and/or Autism Spectrum Disorder, ASD. 22 children with diagnose, 4 girls and 18 boys (n = 22), aged 9:4–13:6, and 26 children with typical development, 10 girls and 16 boys (n = 26), aged 10:5–13:4, were recruited and tested with a battery of language tests. Their parents filled in a questionnaire regarding pragmatic abilities. The diagnose-group performed poorer than the control-group in all tests. Correlations were found between several pragmatic tests and language tests in the diagnose-group. Some of the tests were particularly difficult in the diagnose-group. The result emphasizes the need of routine speech-language pathologist language assessment during diagnostic evaluation of children with neurodevelopmental disabilities.

What this paper adds

This paper adds knowledge about how grammar and lexicon is correlated to pragmatic abilities in children with neurodevelopmental disorders like ASD and ADHD. Which language tests in the test battery used in the present study that might be more or less difficult in ADHD and/or ASD, will also be answered.

Keywords

Pragmatic abilities, language abilities, ASD, ADHD, SLP, narrative
1. Background

During neurodevelopmental assessment in children regarding Attention Deficit Hyperactivity Disorder, ADHD, as many abilities needed in order to make a diagnostic evaluation must be examined, according to recent national Swedish guidelines in child and adolescent psychiatry, CAP. The guidelines also states that 85% of all children with ADHD also suffer from at least one coexisting developmental disability like Language Impairment, LI. However, referral to a speech and language pathologist, SLP, is further only mentioned in terms of an optional addition in the third phase of the diagnostic routine (SFBUP, 2016). In regional Swedish guidelines for assessing autism spectrum disorder, ASD, in Skåne, coexisting language difficulties at various levels are well described. The importance of a specialized, multidisciplinary team is stated. Further, the addition of SLP is this type of team is supported, if needed already during the introductory part of the neurodevelopmental assessment (BUP Skåne, 2014).

Many features in the criteria for ADHD and ASD concerns disabilities in language and pragmatics (APA, 2013). Despite this knowledge of language difficulties in ADHD and ASD, there are few SLPs working in multidisciplinary teams in CAP assessing language in Sweden. Studies have shown poorer language outcome in children with LI combined with ADHD and/or ASD, for example Miniscalco (2007). Comprehension and communication were also found to be more impaired than structural expressive language skills in ADHD, which would suggest extensive language assessment in order to detect more subtle difficulties (Bruce, Thernlund & Nettelbladt, 2006). The reason children are referred to CAP might be their uneven functioning profile, which makes diagnostic differentiation taxing (BUP Skåne, 2014). The pattern of overlapping language problems and more subtle pragmatic deficits will be at focus in the present study.

1.1. Language abilities

At 7 years of age, the time of school start phonology, grammar and lexicon in general should be fully developed in Swedish children. Some aspects of lexical production and understanding are still to be further developed (Nettelbladt & Salameh, 2007). Lexical size continues to develop during school age and over the lifetime (Bruce, 2007). Reorganization within a child’s lexicon occurs at 5–9 years, and words are associated in a different way (Nelson, 1977). The new pattern of association is within-class, paradigmatic like cold – warm, unlike the outside-class syntagmatic association cold – ice cream, that younger children make. This so called syntagmatic-paradigmatic shift is manifested when the words semantic features are more established and the child masters a higher level of language abstraction (Holmström, 2015). Pragmatics does contain features like narrative, the ability to tell and understand stories (Holck, 2009), which is developed during school years (Magnusson, Naucrér & Reuterskiöld, 2008).

1.1.1. Pragmatic abilities

Perkins (2007) defines pragmatics as communication by the use of linguistic and nonlinguistic capacities. He emphasizes the interaction, and claims that meaning is created as a combination of language and expressive modalities. From a psychiatric perspective, Brown (2005) includes nonverbal aspects like facial expression, body language and tone of
voice as part of pragmatic discourse when clarifying misunderstanding for example. The context is utterly relevant for pragmatics because of its interactional base.

Non-literal or figurative language, such as metaphors, usually is included under pragmatics. Metaphors demand higher cognitive functioning combined with pragmatic ability since they have to be interpreted as a unit (Cummins, 2014). The most studied non-literal language is metaphors. In ASD metaphors are well known to be problematic (Cummins, 2014; Mashal & Kasirer, 2011).

If only the pragmatic domain of the language is impaired, but no other language abilities, the diagnose Pragmatic Language Impairment, PLI, is relevant. ASD is one of the most common disabilities that include pragmatic disabilities, but other reasons for impaired pragmatic abilities can be behavioral disorders like ADHD, or intellectual disability (Cummins, 2014), right- or left hemisphere damage (Saldert, 2006), or Cerebral Palsy, CP (Holck, 2009).

In pragmatic understanding Theory of mind, ToM, is often regarded as a fundamental cognitive capacity (Perkins, 2007). ToM is a paradigm concerning what a person believes about another person’s beliefs (Dahlgren, 2002). ToM is a crucial component in understanding and telling narratives for example. One must be able to take the listeners point of view and understand what story elements need to be told for the listener to grasp the content of the narrative (Holck, Dahlgren Sandberg & Nettelbladt, 2011, Norbury & Bishop, 2003). Happé (1994) investigated a set of ToM-tasks including a so-called second order ToM-task of false belief, FB. FB means understanding that one person can act on false premises (Nettelbladt, 2013), which children at the age of 7–8 years usually master (Dahlgren, 2002; Nettelbladt, 2013).

1.1.2. Narrative ability

Creating and understanding a narrative or story is a demanding task requiring high-level language operations and different pragmatic skills. Narratives require planning, integration of information and the ability to judge the listeners needs (Leinonen, Letts & Smith, 2000). One common denominator in narratives is their linguistic shape with a beginning, middle and end, as well as the importance of cause-effect (Leinonen et al., 2000). These ingredients represent different types of coherence, connections of content. Relations between ideas like “X is a reason for Y”, maintaining the same topic or goal in the narrative, and reflecting order of events in an intelligible way includes in coherence.

The structural connections in a narrative are referred to as cohesion. The most evident sign of cohesion in a narrative are words that link series of events together, for example then and hence, referring to a person she, or a thing it. At the age of 6 children can produce a narrative containing the relevant features similar to those adults make (Leinonen et al, 2000).

Understanding of narratives can be described as “achieved by decoding the literal meaning of what is heard and, using contextual information and general knowledge, inferring what is not directly stated” (Dodwell & Bavin, 2008, p. 204). There are things not fully expressed in narratives, in order to understand all events one must be able to make inferences or “read between the lines”. In this so called ‘pragmatic inference’ usage of the context will be needed to gain understanding of the underlying meaning (Verschueren, 1999).

Botting (2002) argued that narratives are one of the most ecologically valid measures of communicative competence; normative data is provided, narrative ability is associated with literacy ability, and narratives involve pragmatic elements which could distinguish different diagnostic groups. Two types of narrative tasks often studied are story recall, and story
generation where the subject without any model generate their narrative from a series of pictures. Botting (2002) compared generating and retelling a narrative concluding that story generation is to prefer before story recall. Leinonen et al. (2000) also suggested that generating narratives is a more spontaneous type of narrative that reflects the child’s ability to organize, monitoring the listener’s needs and be creative. A structured measurement of narratives is Narrative Assessment Protocol, NAP (Bliss, McCabe & Miranda, 1998) which can be used examining narratives at a macro level or a micro level.

1.2. Language disorders

Language ability can be impaired in different ways, and difficulties can be manifested at different language levels. Partly because of this variety in inadequate functioning, there is a confusion in terminology in language disorders, which Bishop (2014, p. 381) discussed and described as a “mayhem in diagnostic labels”. The “purer” diagnose Specific Language Impairment, SLI, for research purposes have strict criteria like no hearing impairment, but other cognitive abilities and neurologic status matching the persons age (Leonard, 2014). If pragmatic difficulties are the main problem the diagnose Pragmatic Language Impairment, PLI, is suggested. Language difficulties change over time and are heterogeneous, which would suggest a dimensional approach in clinical practice to capture a child’s specific language profile, not “a single diagnostic solution for a range of problems” (Bishop, 2004b, p. 309). The term Language Impairment might thus be a better option in clinical practice, since it is more flexible and can describe different type of language difficulties, including pragmatic disabilities for example. Prevalence of LI differs between 3 to 10% (Nettelbladt & Salameh, 2007), approximately 5% (Ek, 2015). Internationally, the prevalence of severe language problems is 1–2% over time, more boys than girls have an LI (Leonard, 2014). Comorbidity is usual in language difficulties, but SLI-criteria negate other diagnoses like intellectual disability, ASD or ADHD. This might lead to underdiagnosed LI, since the difficulties in language might be considered part of neurodevelopmental diagnoses (Nettelbladt & Salameh, 2007).

1.3. Neurodevelopmental disorders

1.3.1. Autism

In Diagnostic and Statistical Manual of Mental Disorders 5th ed., DSM-5 (American Psychiatric Association APA, 2013), the concept of a spectrum of disorders constituting autism is presented. ASD criteria are divided into the spheres social communication, and repetitive behaviors, interests, and aberrant perception. Besides the more obvious component of language in social communication, language can also be a part of the second sphere; repetitive behaviors includes inadequate usage of speech like echolalia, idiosyncratic phrases, ritualized patterns or verbal behavior are traits in restricted, repetitive patterns of behavior using language.

In 1997 Rapin and Dunn, in an article often cited on language deficits in ASD, emphasized the pragmatic difficulties but widened the communicative discourse by exemplifying different levels of language impaired in ASD. The lower levels of language processing, like phonology and syntax, might be equally impaired as the higher levels of complex syntax, semantics, and formulation of discourse, forming a spectrum of more or less severe communicative impairments, they conclude. Non-word repetition and sentence repetition is impaired in some children with ASD at a level of LI (Harper-Hill, Copland & Arnott, 2013), which suggest that assessing phonological and linguistic processing in
children with ASD, and referral to an SLP might be essential for children with suspected ASD (Harper-Hill et al., 2013; Rapin & Dunn, 1997).

Pragmatic abilities are impaired in ASD. Pragmatic problems can concern prosody, difficulties grasping the conversation-partners perspective, talking excessively about own special interests, or only using language in an instrumental way in order to achieve something from others (Bruce & Thernlund, 2008). Miniscalco, Rudling, Råstam, Gillberg and Åsberg Johnels (2014) found that pragmatic ability at later ages could be predicted, not by core language features like expressive language and grammar, but through the ability to imitate the gestures of adults. Norbury and Bishop (2002) found that answering inferential questions from narratives was more difficult in ASD than in SLI or PLI. Arnold, Bennetto and Diehl (2009) found that referencing was difficult in ASD, and that the usage of pronouns like she and it was lower in the ASD-group. Further, inference ability in written text was more difficult in ASD (Saldaña & Firth, 2007), likewise novelty word-learning in young children with ASD (Preissler & Carey, 2005). Metaphors were found to be difficult in 13-year olds with ASD (Mashal & Kaser, 2011).

1.3.2. ADHD

The main characteristics in ADHD are inattention, hyperactivity and impulsivity (APA, 2013). Difficulties can be observed in particularly one of these domains; predominantly inattentive or hyperactive/impulsive type of ADHD; or as a combined type of ADHD including all domains. Language is mentioned within both the inattentive and hyperactive/impulsive domain of ADHD criteria. Examples of inattentive markers like attention in conversations and reading, listening when spoken to, follow instructions and reviewing lengthy papers all do include a language component. Within hyperactive/impulsive symptoms traits such as; often talks excessively, problems with turn-taking in conversations, blurts out answers in advance, fill in utterances of others, interrupts or intruding on others, are directly linked with language describing problems in the pragmatic domain.

Children with ADHD are six times more likely to have a coexisting psychiatric or learning disorder, and two to three times as likely to have a reading or writing disorder than their peers (Brown, 2005). Many children with ADHD suffer from unidentified impaired communication deficits. Behavioral problems are more likely to be recognized, and Brown (2005) suggests that both deficits are a manifestation of executive function impairment. Dodwell and Bavin (2008) suggest children with LI are more likely to show errors in attention, resembling ADHD features.

40% of children referred to psychiatric clinics had an unsuspected coexisting LI, 63.6% including children with an earlier diagnosed LI (Cohen, Barwick, Horodezky, Vallance & Im, 1998; Cohen et al. 2000). In all tests assessing language and pragmatic abilities, Cohen and colleagues administered, the children with a combination of ADHD and LI got the lowest scores. Oram, Fine and Okamoto (1999) found that 20–60% of all children with ADHD have an additional LI, and several children with ADHD were first referred to an SLP.

Various pragmatic abilities are impaired in ADHD (Väisänen, Loukusa, Moilanen, & Yliherva, 2014). Mathers (2006), for example, found that children with ADHD without coexisting LI made more abandoned utterances in written and oral narratives than their peers.

The importance of language assessment as part of diagnostic routine is emphasized in many studies, and it is further suggested that an SLP have best competence to perform this assessment (Brown, 2005; Cohen et al. 2000; Martinussen, 2015; Väisänen et al., 2014).
1.4. Comorbidity between ASD, ADHD and language

There is a documented comorbidity between language difficulties in ADHD and ASD. A review found that the rate of overlap in ADHD and ASD varies between 14–78% in different studies (Gargaro, Rinehart, Bradshaw, Tonge, & Sheppard, 2011). ADHD is the second most common coexisting diagnose in ASD at a percentage of 28.2%, the rates of at least one coexisting diagnoses in ASD was 70%, and rates of two or more comorbid diagnoses was 41% (Simonoff et al., 2008). Gillberg (2015) says that LI is found in 30% of ASD, and that ADHD is found in 40% of ASD. Keen and Ward (2004) studied ASD in children with “unusual behaviors” in different types of special education need, compared with main schools in England. They found that the number of recorded ASD diagnose in these children doubled in a four-year period. The age of receiving diagnosis fell from 11:7 to 3:4 years if diagnosed in 1997 compared with 2001. There was also an increasing overlap of ADHD in the children diagnosed with ASD, the comorbidity rose from 5.2% to 13.7% in four years. They suggest that the higher rates of comorbid ADHD and ASD is due to a greater number of diagnosed ASD in cognitive able children and children who were earlier only diagnosed with ADHD. Gillberg and Fernell (2014) suggest that the reported increasing rates in diagnosed ASD are due to the so called “Autism Plus” discourse, referring to ASD in comorbidity with intellectual disabilities, LI and ADHD. There are several studies showing overlap in ADHD, LI and ASD in different ways. Miniscalco and Gillberg (2009) administered a non-word repetition task to 7-year olds with only neuropsychiatric disorders, NPD, including AHD and ASD, only LI, and NPD + LI. The results showed that NPD + LI had significant lower results on the non-repetition task. Only NPD had the highest scores, but no significant differences versus only LI was found. All of the groups, mean age 7:6 years, had lower scores than the norm group of 5:0–5:11-year olds in the scoring manual to the non-word repetition test. The authors comment on the remarkably low scores in only NPD that the results “may give an indication as to how NPD in a child affects the test results in a negative way, or could be suggestive of underlying mild LI ‘‘overshadowed’’ by the clinically more ‘‘impressive’’ NPD” (Miniscalco & Gillberg, 2009, p. 1151). Therefore they considered describing NPD + LI like a meaningful further severe subgroup of NPD. The need to always consider co-existing language problems in NPD, and to investigate NPD in children with LI scoring low on non-word repetition tasks, is also underscored.

Many referred studies suggest multidisciplinary assessment including SLPs assessing neurodevelopmental disabilities because of the substantial overlap and comorbidity between ADHD, ASD and different language difficulties. The comorbidity in these diagnoses is bidirectional, and studies also show importance of broader multidisciplinary assessments in children with LI (Ek, 2015; Fernell, Norrelgen, Bozkurt, Hellberg, & Löwing, 2002). Bishop (2004b) also concludes that pragmatic problems are best assessed by multidisciplinary teams in order to be able to detect possible ADHD or ASD.

1.5. Hypotheses

The hypothesis in the present study was that there is a connection between pragmatic tests and tests measuring language in children with ADHD and/or ASD. It was further suggested that some or several of the tests in the testing battery from the present study would cause more problems in subjects with diagnose, D-group.

1. Does the test battery in the present study reliably distinguish the diagnose-group from the non-diagnostic group?
2. Is there a correlation between language tests and tests regarding pragmatic ability in the D-group, and how is that potential connection manifested?

3. Is the test battery in the present study adequate for assessing language in children with ASD and/or ADHD, or are some of the subtests sufficient?

2. Methods

2.1. Participants

For the D-group inclusion criteria was diagnose ADHD and/or ASD, or being subject of investigation regarding one or both of these diagnoses. The ages of the subjects varied from 9:4 to 13:6 years.

Exclusion criteria were intellectual disabilities, disabilities regarding vision or hearing, other primary language than Swedish, and history of language disabilities, and/or previous contact with a speech-language pathologist, SLP. Recruitment of subjects with ADHD or ASD who matched all of the exclusion criteria was difficult, and some adjustments had to be made which lead to including bilingualism and a history of language difficulties in the D-group.

Subjects with no diagnoses, ND-group, were 10 girls and 16 boys (n = 26), and subjects with diagnose/-s ADHD and/or autism, D-group, were 4 girls and 18 boys (n = 22). All the subjects (n = 48) ages varied between 9:4–13:6 years, M 11:7 and SD 0:11 years. ND-group: 10:5–13:4 years, M 11:9, SD 0:8, D-group: 9:4–13:6 years, M 11:5, SD 1:2. In the D-group (n = 22) diagnoses received prior to or during assessments related to the present study were distributed as follows: some had ADHD (n = 7), ADHD + depressive episode (n = 1), ADHD + Tic Disorder (n = 1), ADHD + Tic Disorder + Oppositional Defiant Disorder, ODD, moderate grade (n = 1), ADHD with primarily attention deficits (n = 4), ASD (n = 2), ASD + ADHD with primarily attention deficits (n = 2), ASD + ADHD (n = 2) and ASD + LI (n = 2).

2.2. Materials

All subjects were tested with a battery of language tests for Swedish speakers, frequently used by Speech and Language Pathologist in SLP-practice. The subjects’ parents did also fill in a questionnaire concerning their child’s pragmatic abilities.

2.2.1. Assessment of language abilities

Receptive grammatical comprehension was tested using The Test for Reception of Grammar 2 (TROG-2; Bishop; Swedish manual, Garsell, 2009), which also served as a baseline and exclusion criteria regarding the ND-group. There were 20 blocks with 4 sentences each representing one specific grammatical structure at increasing difficulty in TROG. The subject has to choose which picture out of four that represent each sentence.

Word definition was assessed with the subtest Defining words from the test battery Testbatteri Bedömning av Subtita Språkstörningar, Test Battery Assessment of Subtle Language Deficits (TBSS/BeSS; Laakso, 2007). There were ten words of increasing difficulty the subject was asked to define in own words. Responses gave 3–0 points
depending on the grade of accuracy. There are no standardized scoring manual for the ages of 9–13, why the results from the ND-subjects served as comparison for the D-group.

**Word-retrieval** was assessed using the confrontation picture naming test Boston Naming Test (BNT, 2nd ed.; Kaplan, Goodglass & Weintraub, 2001). There were 60 pictures of decreasing difficulty the subject is encouraged to name. According to Swedish norms all 60 pictures were tested in all subjects (Brusewitz & Gómez-Ortega, 2005).

**Word fluency** was tested phonemically and semantically. In the test FAS the subject say as many words possible starting with the letters F, A and S during one minute per letter. During scoring, all words emerged from the three letters (F, A and S) will be added. Semantical word fluency was based upon the semantical category **Animals**. The scoring procedure was retrieved from Carlsson (2009), and Laakso (2007).

**Lexical organization** was assessed using the discrete word association test the short Kent-Rosanoff-list, **KR-list**, based upon the original list made by Kent and Rosanoff (1910). Johansson and Wahlstrand (2010) developed the short **KR-list** consisting of 50 out of the original 100 words; 35 nouns and 15 verbs, that the subject heard and made one-word associations from.

**2.2.2. Assessment of pragmatically related abilities**

**Narrative generation, recall and false belief** were tested using the “Fish Story” from Expression, Reception, and Recall of Narrative Instrument, **ERRNI** (Bishop, 2004a). The subject tells the narrative aided by 15 pictures, and retells the same narrative after a break. Idea scores for the first story and Forgetting score for the retell will render maximum 48 points each. There is a component of false belief in the narrative, a girl swapping a doll and a fish without anyone else knowing. There were also comprehension questions, of which some test inference, with a maximum score of 18 points. Scoring was performed using both the **ERRNI**-manual explained above, and the macro level from Narrative Assessment Protocol (NAP; Bliss et al., 1998) measuring **Topic maintenance, Event sequencing, Explicitness, Referencing, Cohesion and Fluency**. NAP was used in Holck, et al. (2011), who presented a model of scoring: 3 points = “appropriate”, 2 points = “variable” and 1 point = “inappropriate”.

**Comprehension of orally presented narratives** was tested using the subtest **Understanding spoken paragraphs, USP**, from Clinical Evaluation of Language Fundamentals - Fourth Edition, the Swedish standardization (CELF-4; Semel, Wiig & Secord; Swedish manual, Garsell, 2013). Three short narratives with following comprehension questions targeting main idea, details, sequence, inferential and predictive information were presented.

**Comprehension of metaphors**. The subtest **Metaphors** from the test battery TBSS/BeSS (Laakso, 2007) was used in order to investigate the subjects’ comprehension of metaphors. There were ten sentences representing different metaphors the subject explained in own words. Scores from 3–0 was given depending on the accuracy of the interpretation. Since there are no standardized scoring manual in the ages of 9–13, the ND-subjects constituted as a norm group which the D-group was measured against.

**2.2.3. Questionnaire**

**Pragmatic abilities**. The questionnaire **Pragmatic Profile, PP**, from CELF-4 (Semel et al., 2013) with 50 questions was distributed to all parents. The questions in the **PP** concerned rituals and conversational skills, asking for, giving, and responding to information, and nonverbal communication skills.
2.3. Procedure

Participants in the ND-group were consecutively recruited from two schools via principals and teachers. The D-group was recruited from Child and Adolescent Psychiatry, CAP, and Children and Adolescent Habilitation, CAH, in a town in southern Sweden.

In the D-group, \( n = 26 \), some were diagnosed prior to the present study, and some participated as part of their neurodevelopmental evaluation, resulting in their diagnose/-s, ADHD and/or ASD. DSM-IV (APA, 1994) and DSM-5 (APA, 2013) were used. As ADHD both combined type and primarily attention deficit disorder, were included in the study. In the original ND-group, \( n = 27 \), one of the ND-subjects was in the present study found to have a LI and was subsequently excluded.

Children with diagnose/-s were recruited via colleagues in CAP and CAH, who contacted the parents. Some of the children recruited from CAP were under diagnostic evaluation regarding ASD and/or ADHD during the study. The author administered the test battery from the present study as the language part of the neurodevelopmental evaluation in these children, following the research assessment procedure. Complementary language tests were in some of these children administered as a follow-up. None of the subjects medicating for their ADHD had taken their medication at the day of the assessment.

The assessment took 1–1.5 hours, following a fixed test order in all subjects, including information and introduction. The subjects were encouraged to ask questions if necessary and were if needed given additional instructions prior to the subtests. The tests were given in the following sequence: ERRNI, TROG-2, Metaphors from BeSS/TBSS, KR-list, Defining words from BeSS/TBSS, Understanding Spoken Paragraphs, USP, from CELF-4, BNT, FAS and Animals. A short break with biscuits and lemonade took place after the KR-list. All tasks were read aloud to the subjects, the sentences in Metaphors were also given in written text. ERRNI was audio-recorded for later transcription, all other tests were scored manually. ND-subjects were assessed in their schools, while the D-subjects were assessed in an office at CAP. The questionnaire Pragmatic profile, PP, from CELF-4 was filled in at home by the parents in the ND-group, the parents of the D-group was taking it in the waiting room during their child’s assessment.

Ethics. The present study was approved by the Ethics Committee, reference number 2014/446-31. All children and parents gave informed consent participating in the study.

2.4. Statistical analyses

Statistics were made using IBM SPSS Statistics, version 23.0. Due to small sample sizes nonparametric tests were used. Mann-Whitney U-test was computed making between-group comparison and in-group-comparison. Spearman rank correlations computed association between variables in-group and between groups. All Spearman ranks were two-tailed. \( p < .01 \) was considered strongly significant, and \( p < .05 \) as moderately significant. For effect size-measure, Cohen’s \( d \) was used (https://www.psychometrica.de/effect_size.html#non parametric). Effect sizes were considered small when 0.20, medium if 0.50 and large at 0.80 (Becker, 2000).
3. Results

The main findings in the present study were all tests but the KR-list, were significantly more difficult in the D-group, showing that they are relevant when assessing ADHD and/or ASD. Other findings were the strong positive correlation in the D-group between Metaphors and TROG (grammatical understanding), and Metaphors and Defining words. Inferential questions in USP also had a strong positive correlation to BNT (lexicon size).

3.1. Descriptive statistics

Table 1 show the distribution of all test results but ERRNI in the two groups compared to each other. As shown in Table 1, all test results were higher in the ND-group than in the D-group. Significant at p .001 were Metaphors, PP, FAS and Inference questions from USP, indicating that the D-group managed these test less well. PP, Metaphors and FAS also rendered a large effect size. Significant discrepancy between the groups, p .05, was found for Predictive questions from USP, BNT, TROG, Animals and Defining words. Also, USP, computed in raw scores, was significantly more difficult in the D-group. No significant correlation was found regarding the KR-list and USP computed in standard scores. In the ND-group, 11 children had undergone the syntagmatic-paradigmatic shift (defined as a score over 60% in the table), whereas the number was 9 children in the D-group.

Table 1

Results from all tests but ERRNI in the ND-group and the D-group: mean (M), standard deviation (SD), between-group comparison using Mann-Whitney U-test (U-value), 2-tailed p-value of Spearman rank correlations (p-value) and effect size calculated as Cohen’s d (d-value).

<table>
<thead>
<tr>
<th></th>
<th>ND-group (n = 26)</th>
<th>D-group (n = 22)</th>
<th>U-value</th>
<th>p-value</th>
<th>d-value</th>
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</thead>
<tbody>
<tr>
<td>TROG</td>
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<td>92.73</td>
<td>13.11</td>
<td>185</td>
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<td>9.73</td>
<td>5.16</td>
<td>108</td>
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<td>4.13</td>
<td>12.45</td>
<td>4.84</td>
<td>190.5</td>
</tr>
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<td>15.86</td>
<td>52.66</td>
<td>14.07</td>
<td>229.5</td>
</tr>
<tr>
<td>BNT</td>
<td>41.73</td>
<td>4.22</td>
<td>38.68</td>
<td>5.54</td>
<td>180.5</td>
</tr>
<tr>
<td>FAS</td>
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<td>7.86</td>
<td>20.45</td>
<td>7.65</td>
<td>156.5</td>
</tr>
<tr>
<td>Animals</td>
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<td>5.59</td>
<td>15.64</td>
<td>5.49</td>
<td>183.5</td>
</tr>
<tr>
<td>USP ¹</td>
<td>7.88</td>
<td>2.14</td>
<td>7.82</td>
<td>2.59</td>
<td>273</td>
</tr>
<tr>
<td>USP ²</td>
<td>11</td>
<td>1.77</td>
<td>9.86</td>
<td>1.83</td>
<td>190.5</td>
</tr>
<tr>
<td>USP Inference questions</td>
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<tr>
<td>Pragmatic profile ¹</td>
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<td>3.91</td>
<td>3.41</td>
<td>39</td>
</tr>
<tr>
<td>Pragmatic profile ²</td>
<td>171.35</td>
<td>15.03</td>
<td>132.23</td>
<td>19.66</td>
<td>36</td>
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</table>

*p < 0.05; **p < 0.01

¹ based on standard score, ² based on raw score.
The time between narrative generation and retell in table 2 varied, since the test TROG was distributed in between. In both groups there was a 14 minutes pause in general (D-group: 11–19 minutes, \( M = 14.47 \); ND-group: 11-24 minutes, \( M = 14.17 \)). This is in accordance with the manuals suggested 10–30 minutes (ERRNI; Bishop, 2004a). ERRNI was more difficult in the D-group than in the ND-group in all perspectives. Compared with the standard scores in the manual, based upon English speakers, for Comprehension questions, Idea score and Forgetting score, the results are lower in the Swedish speaking ND-group.

Table 2

<table>
<thead>
<tr>
<th>Topic maintenance 1</th>
<th>ND-group (( n = 26))</th>
<th>D-group (( n = 22))</th>
<th>U-value</th>
<th>p-value</th>
<th>d-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
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<td>M</td>
<td>SD</td>
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</tr>
<tr>
<td>3.00</td>
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<td>0.47</td>
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<th>Event sequencing 1</th>
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<th>p-value</th>
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</thead>
<tbody>
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<td>SD</td>
<td>M</td>
<td>SD</td>
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<td>2.73</td>
<td>0.53</td>
<td>2.86</td>
<td>0.49</td>
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<th>d-value</th>
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</thead>
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<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>0.65</td>
<td>1.77</td>
<td>0.69</td>
<td>135</td>
<td>.001**</td>
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<th>Comprehension question</th>
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<th>D-group (( n = 22))</th>
<th>U-value</th>
<th>p-value</th>
<th>d-value</th>
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</thead>
<tbody>
<tr>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.77</td>
<td>1.82</td>
<td>11.59</td>
<td>3.02</td>
<td>152.5</td>
<td>.005**</td>
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<table>
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<th>Fluency 2</th>
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</thead>
<tbody>
<tr>
<td>M</td>
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<td>M</td>
<td>SD</td>
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<td></td>
</tr>
<tr>
<td>2.31</td>
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<td>0.8</td>
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<table>
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<th>U-value</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.5</td>
<td>3.71</td>
<td>21.5</td>
<td>7.14</td>
<td>123</td>
<td>.001**</td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01
1 based on standard score, 2 based on raw score.

3.1.1 ND-group

There were both positive and negative correlations between pragmatics and core language at different significance levels in the ND-group. Metaphors had a strong positive correlation with Defining words \(( r = .558; p = .003 \). Metaphors correlated positively with BNT \(( r = .472; p = .015 \). USP, measured in raw score, correlated positively with Defining words \(( r = .410; p = .038 \). A negative correlation was found between ERRNI Fluency retell and Animals, semantic word fluency \(( r = -.396; p = .045 \).
3.1.2. D-group and ND-group combined

One correlation between pragmatics and language was positive at $p < .01$ or higher in all groups (ND + D, D and ND), *Metaphors* and *Defining words*. In ND + D the significance level was $r = .687; p = .000$, compared with the D-group: $r = .736; p = .000$; and the ND-group: $r = .558; p = .003$.

In all three groups the two pragmatic ERRNI-scores *Idea score* and *Forgetting score* were also significant at a $p = 0.01$ level, in ND + D as follows: $r = .799; p = .000$.

3.2. Qualitative findings

The number of subjects making literal interpretations of the *Metaphors* was quite similar in the groups. The number of literal responses in the D-group was higher, varying from zero to nine, compared with zero to six in the ND-group.

In ERRNI, incorrect words appeared in both groups, there were both incorrect use of words, omitted words, wrong preposition, phonologic errors like “fiks” for “fisk” (“fish”), vague neologisms like “food-thing”, and incorrectly conjugated words. Also the syntax was sometimes incorrect with erroneous verb placement, which is more likely to be found in bilingual persons. Incorrect usage of words, exchange of concepts and word substitutions like “ice-cream…house” for kiosk were more frequent in the D-group. In the D-group there were five conjugation errors, and in the ND-group there were three ones. In the Fluency-measure several different types of so called mazes occurred. Mazes can be filled pauses, repetitions, connectors (e.g. and then between series of events), or phonological, lexical or grammatical revisions, that do not contribute to the understanding of the utterance (Fiestas, Bedore, Peña & Nagy, 2005). An example from one of the least coherent generated narrative in the D-group, aged 12:4 years, shows mazes like connectors, repetitions and fillers, but also errors in reference and one conjugation error:

“… then what’s it called showed what’s it called he who stood in the pay desk the fish he wanted, and then he gaved that fish to what’s it called the boy eeh, he got his money he wanted-ed the money that he had ...”.

There are obvious errors in Fluency and Referencing, which clearly hampers the intelligibility for the listener.

4. Discussion

It was expected that correlations between tests would occur, and that the result in the D-group would be lower in general compared with the ND-group. The only subtest not showing any significant difference between the groups was the *KR-list*. The subjects with diagnose had strongly significant lower scores in the *PP, Metaphors*, Inference questions from *USP*, and *FAS*, with an large effect size on *PP, Metaphors* and *FAS*. However, the finding that so many tests were more difficult in the D-group highlights the sometimes more diffuse language difficulties in a neurodevelopmental sample.

4.1. Result discussion

In the D-group *Metaphors* were more difficult than in the ND-group, $p < .001$, which was an expected result, since studies show that figurative language is difficult in ASD and ADHD
(Cummins, 2014; Mashal & Kasirer, 2011). Defining words was also more difficult in the D-group, \( p = .05 \), possibly because of the narrative component.

FAS and Animals were difficult in the D-group, FAS at a strong significance level, \( p < .001 \). In typically developed children, both phonemic and semantic word fluency was correlated with age, but FAS increased more than Animals between 6 and 15 years (Carlsson, 2009). This pattern, with a wider discrepancy in FAS than in Animals was also found in the present study, in both groups. Einald and Hallberg (2015) found no correlation between FAS and education, but with FAS and perceived reading skills and reading habits regarding fiction books. Separating education and age in school-ages is problematic, but matureness in executive functions is needed for generating more words during adolescence (Carlsson, 2009), which in the present study seems applicable, since executive functions in the D-group are impaired.

In both the D-group and ND-group Metaphors and Defining words correlated positively at a strong level. Rather equal scores between the tests was also fund in standardizations for 13–16 year olds (Olsson-Bolonassos & Sundfors, 2008), and 15–18 year olds (Andersson & Wieslander, 2012). Einald and Hallberg (2015) found positive correlations between completion of university studies, Metaphors and Defining words. There is also a narrative part in both tasks, which might give a stronger correlation between the tests. One implication is that lexical knowledge is a necessary base for understanding figurative language like metaphors, and that these abilities are developing aided by education.

There was a strong positive correlation, \( p < .001 \), between Metaphors and TROG, and a significant correlation, \( p < .05 \), between Metaphors and FAS in the D-group. TROG is a test measuring grammatical understanding, but can also be used as a baseline regarding language understanding, since the ability of understanding sentences can be considered a basic component of language knowledge. If this ability is impaired, which it the case in many of the D-subjects, it is plausible that the ability of understanding more complex figurative language also is impaired. FAS and Metaphors correlated in the D-group, which might depend on the cognitive flexibility that is required in both tasks.

Children with LI, mono- and bilingual, have reported weaknesses in lexical networks and difficulties in both lexical organization and size (Holmström, 2015; Leonard & Deevy 2004). Therefore, it was unexpected that the KR-list did not render greater differences between the groups and that the KR-list did not correlate to tests like TROG measuring lexical size. There were also surprisingly few children in the TD-group that had undergone the syntagmatic-paradigmatic shift given that they are 9 years or older.

Several positive correlations were found between different measures in ERRNI in both groups. The Idea score and Forgetting score correlated to each other at a strong significance level in both groups. Some negative correlations in ERRNI-measures were found in the D-group. There was a crucial false belief-task in the narrative; the little girl switches places of the doll in their bag and the fish in the boy’s bag without him knowing. Therefore the subjects’ interpretation of this specific event was relevant for further investigation. There were more subjects in the D-group \( (n = 8) \) that not mentioned or misinterpreted this event in the generated narrative and/or retell, than in the ND-group \( (n = 4) \). In the D-group the false belief-task got interpretations like the boy were robbed by the little sister, the bags were switched, and the boy got a doll.

Linguistic errors in ERRNI, like incorrect use of words, conjugation errors and word substitutions were more frequent in the D-group, which might be due to less developed language in general or marginally younger ages in the D-group. One verb from the example from ERRNI in 3.3 with incorrect conjugation, “gaved” (“gedde”), is comparable with the ones made by younger children when learning how to conjugate. This type of so called overgeneralizing tends to peak in about 4–5 years of age and decline thereafter in Swedish
speaking typically developing children (Nettelbladt & Salameh, 2007), but was found in much older children in this study. Confusion in “home/to them” and “here/there” were found in the D-group, but not in the ND-group. This is likely due to difficulties in referential deixis in ASD for example (APA, 2013).

The many mazes like repetitions in the D-group might be due to difficulties remembering and planning, or serve as a way of once again hear the speech output, like Fiestas et al., (2005) suggests. Filled pauses and repetitions might also indicate rapid language growth (Fiestas et al., 2005). In children with CP assessed with the narrative recall test BST scored using NAP, mazes had positive correlation with Idea score, implying that mazes were used as a strategy trying to recall relevant pieces of information and in word-finding (Holck et al., 2011). In the present study correlations between ERRNI-measures was not at focus, but the idea of mazes as a helpful strategy seems very plausible to apply. The word retrieval difficulties and self-initiated repairs also resemble the ones Saldert (2006) found in persons with right- or left hemisphere damage. Abandoned utterances were further found in children with ADHD in Mathers (2006).

4.2. Methodological discussion

Subjects participating in the ND-group might on the one hand have been more motivated than their peers, or on the other hand have interpreted participating as obligatory. Parents might have seen participation as a way of getting an SLP assessment. The test situation was not constant, since ND-subjects were tested in their schools, and subjects with diagnose were tested at CAP at the hospital. During the KR-list, this became clear since some of the subjects made associations to things they saw in the test room rather than the target word, for example mirror or painting, things that not occurred in all assessment rooms.

4.2.1. Scoring procedure

Fluency was the category causing most trouble in both groups. During story generation the highest number of disfluencies was 28 in the ND-group and 60 in the D-group. During retell the highest numbers of disfluencies in the ND-group was 35. In the D-group the highest number of disfluencies was 55, and the mean was 20.23 during retell. Some of the D-subjects did not generate the narrative on their own initiative, the author had to elicit by asking what happened in the pictures.

Understanding spoken paragraphs from CELF-4 was a bit problematic to score, which also Christoffersson and Pihl (2015) noted. The manual is quite strict regarding accepted answers giving a few examples for each question. Many responses from the subjects were in the authors opinion adequate and similar to those suggested in the manual, but did not give any points due to slightly different wording. Some of the questions were also somewhat oddly formulated, in relation to the manual’s suggested answers. Those specific questions also did render lower scores in many subjects. The subjects answers were sometimes more correct according to the wording of the question, but not right according to the manual. Despite this, the manual’s suggested answers were the ones accepted as correct in the present study.

Pragmatic profile. When answering the PP from CELF-4 some of the parents to ND-subject scored “always” in all questions giving 200 in raw scores. This might suggest that they were provoked by the questions interpreting them as indicating that their child was poorly educated, that they wanted their child to appear as proficient and they had not
observed anything “wrong” with their child, that they did not understand the questions, or that they simply did not care to fill in the questionnaire carefully.

4.3. Limitations

Since the groups were small, it is difficult to draw general conclusions from the present study, but strong indications, as so many differences between the D-group and the NP-group were significant at \( p < 0.001 \), which is considered very strong. A limitation is that the subjects were not controlled for or matched on socioeconomic background. Therefore, the groups might differ significantly in these aspects.

5. Conclusions

There is an obvious difference between pragmatic and language skills in subjects with and without ADHD and/or ASD in the present study. The D-group performed worse than the ND-group in all tests assessed, and all of them but the KR-list would be sufficient assessing language in a diagnostic group. Positive correlations found between pragmatics and language suggest that these abilities tends to develop in a somewhat synchronized pace in ADHD or ASD, compared with the ND-group, where only Metaphors and BNT, and USP and Defining words correlated at a positive significant level – but Fluency retell and Animals correlated negatively. The only strong positive correlation found between pragmatics and language in both groups, combined and separated, was Metaphors and Defining words, suggesting that lexical knowledge and ability to explain interact in these tasks. Pragmatic abilities also correlated with one another in both groups, suggesting that pragmatic abilities interact in different ways when having or not having neurodevelopmental disabilities. In spite of the fact that one inclusion criterion was no history of language deficits or earlier contact with an SLP, there were subjects in the D-group diagnosed with additional LI, which was detected in the study. In normal clinical practice, only a few of the subjects in the D-group would have been referred to an SLP during their neurodevelopmental assessment. This emphasises the risk that LI will remain undetected in children undergoing neurodevelopmental assessment.

Clinical implications. Most of the language tests used in the present study would be relevant using when assessing children with neurodevelopmental disorders. Sincerely answered PP is a very good complement to assessing the children; it can distinguish ASD and ADHD, and give information about areas suggested for intervention. In order to get more valid results in PP, an interview-setting where the parents are able to discuss the questions with the examiner is suggested. Low scores in PP combined with TROG, Defining words and FAS might implicate ASD or ADHD. Similar results might be found between Metaphors and TROG or Defining words, inferential questions and BNT in ADHD or ASD. Another way of putting it is that to always expect, and evaluate language difficulties, not “only” pragmatic deficits, in children with neurodevelopmental disabilities is strongly indicated. Some tests might be similarly difficult in children with ADHD and/or ASD, like Metaphors and TROG or Defining words, inferential questions and BNT. When assessing a child that shows difficulties in these tests, maybe a suggestion should be to further assess neurodevelopmental disabilities. The high frequency of mazes in ERRNI might suggest that several disfluencies might serve as a clinical marker indicating ADHD or ASD. There are language disabilities in ASD and ADHD that language assessment can distinguish. SLPs possess the required language expertise performing these assessments, interpret the results in
diagnostic evaluation, propose recommendations and implement adequate intervention. The results in the present study therefore calls for routine SLP assessment as an integrated part of neurodevelopmental investigation.

Further research. The results of this study emphasises the needs for larger studies using the same or similar tests in ASD and/or ADHD, and studies with subjects of different ages. Other studies might assess mazes in comparison with other clinical groups. Also studying language and pragmatics in young offenders with ADHD would be at relevance. A further subject for research directly linked to the present study, would be to compare assessments of children leading to diagnose ADHD and/or ASD performed with and without an SLP as part of the multidisciplinary team.
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Appendix 1

Dendrogram and icicle-plot with two clusters based upon the D-group’s results.