

Literacy and comprehension in school-aged children:
Studies on autism and other developmental disabilities

Jakob Åsberg



UNIVERSITY OF GOTHENBURG

Department of Psychology

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Språket är en sockertång som man kan gripa världen med.
Lennart Hellsing

Abstract

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The present thesis consists of five studies and addresses literacy and comprehension skills in children with autism spectrum disorders (ASD, including Asperger's disorder) and, to a lesser extent, attention disorders (eg. Attention Deficits Hyperactivity Disorder; ADHD). Although a completely clean and coherent picture of the abilities of these groups was not attained in the studies, the findings indicate that difficulties in reading comprehension and/or listening comprehension of connected discourse are common in children with ASD and children with ADHD at the group level (Study I, II and/or III). For children with ADHD, such difficulties often co-occurred with word decoding and spelling difficulties (Study II). Word decoding skills were more variable for students with ASD, yet typically unimpaired. These findings are broadly consistent with previous research. When difficulties in word decoding were observed in children with ASD, such difficulties appeared to conform to a 'normal pattern' in terms of underlying cognitive and psycholinguistic abilities (e.g. poor phonological awareness and rapid naming) (Study IV). Finally, for children with ASD, discourse-level comprehension appeared to be more difficult than what one would expect from non-verbal cognitive level and basic language comprehension skills (study III). However, there were also initial indications that the discourse comprehension skills in ASD were amenable of positive change through educational intervention in collaboration with school staff (Study V). The results presented in the thesis are of importance for professionals who are concerned with understanding and supporting literacy and comprehension development in all children.

Key words: autism, Asperger's disorder, reading, literacy, language, discourse comprehension, cognition, special educational needs.

Jakob Åsberg, Department of Psychology, University of Gothenburg, Box 500, SE-405 30 Göteborg, Sweden. Phone: +46 31 786 1856; fax +46 31 786 4628. E-mail: psyjaas@psy.gu.se

Populärvetenskaplig sammanfattning

Väl utvecklade tal- och skriftspråkliga färdigheter är oerhört viktiga för att självständigt klara sig i skolan, arbetslivet och vårt moderna samhälle i stort. Elever med olika typer av neuropsykiatriska utvecklingsavvikelser (t ex autism eller ADHD) rapporteras ofta av föräldrar eller lärare ha svårigheter med språk och läsning. Den här avhandlingen består av fem delarbeten som på olika sätt avser att belysa läsning, stavning och språk- och hörförståelse hos barn med autism eller uppmärksamhetssvårigheter/ADHD. Huvudfokus ligger på barn med autism-relaterade tillstånd.

Har barn med ovan nämnda funktionsnedsättningar läs-, språkförståelse- och skrivsvårigheter? Vilka slags problem har de i sådana fall? Det har varit en tydlig slagsida mot fokus på pojkar i tidigare forskning, vilket delvis kan förklaras av att pojkar är överrepresenterade i dessa grupper. Är tidigare beskrivningar giltiga också för flickor med dessa funktionsnedsättningar? Kan lärare stödja utvecklingen av förståelse för sammanhängande texter eller berättelser? För att besvara dessa frågor har grupper av elever utfört olika uppgifter och resultaten har sedan jämförts med normer eller med prestationen hos jämförelsegrupper av barn utan funktionsnedsättning. I en studie rapporteras resultaten från en interventionsstudie där vi samarbetade med personal på skolor för elever med autism-relaterade tillstånd. Förhoppningsvis kan de resultat som presenteras i avhandlingen vara av värde för lärare, forskare, kliniker och föräldrar när de ska förstå och stödja elever med neuropsykiatriska funktionsnedsättningar.

Jag kommer fortsättningsvis att använda termen autismspektrumtillstånd (AST) för att referera till Aspergers syndrom, autism och närliggande tillstånd. Förekomsten av AST beräknas ligga runt 0.5-1%. Personer med AST är en mycket heterogen grupp. Medan somliga personer med AST är totalt beroende av hjälp med i stort sett allt i livet – kanske utvecklar de aldrig något funktionellt språk – har andra ett väl utvecklat ordförråd, bor i egen lägenhet och har ett kvalificerat arbete. Denna avhandling fokuserar på elever med AST som går i grundskolan, och som inte har betydande intellektuella funktionsnedsättningar. Tidigare psykologisk forskning på barn med AST har bland annat beskrivit svårigheter med att ”sätta sig in i andras tankar”, att integrera information i meningsfulla helheter och att flexibelt reglera sitt beteende och tänkande. Man har utifrån tidigare forskning anledning att förmoda att detta skulle kunna påverka läs-, språkförståelse- och skrivutvecklingen negativt, men inte

nödvändigtvis på alla nivåer. Teoretiskt är det intressant att veta om AST framförallt påverkar förståelsen av innehållet i text, men att den tekniska avkodningen av ord (läsflyt) möjligen fungerar smidigt hos dessa elever. Möjligen är även utvecklingen av stavning en förmåga som inte påverkas av AST. Vidare har tidigare forskning antytt att elever med AST har särskilda svårigheter att uppfatta betydelsen i *sammanhängande* texter, t ex berättelser.

Uppmärksamhetssvårigheter, hyperaktivitetssyndrom eller ADHD (Attention Deficits Hyperactivity Disorder), som det vanligen kallas även i Sverige, är en relativt vanligt förekommande funktionsnedsättning. Förekomsten av ADHD har beräknats ligga någonstans mellan 2-7% bland barn, och man har identifierat såväl genetiska som sociala sårbarhetsfaktorer. I diagnoskriterierna för ADHD listas en serie beteenden inom uppmärksamhetssvårigheter och hyperaktivitet/impulsivitet. I Skandinavien används ibland även begreppet DAMP (Deficits in Attention, Motor control and Perception) för att referera till kombinationen av ADHD-relaterad problematik och motoriska problem. Ett klassrum är sannolikt en mycket svår miljö för ett barn med ADHD. I klassrummet förväntas man till exempel ofta sitta still, hålla reda på penna och papper, lyssna uppmärksamt på läraren och arbeta ihärdigt och planerat med uppgifter som inte alltid är särskilt roliga eller ger något omedelbart utbyte. Utifrån tidigare forskning har man viss anledning att tro att barn med ADHD har mer globala problem med att erövra skriftspråkliga färdigheter. I föreliggande studie hoppades vi lära oss mer genom direkta jämförelser med barn med AST, och med barn utan funktionsnedsättning.

I den första studien i avhandlingen ingick grupper av barn med AST, uppmärksamhetssvårigheter/DAMP och barn utan kända funktionsnedsättningar. När det gällde ordavkodningsförmåga fann vi ingen signifikant skillnad mellan grupperna. Det fanns dock en stor variation i grupperna med AST och DAMP även i grundläggande ordavkodningsförmågor. När det gäller läsförståelse presterade AST-gruppen signifikant svagare än jämförelsegruppen utan funktionsnedsättning, och det var en klar tendens till samma resultat för gruppen med uppmärksamhetssvårigheter.

I studie 2 deltog totalt 110 flickor med AST, ADHD och jämförelseflickor utan funktionsnedsättning. I denna studie ingick även mått på stavning vid sidan av ordavkodning och läsförståelse. Flickorna med AST kunde inte statistiskt skiljas från de andra grupperna avseende snittresultat på någon av läs- och skrivuppgifterna. Däremot hade ca hälften av

flickorna med AST och ADHD någon form av läs- och skrivsvårighet, vilket kan jämföras med en 6%-ig förekomst bland jämförelseflickorna. Dessutom användes i studien ett mått på graden av autism- respektive ADHD-relaterad problematik. Bägge dessa mått var statistiskt kopplade till läsförståelse på så sätt att höga nivåer av autism- respektive ADHD-relaterad problematik var kopplade till lägre resultat på läsförståelsetesten. Däremot fanns ingen signifikant koppling mellan höga grader av autism-relaterade beteenden och lägre ordavkodning eller stavning. Hög grad av ADHD var däremot kopplat även till lägre ordavkodning och stavning. Även vid gruppjämförelser framgick att ADHD-gruppen presterade generellt svagt på uppgifterna som testade läs- och skrivfärdigheter. Resultaten visar i sin helhet att det är viktigt att noggrant följa bägge gruppernas läs- och skrivutveckling. När det gäller läs- och skrivutveckling tycks ADHD vara förenat med en mer global problematik, medan AST mer specifikt tycks inverka negativt på läsförståelsen. Dessa resultat sammanfaller i stora drag med tidigare forskning.

I studie 4 fokuserades specifikt ordavkodningsförmåga hos elever med AST, genom jämförelser med en jämnårig grupp av barn utan funktionsnedsättningar. Återigen bekräftades resultatet att barn med AST inte hade några särskilda problem med ordavkodning. Men detta resultat gällde bara på gruppnivå. Det fanns en mindre grupp av barn med AST som presterade svagt i ordavkodning. Dessa barn visade sig genom vidare analyser ha problem inom språkliga områden som läsforskning på barn utan AST visat vara viktiga för en god ordavkodningsutveckling, nämligen fonologisk medvetenhet, snabb benämning och ordförråd.

Fokus i studie 3 var språk- och hörförståelse hos barn med AST och barn utan funktionsnedsättning. Resultaten i studien bekräftade att barn med AST har problem med att förstå innehållet i sammanhängande berättelser. Dessutom befanns problemen vara större än vad man kunnat förvänta utifrån elevernas icke-verbala begåvning och även deras förståelse för enskilda ord och meningar. En andra avsikt var att se om elever med AST hade oproportionerligt stora problem med att uppfatta information som sades ”mellan raderna” i berättelserna. Men något bevis för att så skulle vara fallet framkom inte.

I det sista arbetet försökte vi stödja förståelseutvecklingen hos 12 barn med AST i skolmiljö. En viktig tanke inom autismpedagogik är den s.k. ”tydliggörande pedagogiken” vilket bland annat innebär att tydligt visa eleven vad som ska göras och hur detta ska göras. Överfört till läs- och hörförståelse blir då utmaningen att försöka finna på ett sätt att göra en ”privat”

kognitiv aktivitet som förståelse tydlig och synlig för barnen och deras lärare. Ett material som delvis utvecklats av den svenska forskaren och specialpedagogen Lena Franzén ansågs vara lämpligt för detta ändamål. Inspiration till upplägget i interventionen hämtades också från utvecklingspsykologen Lev Vygotskys tankar om betydelsen av social interaktion och redskap för lärande. Resultatet från studien visade att barnens hörförståelse genomgick en statistisk säkerställd förbättring efter fyra veckors användning av materialet. Dessutom tyckte eleverna och deras lärare i regel att detta var ett relativt roligt och effektivt sätt att arbeta. Samtidigt är det viktigt att påpeka att det inte är något "mirakelmedel" som presenteras i arbetet. Förbättringen var specifik för just den tränade variabeln och även statistiskt signifikant, men effekten var inte särskilt dramatisk. Det finns också flera störningsfaktorer i studien som potentiellt kan ha spelat in i det resultat som framkom. Å andra sidan är detta ett område som knappt varit föremål för tidigare forskning, även internationellt sett, så förhoppningsvis kan studien inspirera till mer forskning och pedagogiskt utvecklingsarbete inom detta viktiga område.

Sammanfattningsvis så framkom vissa mönster i avhandlingen. För elever med AST tycks särskilt förståelse för skrivet eller uppläst textmaterial innebära utmaningar, medan elever med ADHD inte sällan har mer globala skriftspråkliga problem. Samtidigt finns stora individuella variationer. En viktig implikation av detta arbete är att man ska vara försiktig med att ta för givet att ett barn som kan läsa snabbt och korrekt per automatik också förstår innehållet i texter och berättelser. Dessutom är det inte säkert att eleven förstår det övergripande sammanhanget i en berättelse, även om hon eller han förstår enskilda ord och meningar. Detta är viktig kunskap för alla som arbetar med barns språk- och skriftspråkutveckling, men kanske är det extra viktiga för dem som arbetar med elever med AST. Slutligen hoppas jag att studien kan bidra till en ökad medvetenhet kring möjligheterna för specialpedagogisk intervention inom dessa områden.

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Göteborg, September 2009
Jakob Åsberg

Preface

This thesis consists of a summary and the following five studies referred to by roman numerals:

- I. Åsberg, J., Dahlgren, SO. & Dahlgren Sandberg, A. (2008). Basic reading skills in high-functioning Swedish children with autism spectrum disorders or attention disorder. *Research in Autism Spectrum Disorders*, 2, 95-109.
- II. Åsberg, J., Kopp, S., Berg-Kelly, K. & Gillberg, C. (in press). Reading comprehension, word decoding and spelling in girls with autism spectrum disorders (ASD) or attention-deficit/hyperactivity disorder (AD/HD): performance and predictors. *International Journal of Language and Communication Disorders*.
- III. Åsberg, J. (2009). Patterns of language and discourse comprehension skills in school-aged children with autism spectrum disorders. Manuscript submitted for publication.
- IV. Åsberg, J. & Dahlgren Sandberg, A. (2009). Dyslexic, delayed, precocious or just normal? Word reading skills of children with autism spectrum disorders. Manuscript submitted for publication.
- V. Åsberg, J. & Dahlgren Sandberg, A. (2009). Discourse comprehension intervention for high-functioning students with autism spectrum disorders: Preliminary findings from a school-based study. Manuscript submitted for publication.

Contents

Introduction	1
Typical and atypical development from a cognitive and educational perspective	1
Developmental disabilities	2
<i>Autism spectrum disorders</i>	2
<u>Prevalence</u>	3
<u>Comorbidity</u>	3
<u>Cognitive models</u>	4
<u>School and learning</u>	6
<i>Disorders of attention and/or hyperactivity-impulsivity</i>	7
<u>Diagnosis and prevalence</u>	7
<u>Comorbidity</u>	7
<u>Cognitive and psychological models</u>	7
<u>School and learning</u>	8
<u>Deficits in attention, motor control and perception</u>	9
Reading, writing and listening: tasks and difficulties for school children.	10
<i>Word decoding and spelling</i>	11
<u>Supporting word decoding and spelling</u>	13
<i>Reading comprehension and listening comprehension of discourse</i>	13
<u>Supporting comprehension</u>	16
Reading, spelling and listening abilities in children with developmental disabilities	17
<i>Children with autism spectrum disorders</i>	17
<u>Hyperlexia</u>	17
<u>Word decoding and spelling in children with ASD</u>	18
<u>Reading and listening comprehension of discourse in children with ASD</u>	20
<i>Children with attention disorders</i>	22
<u>Word decoding and spelling in children with AD/HD</u>	22
<u>Reading and listening comprehension of discourse in children with AD/HD</u>	23
<i>Summary of the introduction</i>	24
Aims of the empirical studies	24
<i>Study I</i>	25
<i>Study II</i>	25

	<i>Study III</i>	26
	<i>Study IV</i>	26
	<i>Study V</i>	27
Method		28
	<i>Participants</i>	28
	<u>Study I - Study V</u>	28-29
	<i>Instruments and assessment</i>	
	<u>Study I - Study V</u>	29-31
	<u>Intervention in Study V</u>	32
Results		33
	<i>Study I</i>	33
	<i>Study II</i>	34
	<i>Study III</i>	34
	<i>Study IV</i>	35
	<i>Study V</i>	35
General discussion		36
	<i>Word decoding and spelling in attention disorders</i>	37
	<i>Comprehension in attention disorders</i>	37
	<i>Word decoding and spelling in ASD</i>	38
	<i>Comprehension in ASD</i>	39
	<i>Conclusions</i>	43
	<i>Limitations and future directions</i>	43
References		46

Introduction

Literacy is a human right and a crucial tool for personal fulfilment, empowerment and education (UNESCO, 2008). Research has indicated that literacy difficulties are common among children with developmental disabilities, such as autism spectrum disorders (ASD) and attention disorders (e.g. Attention Deficit Hyperactivity Disorder; ADHD) (e.g. Maughan & Carroll, 2006). However, this characterisation is based on a rather small literature, in particular for ASD. There is furthermore a broad agreement in the literature that close continuities exist between children's oral and written language development among typically developing children. The present work examines both oral and written language abilities in children with developmental disabilities. The thesis focuses on higher-functioning children with ASD (including Asperger's disorder), but also includes children with attention disorders.

Do Swedish children with these conditions have difficulties with literacy and comprehension? If so, what kinds of problems do they have? The bulk of research on literacy difficulties in children with developmental disabilities has been done on boys; are girls with ASD and ADHD also affected? Can teachers support the comprehension development of children with ASD in school? These are some of the questions addressed in the present thesis and they are posed based on the belief that by gaining more knowledge about patterns of strengths and needs in children who differ in *some* regards from the majority, educators, clinicians and researchers will be in a better position to support language and literacy development for all.

Typical and atypical development from a cognitive and educational perspective

In this thesis cognitive and educational perspectives are combined. A cognitive perspective means the inclusion of a cognitive level of analysis (i.e. mental processes, broadly defined), which is assumed to underlie the behavioural expression. Snowling and Hulme (2008) describe that a cognitive explanation of developmental and learning disorders 'is essentially a functional explanation, couched in terms of how a particular skill is learned and performed, and in what ways this typical functioning is disturbed' (p. 8). An important strength of a cognitive perspective, over a strictly behavioural one, is that it can account for the fact that the same behaviour can rely on different cognitive mechanisms (cf. Morton, 2004; Toomela, 2008). This idea is important when trying to understand typical and atypical development as

there could be many different cognitive pathways to failure in developing a certain skill (Morton, 2004). Further, I consider cognitive explanations as typically free standing in relation to more global accounts of child development, and the same cognitive model of a childhood disorder can apparently be framed within different larger frameworks of development (e.g. nativist, cultural-historical or constructivist). Finally, Snowling and Hulme (2008) note that an important strength of cognitive explanations is that they relate ‘closely (though indirectly) to how we can best assess and treat a disorder’ (p. 8). This brings us to the educational perspective, which, in my view, means that the researcher does not settle for describing or even explaining learning difficulties and impairments in children, but also attempts to change the situation in a positive direction through intervention and co-operation with schools. Hence, an educational perspective is normative.

Developmental disabilities

Autism spectrum disorders or attention disorders are behaviourally defined conditions usually diagnosed according to the criteria outlined in the Diagnostic and Statistic Manual of Mental Disorders (DSM-IV) published by the American Psychiatric Association (APA, 1994) or the International Classification of Diseases and related health problems (ICD-10) published by the World Health Organisation (WHO, 1992). The diagnostic criteria in DSM and ICD are descriptive, not explanatory or theoretical (Morton, 2004). Whereas a categorical approach to diagnosis is needed for some purposes in clinical and educational contexts, both categorical and dimensional approaches have been used in research.

Autism spectrum disorders

In the present thesis the term ‘autism spectrum disorders’ (ASD) will be used to refer to a set of conditions, typically of neurodevelopmental origin, that share three core features:

1. Impairment in reciprocal socialization;
2. Impairment in reciprocal communication;
3. Restricted and repetitive behaviours, with stereotypical interests.

Sometimes the rare conditions of childhood disintegrative disorder and Rett syndrome are included in the autism spectrum. In the current study ASD refers to autistic disorder, Asperger’s disorder and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) or atypical autism.

The reason for the adopted 'spectrum' term partly has to do with the fact that it has proven to be difficult to tease apart these diagnoses developmentally. The main difference between autistic disorder and Asperger's disorder, according to present criteria, lies in cognitive and linguistic development in early childhood. In contrast to what is the case for autistic disorder, normal speech onset and intellectual development during the first years of life is necessary for a diagnosis of Asperger's disorder. However, it is not clear whether this a valid discrepant criterion among school-age children with these disorders, and by adulthood, language skills – such as receptive and expressive vocabulary – may fall below age-normal levels in Asperger's disorder (Howlin, 2003). Conversely, children with autism can grow up to have normal speech fluency and core oral language skills by school-age, and 'once children with HFA [high-functioning autism] develop fluent speech and are without structural language impairment (SLI), they may jump to the developmental pathway of the children with AS [Asperger's syndrome]' (Bennett et al., 2008, p. 618). Language use, i.e. social communication and pragmatics in conversations, still presents a challenge to school-aged children with ASD, and this seems true for autistic disorder as well as for Asperger's disorder and PDD-NOS (Verté et al., 2006).

Autistic features and symptomatology refer to behaviours related to ASD, which are spread in the population although not necessarily reaching clinically relevant levels. Research has shown that ASD and autistic features are highly heritable, but that the triad of behaviours is heterogeneous in the population, both behaviourally and genetically (Snowling & Hulme, 2008; Ronald et al., 2006).

Prevalence. Recent estimates indicate that the prevalence is approximately 1% (Baird et al., 2006). There is a higher preponderance of boys among children with ASD. Baird et al. (2006) provided an estimated sex ratio of 3.3:1 (boys: girls). Psychological and educational research on girls with ASD is scarce (cf. Attwood & Grandin, 2006).

Comorbidity. The issue of comorbidity in ASD is a complex topic since it is difficult to decide if co-occurring difficulties are independent or correlated features of the main disorder. Partly because of such difficulties, some argue that the concept of comorbidity is of questionable value in the field of childhood development disorders (Kaplan, Dewey, Crawford & Wilson, 2001). Nevertheless, a substantial proportion of children with ASD have a general intellectual disability. Yet, Rajendran and Mitchell (2007) report that at least 75% have IQs in the normal range, which is an estimation that has risen dramatically the last

decades. High degrees of ADHD-related behaviours among children with ASD have also been reported (e.g. Sturm, Fernell & Gillberg, 2004), and the reverse pattern also appears common (Hattori et al., 2006). However, there is still a controversy on the meaning of such phenotypical overlap between ASD and ADHD. More specifically, there is disagreement as to whether ADHD behaviours in a child with ASD represent another 'type' of ADHD, with a potentially different etiology and expression. For example, behaviours related to inattention might actually be a consequence of restrictive interests that prevent the child from being attentive to other things (Sinzig, Walter and Doepfner, 2009). Likewise, hyperactive behaviours can sometimes be difficult to differentiate from the stereotyped movements often seen in ASD. These would then be examples of phenocopy phenomena. Hence, some researchers and clinicians (e.g. Plizska, Carlson & Swanson, 2003, as cited in Sinzig et al., 2009) question the point of diagnosing subtypes of ADHD in a child with ASD. However, there is also a growing recognition of a genuine overlap. For example, a recent twin study (Ronald, Simonoff, Kuntsi, Asherson & Plomin, 2008) indicated a moderate degree of genetic overlap between traits relating to ASD and ADHD, both at the population level and at the extremes (i.e. at very high levels of ASD and ADHD). These findings are seen as important for 'psychologists and psychiatrists, who may have assumed these sets of behaviours are independent' (p. 535). Among low-functioning children with ASD, epilepsy is a common co-occurring condition. Mood and anxiety disorders are also common (Matson & Nebel-Schwalm, 2007), not least among higher-functioning girls with ASD (Kopp, Berg-Kelly & Gillberg, 2009). While a pervasive pragmatic difficulty in language use is universal for children with ASD, some school children with ASD have additional structural or core oral language difficulties in the areas of phonology, morpho-syntax and/or vocabulary (Kjelgaard & Tager-Flusberg, 2001; Miniscalco, 2007), and among children with autism and intellectual disability a majority fail to develop any functional language at all (Tager-Flusberg, Paul & Lord, 2005). Language comprehension in ASD will be discussed in greater detail below, but it could be noted here that recent research suggests that the type of language impairment seen in some children with ASD appears not to be etiologically of the same type as that seen among non-autistic children with specific language impairment (Whitehouse, Barry & Bishop, 2008).

Cognitive models. There are different cognitive theories that attempt to explain the behavioural phenotype that defines the disorder. According to Frith (2003) and others (e.g. Dahlgren, 2002; Rajendran & Mitchell, 2007), the three main cognitive theories are:

- (i) Theory of mind-deficit (Baron-Cohen, Leslie & Frith, 1985; Tager-Flusberg, 2008); This theory is based on research noting that children with ASD have deficits or delays in the ability to impute mental states (such as beliefs and false-beliefs) when interpreting the behaviours of others.
- (ii) Executive dysfunctions (Hill, 2004; Ozonoff, Pennington & Rogers, 1991); This theory is based on research showing that children with ASD have impaired executive functions (EF). EF is an umbrella term that refers to a range of cognitive functions presumed to be under frontal-lobe control, such as planning, set-shifting, working memory, monitoring and inhibition. EFs are necessary for self regulation and allow us to act flexibly in a world prone to change (c.f. Barkley, 1997).
- (iii) Weak central coherence (Frith, 1989; Happé & Frith, 2006); This theory is based on research demonstrating that individuals with ASD have a tendency to process information or stimuli independent of context and in a fragmented fashion.

According to Frith (2003), the three theories explain different aspects of the behavioural phenotype: The theory of mind-deficit can explain impairments in socialization, communication and imagination and the theory of executive dysfunctions can explain restricted, repetitive and stereotypical behaviours and interests. Weak central coherence, on the other hand, may not explain any of the core symptoms of ASD, but rather a set of behaviours that tend to be very common among individuals with ASD, e.g. 'islets of ability' and narrow attention to details. Also Dahlgren (2002) argues that there is no core deficit in ASD: 'A case could be made for a combination of different deficits that explain the behaviour in autism and Asperger syndrome, i.e. deficits in theory of mind, executive functions, central coherence, language competence and memory functions' (p. 47).

There are, of course, other psychological and cognitive theories of ASD besides those presented above (see e.g. Baron-Cohen, 2002; Hobson, 2002; Williams, Goldstein & Minshew, 2006; Wimpory, Nicholas & Nash, 2002). For example, the role of impaired joint attention (JA) skills has been stressed in recent years (Tomasello, 1999). JA behaviours (e.g. producing and responding to pointing gestures) are sometimes mentioned in the context of theory of mind, depending on how broadly this term is used. These behaviours, typically present around nine months of age, are presumed to reflect an early appreciation for others as intentional beings, which in turn is considered necessary for the onset of symbolic (e.g. language) understanding (Tomasello, 1999). Failure to engage in JA with other people is considered a reliable indicator of autism in toddlers (Leekam, 2007).

School and learning. Children with ASD often struggle in school. In a survey by The National Society of Autism in Sweden (Riksföreningen Autism, 2008), children with ASD were found to have greater difficulties reaching the curriculum 'learning goals' for Swedish schools compared to other disability populations.

In their studies of academic performance in high-functioning (IQ > 70) boys with autism, Minshew, Goldstein, Taylor and Siegel (1994) noted impaired abilities in what they call 'complex' and 'interpretative skills' (e.g. comprehension of complex linguistic instructions, problem-solving and reading comprehension) but intact or even enhanced 'mechanical' skills (e.g. arithmetic and word decoding).

According to contemporary views, school learning and teaching are not only individual or cognitive processes, but to a large extent also social and communicative enterprises (Ireson, 2008). An important ingredient in this dominant view of learning and teaching is the old vygotskyan notion that 'human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them' (Vygotsky, 1978, p. 88). Teachers and researchers have expressed concerns that children with ASD seem to learn and think differently and to a larger extent asocially (Powell, 2000; see also Tomasello, 1999). Students with ASD and teachers often seem to find it challenging to reach intersubjective understanding, something that might be essential for successful complex and cultural learning according to current conceptions (Ireson, 2008; Olson, 2003). Jordan (2005) interprets such difficulties within the context of the abstractness of the language of instruction, which can be hard for children with ASD to grasp. She gives an example of a teacher 'asking', *Would you like to come and read now, John?* to which the child with ASD may very well answer (without being wayward) *No thanks* (p. 230).

Explicit and structured teaching that creates few instances of ambiguity for the student with ASD concerning what to do, where to do it, with whom and for how long is presumed to benefit social and academic functioning (cf. Schopler, Mesibov & Hearshey, 1994). Furthermore, it has been pointed out repeatedly that children with ASD often need to learn explicitly what others acquire intuitively (e.g. Jordan, 2003). Furthermore, assisting students in 'learning how to learn' appears important (Powell, 2000).

Disorders of attention and/or hyperactivity-impulsivity

According to Barkley (1997), the English physician George Still published one of the first scientific descriptions of childhood disorder(s) of attention and hyperactivity/impulsivity in 1902. He described the behaviours of 20 children in his clinic as having a deficit in 'volitional inhibition' and a deviant moral development. Diagnostic labels (e.g. 'hyperactive child syndrome', 'hyperkinetic reaction of childhood', 'attention deficit disorder') and diagnostic criteria have undergone revisions several times since (Barkley, 1997). The term ADHD is used in DSM-IV (1994).

Diagnosis and prevalence. ADHD is one of the most common childhood developmental disorders (Barkley, 1997). The prevalent view is that ADHD comprises two major sets of symptoms: (1) inattention and (2) hyperactivity/impulsivity. ADHD appears in three subtypes depending on whether the criteria are met for either or both sets of major symptoms: predominantly inattentive (ADHD-I), predominantly hyperactive-impulsive (ADHD-HI) or combined type (ADHD-C) (APA, 1994).

Skounti, Philalithis and Galanakis (2007) report that the estimations of the prevalence of ADHD range from 2.2% to 8.9%. The boy:girl ratio of ADHD prevalence has been estimated to 3:1 (Barkley, 1997). However, this difference is higher in clinical than in school-based samples, suggesting that girls are less likely to be referred for ADHD-related problems (Biederman & Faraone, 2005). Both social/familial and genetic risks have been identified as important factors in the ADHD etiology (Barkley, 1997; Biederman & Faraone, 2005).

Comorbidity. Co-occurring difficulties or impairments seem to be the rule rather than the exception in ADHD. Childhood disorders that are common among children with ADHD include learning disabilities (including reading and writing disabilities), autistic traits, developmental coordination disorder and conduct disorder (cf. Kadesjö & Gillberg, 2001; Kopp et al., in press; Biederman & Faraone, 2005).

Cognitive and psychological models. Cognitive and psychological models of developmental disabilities face the challenge of attaining both specificity (the hypothesised underpinning needs to be sufficient to cause the behaviours that define the disorder) and universality (the

hypothesised underpinning is necessary and shared by all individuals with the given behaviourally defined disorder) (Morton, 2004).

Two important psychological theories of ADHD are: (1) the executive dysfunctions theory, e.g. the theory of Barkley (1997), which proposes deficient inhibitory control as the underlying core deficit, and (2) the delay aversion theory, where the underlying model is a motivational difficulty in waiting that is independent of inhibitory deficits (Sonuga-Barke, Taylor, Sembi & Smith, 1992). According to a meta-analysis by Willcutt, Doyle, Nigg, Faraone and Pennington (2005), executive deficits are characteristic for children with ADHD at the group-level, however the theory lacks in specificity and universality. Solanto et al. (2001) put the executive dysfunctions theory and the delay aversion theory to a head-to-head comparison in one and the same study. The measures of executive functions and delay aversion were both independently correlated with ADHD symptomatology, yet the model was much improved by combining the two constructs. This has paved the way for dual or multifactorial models of ADHD that are considered to better account for the heterogeneity of the phenotype and neuropsychology in ADHD (Castellanos, Sonuga-Barke, Milham & Rosemary, 2006).

School and learning. A classroom is a challenging environment for a child with problems related to ADHD (Kos, Richdale & Hay 2006). In a classroom, children are often expected to sit still, keep track of books and pencils and listen attentively to topics that are not always of immediate interest. Students in classrooms of today are also required to take responsibility for their own learning and schoolwork to a much higher extent than was the case with the teacher-directed 'skill-drill'-type of pedagogy of the past. It might thus not be surprising that academic difficulties are common in children with ADHD. There is sometimes a concern expressed that the process of diagnosing or labelling a child with ADHD may in itself create educational difficulties for these children through a self-fulfilling prophecy-process, and there is indeed some experimental evidence that teachers interpret child behaviours differently depending on the explicit presence of ADHD (cf. Kos et al., 2006). However, school difficulties are common also among non-referred children with ADHD (DuPaul, 2007).

Unravelling the mechanisms linking ADHD to academic difficulties is a topic of ongoing research. Thorell (2007) provided evidence for a mediating role of executive dysfunctions at a cognitive level of analysis. Milich, Balentine and Lynam (2001) reviewed research on functional outcome and co-occurring difficulties in children with ADHD as a function of

subtype, and concluded that educational underachievement is more closely linked to inattention than hyperactivity-impulsivity. Studies of classroom behaviours have indicated that ‘off-task’ behaviours are common among students with ADHD, especially during activities such as listening to the teacher or silent reading (Vile Junod, DuPaul, Jitendra, Volpe & Cleary, 2006). Siegel, Goldstein and Minshew (1996) point out that ‘anything novel, challenging and varied enhances performance of individuals with ADHD’, which is in sharp contrast to what is the case for students with autism who typically ‘encounter difficulty adjusting to change in the environment’ (p. 13). Despite such obvious differences, some common guidelines for arranging the learning environment for the students can be applied. Specifically, Siegel et al. suggest that both groups of students benefit from, for example, highly structured tasks, reduced extraneous classroom stimuli, and brief work periods with tasks organised in small units (p. 14). Based on classroom observation studies, Kos et al. (2006) report that teachers tend to modify their teaching for students with ADHD by providing greater structure and routines.

One factor, that is currently receiving more attention, is the role of parental support and parental school involvement for children’s academic performance and development (Hoover-Dempsey et al., 2005). In a recent study by Rogers, Weiner, Marton and Tannock (2009), parents of children with ADHD reported less self-efficacy in their ability to help their children, and they also felt they had less time and energy for such assistance. Furthermore, compared to comparison group parents, they felt less welcome and supported by school staff.

Deficits in Attention, Motor control and Perception (DAMP). There has been considerable debate on the diagnosis of DAMP in the Swedish press. As described by Gillberg (2003) and Dahlgren (2002), the diagnostic term DAMP has generally been replaced by the combination of ADHD and developmental coordination disorder (DCD) in order to assimilate to the diagnostic categories used in the DSM (see also Snowling & Hulme, 2008).

Reading, writing and listening: tasks and difficulties for school aged children

'One of the hallmarks of expert reading is the ability to identify several letters quickly and in parallel' (Skarratt & Lavidor, 2006, p. 1749).

'We read to understand, or to begin to understand' (Manguel, 1996, p. 7).

The two quotes above capture two different aspects or components of the reading process and ability. The first component is word decoding, which refers to the process of transforming written words to the sound patterns of the spoken language equivalents of these words. The second process is comprehension, i.e. the extraction of meaning from text. This dual-component view is of key importance for the present work. According to the 'Simple view of reading' (Gough & Tunmer, 1986; Hoover & Gough, 1990), the reading ability is the product of word decoding/recognition and language/listening comprehension.

If reading comprehension comprises the two dimensions of language/listening comprehension on the one hand and word decoding on the other, then qualitatively different types of reading difficulties could be expected. Stuart, Stainthorp and Snowling (2008) capture this hypothesis in Figure 1. Three types of reading difficulties are possible in this model: specific word-decoding problems, located in the upper left corner; specific comprehension problems, located in the lower right; and mixed reading difficulties, meaning difficulties in both comprehension and word decoding, located in the lower left corner.

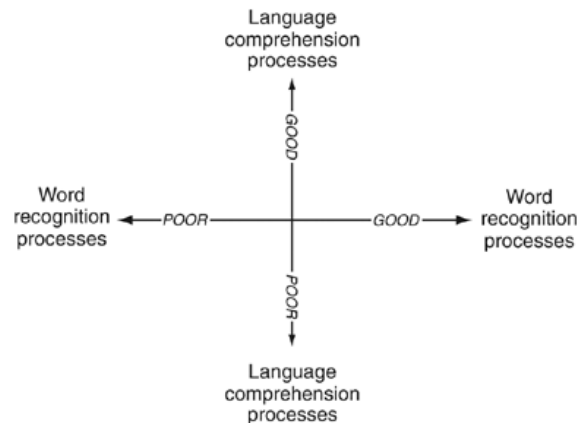


Figure 1. A graphical description of the 'Simple view of reading' from Stuart et al. (2008). Printed with kind permission from the publisher.

There is currently a growing amount of research suggesting that reading difficulties can be grouped according to this framework (Aaron, 1989; Catts, Adolf & Weismer, 2006; Bishop & Snowling, 2004; Cain & Oakhill, 2007). A large body of research has been devoted to examining the psycholinguistic bases of specific word decoding problems or dyslexia (Høien & Lundberg, 2000; Ramus & Szenkovits, 2008). Any reading comprehension difficulties experienced by children with dyslexia are typically seen as secondary effects of a ‘bottleneck’ in word decoding, i.e. as consequences of misidentified words and/or cognitive load (Høien & Lundberg, 2000). Specific comprehension problems have been noted in two different populations. The term “poor comprehenders” is commonly used to refer to mainstream children who in the face of normal word decoding skills display low levels of reading and listening comprehension (Cain & Oakhill, 2007; Nation, Clark, Marshall & Durand, 2004). Among children with disabilities, the term hyperlexia (Grigorenko et al., 2003; Nation, 1999) is sometimes used to refer to essentially the same patterns of reading behaviour as ‘poor comprehension’. However, the definition of hyperlexia is highly inconsistent over different studies (see more below). Finally, mixed reading difficulty has also been called ‘garden variety poor readers’ or ‘backward readers’ (Bishop & Snowling, 2004).

Developmental research has indicated that partly different, although not necessarily dissociated, cognitive/linguistic ontogenetic roots project onto the word decoding and comprehension components (Lundberg, 2002; Bishop & Snowling, 2004).

Word decoding and spelling

Lundberg (1978, as cited in Lundberg, 2002) meant that to be able to link speech to letters in the alphabet and vice versa, the child needs to shift his/her focus of attention from the *content* to the *form* of language, i.e. the child needs to become linguistically aware. An abundant amount of research has since shown that metalinguistic skills – and in particular meta-phonemic abilities, or phonemic awareness – play a key role in word decoding development (Bradley & Bryant, 1983; Lundberg, 2002) and that a weakness in this area is at the cognitive core of specific word decoding difficulties or dyslexia (Høien & Lundberg, 2000; Lyon, Shaywitz, & Shaywitz, 2003; Ramus & Szenkovits, 2008). Phonemic awareness is crucial also for spelling. Spelling is intimately connected to word decoding ‘not only because sounds are being linked to letters but because words are being encoded – literally put into a code instead of merely being deciphered or decoded’ (Shaywitz, 2003, as cited in Lyon et al., 2003,

p. 6). Spelling is thus theoretically expected to mirror word-decoding proficiency more closely than comprehension. Other factors known to influence word-decoding proficiency – directly or indirectly – are orthographic knowledge, morphological awareness, rapid automatic naming (Roman, Kirby, Parrila, Wade-Woolley & Deacon, in press) and, at least for some words, vocabulary (Ricketts, Nation & Bishop, 2007). Recently, multiple risk models of developmental disorders have risen in popularity (Pennington, 2006). In her case series study of children at family risk of developing dyslexia, Snowling (2008) concludes that ‘phonological deficits alone are insufficient to explain literacy difficulties, and it is children with multiple deficits (including language problems) that are more likely to succumb to reading failure’ (p. 142).

There has been much debate regarding the possibility that the relative role of different reading-related skills differs depending on the regularity of the language’s spelling, or so-called orthographic depth. In this context, the question arises whether it is self-evident that studies on reading and spelling in English-speaking children can generalise to, for example, Swedish-speaking children. For example, according to the Grain Size theory (Ziegler & Goswami, 2005), learners of opaque alphabetic systems (e.g. English) need to be flexible in their word reading and draw on knowledge of rhyme and syllable structure, while learners of more shallow alphabetic systems (such as Swedish) to a larger extent can rely exclusively on phonemic knowledge in word identification. Other potential factors may also be involved. For example, recent experimental research indicates that semantic knowledge plays an important role in orthographic learning (e.g. Ouellette & Fraser, 2009). This idea has been further specified by evidence from English that semantic language abilities play a greater role for the ability to read irregularly spelled words than for the ability to read regular ones (Ricketts et al., 2007). Considering that a larger proportion of words are spelled irregularly in English than in almost all other non-English languages, one could potentially deduce that semantic language plays a greater role in the acquisition of written English. However, the empirical evidence is far from consistently in favour of the diverging effect of orthographic depth. A recent study on large groups of children from kindergarten through grade 1 from Sweden/Norway and USA/Australia indicates that the ‘cognitive and language skills underlying reading and spelling development are similar across alphabetic orthographies’ (Furnes & Samuelsson, 2009, p. 275). Yet interestingly, with regard to the question of orthographic learning, Furnes and Samuelsson found that spelling ability in English to a greater extent is dependent on verbal (semantic) abilities in kindergarten.

Supporting word decoding and spelling. There are educational approaches that have proven to be efficient to support students who struggle with word decoding and/or spelling. A training study by Lundberg, Frost and Petersen (1988) demonstrated that phonological awareness can be developed in pre-schoolers outside the context of reading instruction, and that such training is very beneficial. Hatcher, Hulme and Ellis (1994) went on to demonstrate that the inclusion of print in early phonemic training is particularly effective, and today there is a very large literature in this field (e.g. Høien & Lundberg, 2000). Most research to date on the amelioration of word-reading difficulties has focused on word-reading accuracy, while less attention has been devoted to fluency. The most common paradigm for supporting fluency development is that of repeated reading. While children have been found to become quicker readers with this type of exercise, the prospect of transferring skills to non-trained words appears bleak (Hintikka, Landerl, Aro & Lyytinen, 2008).

Reading comprehension and listening comprehension of discourse

From a cognitive perspective, there are reasons to differentiate between the type of comprehension processes going on when one is involved in conversations and those occurring during decontextualised listening and reading comprehension (Oakhill & Cain, 2007; cf. Hjelmquist, 1982). The present study examines decontextualised reading and listening, not conversational understanding, which is very much a joint endeavour between the speakers-listeners (Clark, 1996).

Decontextualised comprehension of connected text or discourse is a tremendously complex cognitive skill. Studies on oral and/or written discourse comprehension have suggested that such processing operates at multiple linguistic and cognitive levels (Cain & Oakhill, 2007), and entails cognitive processes that range from fully automatic memory-based resonance to the goal-directed and strategic search for meaning (Long & Lea, 2005). The goal of discourse comprehension is to understand the *state of affairs* described in the text, which cognitively means to build a coherent mental representation of the situation, a so-called situation model. The comprehension of discourse is thought to draw on many of the same cognitive processes used when conceptualising situations in the ‘ordinary’ world (c.f. Kintsch, 1998).

In everyday language we typically make a clear distinction between reading and listening comprehension. However, from a cognitive perspective there is good evidence that a single comprehension system underlies both listening and reading (e.g. Stuart et al., 2008), which is

also captured in the simple view of reading. There is not total consensus on this view, though. For example, Pressley (2002) argued that skilled readers apply certain meta-cognitive strategies, above their general comprehension skills, to make sense of written text specifically. Supporting the simple view, Keenan, Betjemann and Olson (2008) performed a factor analysis on measures of word decoding and reading and listening comprehension, and found that listening comprehension loaded on the same factor as (most of the) tests of reading comprehension, but separately from word decoding. See Figure 2 for an illustration with descriptions of the points made this far.



Figure 2. The girl to the left is reading aloud from her book while the girl to the right is listening attentively. One body of research suggests that essentially the same *comprehension processes* are involved in these two activities. However, if the two girls are starting a conversation with each other, new pragmatic and socio-cognitive processes are likely to be activated. (Painting by Amira Bavec; printed with her kind permission.)

A corollary of the finding by Keenan et al. is that children with poor reading comprehension (but normal word decoding) typically experience listening comprehension difficulties (e.g. Cain & Oakhill, 2007). However, research findings on the *type* of listening/language difficulties are inconsistent. Some suggest that poor comprehenders typically perform less well than proficient readers on a wide range of ‘core’ language tests, e.g. oral receptive vocabulary and morpho-syntax (Catts et al., 2006; Nation et al., 2004), and that such impairments are likely causes of these children’s comprehension difficulties of connected discourse (see Snowling & Hulme, 2008, for a review). Others suggest that higher discourse-

level processes are particularly or perhaps even specifically confined (cf. Oakhill, 1993). One discourse-level cognitive process that Oakhill and colleagues studied in detail is inferencing. By letting children with differing comprehension skills read stories and then asking them separate questions on (i) explicit content and (ii) implicit content, they have demonstrated that children with specific comprehension difficulties often struggle with the latter. To exemplify, in one of the stories it is stated that a child ‘pedalled’ to school, but without any specific mentioning of a bike, and the child is then asked how the child came to school. Another example is found in the following story: ‘Lucy climbed to the top of the roof. The next day she woke up at the hospital’. For this text to be coherent, the reader or listener not only has to decode and understand the words and sentences, she/he also has to make usage of prior world knowledge to infer that Lucy probably fell down. More recently, Cain and Oakhill (2006) examined individual differences among poor reading comprehenders, and no clear profile emerged; some children presented impaired oral language skills while others did not. Importantly, it appears agreed upon in the field that children who successfully decode a text but struggle with its meaning typically experience comprehension difficulties also if the same text is read aloud to him or her.

Among many skills considered to be important for successful discourse comprehension the following can be mentioned: word decoding accuracy and fluency (for written language: Høien & Lundberg, 2000), oral/receptive vocabulary (Johnston, Barnes & Desrochers, 2008; Lundberg, 2002; Verhoeven & van Leeuwe, 2008), reception of grammar (Scott, 2009), working memory (Carretti, Borella, Cornoldi & De Beni, in press; Swanson, Howard, & Saez, 2007), inferencing (Cain & Oakhill, 2007; Graesser, Singer & Trabasso, 1994; McKoon & Ratcliff, 1992), and executive functions (e.g. sustained attention [Lorch, Berthiaume, Milich & van den Broek, 2007], meta-cognition and self-regulation, [Westby, 2004]; see also Grigorenko et al. [2007] for a genetic study on this connection).

A complicating factor in research on comprehension (and also research on the overlap between reading and listening/language comprehension abilities and disabilities) is that different tests of reading comprehension appear to tap partly different skills (Cutting & Scarborough, 2006; Keenan et al., 2008) and that children who are considered low achievers on one test can perform normally on another (Bowyer-Crane & Snowling, 2005). There are also developmental factors involved. Specifically, reading comprehension tests for young readers often rely heavily on word decoding, and have quite simple linguistic contents. Mirroring the idea that reading comprehension becomes more dependent on comprehension skills with age and ability, Catts et al. (2006) found that 8th grade specific reading

comprehension impairment in some cases were retrospectively better reflected in early listening (discourse) comprehension test scores than early reading comprehension test scores. To complicate things further, also oral language proficiency/ listening comprehension is operationalised very differently over studies, with some researchers using oral vocabulary to index 'listening comprehension', and others using tests of narrative discourse comprehension (see Keenan et al., 2008, for a discussion). Whether the differences between the studies are minor or comparing them is like comparing apples to oranges is not well known. Keenan et al. (2008) are pessimistic: 'Progress in science and validity of diagnoses depend on measurement instruments [...]. [The current situation] means that the answers to research questions could vary as a function of the specific test used to assess comprehension' (p. 298).

Supporting comprehension. In 2002, an American expert panel on reading research, the RAND Reading Study Group, characterised the knowledge base on reading comprehension as 'sketchy, unfocused, and inadequate as a basis for reform in reading comprehension instruction' (Snow, 2002, as cited in Johnston et al., 2008). Furthermore, classroom studies have suggested that teachers typically spend very little time on listening and reading comprehension instruction, both in absolute levels and as compared to time devoted to word reading instruction (Durkin, 1978-79, as cited in Pressley, 2002). While it appears safe to say that research on comprehension instruction is in a stage of infancy as compared to word decoding instruction, quite a lot has actually been learned both before and after the year of 2002.

First, research attempts to stimulate basic language skills are of relevance for reading and listening comprehension skills. Vocabulary training is important to consider, and for example Nash and Snowling (2006) demonstrated that children with poor vocabulary can be taught how to build vocabulary knowledge through a strategy for deriving meanings from the linguistic context, e.g. learn how to identify 'clues' to the meaning of a new word. Further, Yuill and Oakill's (1991) influential study examined the effect of experimenter-delivered inference and comprehension training in samples of children differing in comprehension skill: poor comprehenders who received either explicit inference awareness training or implicit training with comprehension questions significantly improved in relation to a control condition. The effect of inference training was impressive when increase in comprehension age was examined. Specifically, poor comprehenders in the inference-training group gained over 17 months in comprehension age over a period of two months of training.

Palinscar and Brown (1984) introduced an approach called reciprocal teaching where poor readers were taught four strategies: question generation, summarisation, clarification and prediction. The instructional structure during reciprocal teaching is one of cooperative teaching where the teacher and students take turn in leading discussions on texts. Reciprocal teaching has been used to support listening and reading comprehension (e.g. Aarnoutse, van den Bos & Brand-Gruwel, 1998), and the effect of reciprocal teaching has been found positive in a large number of studies (for a review, see Rosenshine & Meister, 1994).

Reciprocal teaching is not the only model based on the belief that good classroom talk is important for comprehension development. Yet, as discussed by Kozulin and Garb (2002) the ‘product’ is in focus in most classrooms (e.g. displaying and assessing comprehension), rather than the ‘processes’ (e.g. learning and teaching comprehension). In order to stress processes, Kozulin and Garb continue, ‘the covert cognitive and metacognitive processes must first be rendered into overt form’ (p. 117). This idea is picked up in a model called Question-answer-relations (QAR) (Raphael & Pearson, 1985; Raphael, Highfield and Au, 2006). The idea behind QAR is to find a way to make explicit to children and their teachers the type of cognitive comprehension processes that researchers have identified. This is done by providing the teachers with an explicit set of concepts for talking and thinking about the activity of comprehension that enable them to ‘label, discuss, dissect, and analyze these slippery ideas with their students’ (Pearson, 2006, p. 5). An example is the concept ‘On your own’-questions, which represent questions assessing schema-based inferencing. QAR has also been conceptualized within a cultural-historical or vygotskyan view of learning. Specifically, Raphael et al. (2006) use the concept ‘Vygotsky space’ (Harré, 1984) to characterize how knowledge is built through interactive processes between the public-private and social-individual during QAR lessons.

Reading, spelling and listening abilities in children with developmental disabilities

Children with autism spectrum disorders

Hyperlexia. The term hyperlexia was first used by Silberberg and Silberberg (1967, cited in Newman et al., 2007) to refer to individuals whose proficiency in recognizing ‘certain words is on a higher level than their ability to comprehend and integrate them’. Hyperlexic reading behaviour has been linked to ‘neurological dysfunction’ (Silberberg & Silberberg, 1968, cited

in Newman et al., 2007) and more explicitly to autism or autism-like conditions (cf. Grigorenko et al., 2002; Grigorenko, Volkmar & Klin, 2003; Nation, 1999). Indeed, Kanner (1943) noted what could be described as a discrepancy between better word decoding and lower reading comprehension in his original descriptions of children with *autistic disturbance of affective contact*: 'Reading skills are acquired quickly, but the children read monotonously, and a story [...] is experienced in unrelated portions rather than its coherent totality' (p. 250).

The research base on hyperlexia is quite meagre and to a large extent based on case studies of children with 'savant-skills' in reading (e.g. Atkin & Perlman Lorch's [2006] study of a non-speaking 4-year old boy with ASD and a precocious ability in oral word reading). In addition, research on hyperlexia has been characterised by great definitional inconsistencies (Grigorenko et al., 2003; Nation, 1999), regarding, for example, (i) the necessity of a seemingly *spontaneously* acquired reading ability, (ii) the *nature* of the discrepancy (for example, low levels of reading comprehension relative to better word-decoding skills [Nation, 1999]; unexpectedly low level of reading comprehension in view of better-word decoding skills and verbal mental age [Snowling & Frith, 1986]; normal word decoding skills, but poor listening comprehension [Catts, Hogan & Fey, 2003]; better word decoding than expected given a low mental age [Grigorenko et al., 2002]), and (iii) the *severity* of the comprehension difficulty (from essentially age-normal comprehension but lower than expected given a superior word decoding ability [Temple, 1990] to very meagre listening and reading comprehension of anything but 'literal units', in the face of mastery of word-decoding [Healy, 1982]). This situation makes comparisons across studies difficult. Furthermore, it is not clear whether the term hyperlexia should be reserved to describe a pattern of reading behaviour in children with autism or if it can occur in the absence of ASD. In the influential study by Catts et al. (2003), the term hyperlexia is used to refer to a group of children without ASD, and also Snowling and Frith (1986) argue that 'hyperlexia is not a syndrome-specific phenomenon' (p. 410). Further, Nation et al. (2006) suggest that there is no reason to separate hyperlexic 'poor comprehenders' with ASD from poor comprehenders without ASD unless there is evidence that the etiology of their comprehension impairments is qualitatively different. Grigorenko and colleagues (2003; Newman et al., 2007), on the other hand, suggest that the term hyperlexia should be reserved for a type of reading behaviour seen in some children with ASD, to preserve the uniqueness of the term.

Word decoding and spelling in children with ASD. General findings indicate that children with ASD perform essentially normal in word decoding (Goldstein, Minshew & Siegel, 1994;

Minschew et al., 1994; Newman et al., 2007). Nation (1999) and Minschew and colleagues (Goldstein et al., 1994; Minschew et al., 1994) suggest that the word decoding processes capitalise on cognitive strengths in ASD. Cognitive strengths mentioned in these studies include a close attention to details and strong ‘mechanical’ and procedural cognitive skills. In the Goldstein et al. study, younger children (all boys) with ‘high-functioning autism’ actually performed better at word-decoding than an IQ-matched non-disabled comparison group, leading the authors to suggest that the development of high-functioning children with autism could be characterised as an ‘early academic success’ (p. 678).

The results from prior studies are not completely consistent though. In a study by Nation, Clarke, Wright and Williams (2006), a heterogeneous group of children with ASD participated, with the criteria for inclusion being measurable language skills. Nine children out of the original 41 were found to completely lack reading ability. Also White et al. (2006) found that word-decoding difficulties were common, although all children had IQs in the non-intellectually disabled range (> 70). In fact, approximately half of the ASD sample in the study by White et al. had word-decoding difficulties of a magnitude that appeared to parallel those of a group of dyslexic readers. Interestingly, poor readers with ASD displayed two cognitive characteristics typically found in children with dyslexia: poor phonological awareness and slow rapid naming.

Spelling in children with ASD has not been well studied. However, Mayes and Calhoun (2006) report a 9% prevalence rate of learning disability in spelling (IQ-discrepancy) in a sample of children with autism. Also, difficulties in spelling may be magnified by severe difficulties in handwriting often seen among boys and girls with ASD (Kluth & Chandler-Olcott, 2008).

Like most reading research generally, mostly English speaking children have participated in previous research on word decoding and spelling skills in children with ASD, and very little Swedish research has been carried out. Furthermore, a very small number of girls have been studied.

Only a few studies have been conducted where researchers have attempted to support word reading and spelling development in children with autism (see Whalon, Otaiba & Delano, 2009). For example, a study by Tjus, Heimann and Nelson (1998) involved 13 children with autism and made use of a computerised ‘rare-event’ program to stimulate language and literacy skills. The participants increased their performance in reading and phonological awareness significantly during the training period, and in phonological awareness in the follow-up. Low functioning children with ASD have typically participated in

research on word reading, which often has been focused on teaching sight word reading (Koppenhaver & Erickson, 2003). Teaching of spelling has also been evaluated (e.g. Batchelder, McLaughlin, Weber, Derby & Gow, 2009). Other researchers have focused not directly on pupils with autism, but on their teachers and school staff in view of the fact that having autism appears to lower expectations from school staff (Mirenda, 2003; see also Kluth & Chandler-Olcott, 2008). It seems important to note that while there are reports of seemingly spontaneously acquired reading skills in children with ASD (Grigorenko et al., 2003), the typical path into literacy for both children with and without ASD is likely to be via mediation and guidance from adults, and time and motivation for guided individual practice. If children are not given such opportunities due to presumed lack of competence, success in reading development is unlikely to follow.

Reading and listening comprehension of discourse in children with ASD. Reading comprehension difficulties have been reported in individuals with ASD (Frith & Snowling, 1983; Snowling & Frith, 1986; Minshew et al., 1994; Nation et al., 2006; Newman et al. 2007; O'Connor & Klein, 2004; Saldana & Frith, 2007). Further, Norbury and Bishop (2002) demonstrate poor listening comprehension for narrative discourse, and a comparative study by Snowling and Frith (1986) indicates a very close match between reading and listening comprehension in readers with hyperlexia.

Given the close continuity between language skills and discourse and reading comprehension, it is important to consider the language phenotype in ASD. Word and sentence comprehension skills in ASD are highly variable, with some school-aged children with ASD have impaired oral vocabulary and syntactical skills while others do not (Kjelgaard & Tager-Flusberg 2001; Williams, Botting & Boucher, 2008). In a study of reading skills in children with ASD, Nation et al. (2006) reported that readers with normal word decoding but poor reading comprehension have significantly lower oral vocabulary scores than do proficient comprehenders with ASD, 'suggesting that impairments in reading comprehension accompany impairments in understanding language more generally' (p. 917). Therefore, it appears safe to assume that poor language skills constrain comprehension of connected written and oral discourse for many children with ASD. But as mentioned, core language skills are highly variable in ASD. Considering that there is more to discourse comprehension than comprehending individual words (Cain & Oakhill, 2007), a number of researchers have suggested that text/discourse level difficulties may be particularly difficult for individuals with ASD. For example, Wahlberg and Magliano (2004) state that 'a growing body of

research suggests that readers with autism have trouble constructing a situation model for discourse' (p. 122), and Healy (1982) suggests, in the context of hyperlexia, that comprehension for this group typically 'breaks down when abstract or organizational strategies are required to gain meaning' (p. 334).

While the number of studies is low, there have been attempts to explain the basis of discourse comprehension difficulties with reference to cognitive characteristics of autism, besides poor basic language skills. For example, research studies on reading or discourse comprehension have demonstrated that individuals with ASD have notable difficulties with inferencing (Young et al., 2005; Jolliffe & Baron-Cohen, 1999; Norbury & Bishop, 2002); however, Saldana and Frith (2007) recently failed to replicate this when using an implicit priming paradigm to assess these processes. Norbury and Bishop point out that inferencing implies 'integrating different sources of information in context' (p. 244f). The generally poor performance by individuals with ASD in studies on inferencing has been interpreted in light of the theory of weak central coherence (Jolliffe & Baron-Cohen, 1999; Noens & van Berckelaer-Onnes, 2005; Norbury & Bishop, 2002). Further, in O'Connor and Klein (2004) a text manipulation, that compelled high-functioning readers with ASD to monitor their own comprehension during reading improved reading comprehension test performance. As comprehension monitoring is presumed to be closely linked to executive functions (Westby, 2004), the results in the O'Connor and Klein study suggest that executive dysfunctions in ASD may be involved in the comprehension difficulties demonstrated among these children. Finally, to comprehend literary texts and stories, the reader or listener frequently needs to monitor the psychological states of different characters, and 'false-belief'-scenarios may be key parts of a story plot – e.g. when Little Red Riding Hood knocks on the door while holding the false belief that her grandmother will open it. But it is not only when such scenarios are present in a story that social-cognitive skills may be important for comprehension. Snowling and Hulme (2008) suggest that poor theory of mind skills might explain why children with autism often experience comprehension difficulties as 'the reader has to share the same frame of reference as the writer [...] to extract the writer's intended message' (p. 96). However, no studies seem to have examined this topic empirically among children with ASD (and there are only very few on individuals without ASD; see Gibbs [1999] for a discussion).

There are thus several potential cognitive factors involved in the causal mechanism linking ASD to comprehension difficulties, and one could perhaps guess that it would be unlikely to find one single cause of the overlap. However, the research base is meagre at present.

Similarly, very little research has been devoted to teaching comprehension to school-aged children with ASD (Chian & Lin, 2007). In one of few studies directly targeting comprehension skills, Whalon (2004) examines the effect of reciprocal teaching (Palinscar & Brown, 1984) in three students with ASD. Whalon demonstrates positive effects regarding question generation and responding during training, and two of the students also improved their comprehension according to results on standardised reading comprehension tests. Flores and Ganz (2007) examined direct instruction in complex inferencing, use of facts, and analogies, and found encouraging results as all four participants (including two students with ASD) showed improvement on the tasks trained. Kluth and Chandler-Olcott (2008) review documented practice in the field of literacy and language teaching for students with ASD.

Children with attention disorders

Word decoding and spelling in children with ADHD. Much more research has been done on word decoding in ADHD than in ASD. The existing research has established that word decoding difficulties are common among children with ADHD. Estimates from different studies indicate that somewhere between 25 and 40 % have a comorbid reading disorder (cf. Maughan & Carroll, 2006). Mayes and Calhoun (2006) report a 25 % prevalence rate of learning disability in spelling. According to Willcutt et al. (2007), correlations between continuous measures of reading and ADHD usually fall between .2 and .4 among school aged children. Behavioural (e.g. Willcutt & Pennington, 2000) and genetic (e.g. Willcutt, Pennington & Defries, 2000) research has furthermore demonstrated that difficulties in reading are more strongly associated with DSM-IV inattention than with hyperactivity-impulsivity.

According to Willcutt et al. (2007), over 20 different theoretical models have been proposed as possible explanations for the comorbidity between ADHD and reading difficulties, and the issue is not settled (Spira & Fishel, 2005). However, the most common standpoint currently seems to be that children who show signs of both disorders (ADHD and word decoding difficulties/dyslexia) carry the cognitive and psycholinguistic bases of each disorder (Pennington, 2006; Maughan & Carroll, 2006). To explain such combinations of difficulties, complex multifactorial (or multiple risk) models of development disorders may be necessary (Pennington, 2006). Little research has been carried out to support reading skills in this group. However, Rabiner, Malone and the Conduct Problems Prevention Research Group (2004) point to the need to further develop academic interventions for children with combined reading and attention problems, as the comorbid group in their study demonstrated very poor

response to a phonics-based reading intervention as compared to groups of children with reading impairment only or attention difficulties only.

Reading and listening comprehension of discourse in children with ADHD. It has been suggested that ADHD may be more strongly associated with weaknesses in reading comprehension than with isolated word decoding (Ghelani, Sidhu, Jain, & Tannock, 2004). Relative to the number of studies on word decoding, there are very few studies on reading comprehension in individuals with ADHD. Studies on discourse comprehension abilities indicate that children with ADHD have difficulties in this area relative to typically developing comparison children (cf. Barkley, 1997; Lorch, Berthiaume, Milich & van den Broek, 2007; McInnes, Humphries, Hogg-Johnson & Tannock, 2003). An overlap between ADHD and oral language impairment has been demonstrated in numerous studies (e.g. Bruce, Thernlund & Nettelbladt, 2006; Miniscalco, 2007; McInnes et al., 2003). Considering that poor core oral language skills are known to negatively affect comprehension of oral and written discourse (Snowling & Hulme, 2008) such difficulties might be the factor responsible for the link between ADHD and comprehension difficulties. Cutting and Scarborough (2006) studied the potentially direct influence of inattention on reading comprehension using dimensional measures in regression analysis. Whereas ratings of inattentive behaviour correlated negatively with reading comprehension in bivariate analysis, this effect was 'almost entirely subsumed within the contributions of word recognition/decoding and oral language proficiency' (p. 294) in regression analysis.

Other research on listening comprehension suggests that impaired higher-order processes in attention and memory may directly cause difficulties comprehending connected discourse (Lorch et al., 2007; McInnes et al., 2003). Inconsistencies in previous research might in part depend on how reading or listening comprehension has been measured. In a study by Cherkes-Julkowski (1995, cited in Ghelani et al., 2004), the reading comprehension performance of children with ADHD (all free from language impairment) declined as the length of the passage increased. According to Ghelani et al., there are 'greater demands for effortful processing on longer passages and, therefore greater demands for effortful control' (p. 365), which is presumed to be extra difficult for individuals with difficulties related to ADHD (see also Samuelsson, Lundberg & Herkner, 2004).

Summary of the introduction

A summary of the literature presented above indicates that children with ASD and attention disorders present with partly different and partly overlapping phenotypes and cognitive correlates. Furthermore, both sets of neuropsychiatric/developmental disabilities appear to impact on the literacy ability, but not necessarily in the same manner. Children with ASD often appear to perform essentially normally at word-decoding, and sometimes even unexpectedly high relative to their mental age. Nevertheless, difficulties in reading comprehension have often been reported for this group. Also listening comprehension of discourse appears to be a challenge for individuals with ASD. However, the background of such difficulties is not well understood. Attention disorders or ADHD, on the other hand, seem to be linked with lower performance in both word decoding, spelling and comprehension. This diverging pattern appears broadly consistent with the cognitive theories of these conditions. Specifically, the cognitive characteristics of ASD might affect comprehension processes but not decoding, while hyperactivity-impulsivity and, in particular, inattention might impede on the literacy development more generally. However, previous research is not consistent. Studying children with communication and/or behavioural difficulties inescapably means a challenge in terms of assessment. For example, Saldana and Frith (2007) recently pointed out the importance of considering the format for assessing comprehension processes in ASD, and that different methodologies can potentially result in diverging results. In addition, recruiting a large number of participants for the studies is also often difficult. Thus, it is not unexpected that only a rather small number of studies have been conducted in this field, and that the results are not fully consistent. Furthermore, little or no Swedish research exists in this field. Hopefully, the present thesis will make a valuable contribution to the literature on literacy and comprehension skills in children with ASD and attention disorders.

Aims of the empirical studies

The thesis consists of five studies with an overall goal to examine skills in reading, spelling and language and discourse comprehension in school-aged children with developmental disabilities, and to explore the potential for positive development of comprehension skills in children with ASD. The focus was placed on children with ASD. In fact, all five studies include children with ASD, while Study I and II also include children with attention disorders.

By directly comparing children with ASD and attention disorders in the same studies, and using the same materials, more knowledge should hopefully be attained regarding the patterns of literacy skills in these two groups of children, including any similarities and differences.

Study I: Basic reading skills in high-functioning Swedish children with autism spectrum disorders or attention disorder.

Little comparative research has been done on literacy skills in children with ASD or attention disorders. Moreover, there is inconclusive evidence regarding the status of basic reading skills in children with ASD. Some studies have found that word reading difficulties are relatively common among children with ASD (e.g. White et al., 2006), while others have found that reading comprehension appears specifically confined (e.g. Minshew et al., 1994).

The first aim was to compare the reading performances of a group of high-functioning children with ASD, a group of children diagnosed with DAMP and a comparison group of children without known disabilities, equivalent in mental age. Separate tests of word decoding ability, word reading comprehension and sentence reading comprehension were used. Another aim was to examine the correlations between the literacy measures, and the associations between results on the literacy tests, on the one hand, and verbal and non-verbal intellectual functioning and memory indicators, on the other, within the groups.

Study II. Reading comprehension, word decoding and spelling in girls with autism spectrum disorders (ASD) or attention-deficit/hyperactivity disorder (ADHD): performance and predictors.

Little is known about the background of literacy skills and difficulties among children with ASD generally, and about reading comprehension skills in children with ADHD. Moreover, research on children with developmental disorders has tended to focus on male participants, and this is evident also in research on language and literacy skills. In the context of children with ASD, Thompson et al. (2003) in fact state that ‘most of what we believe we know about autism is actually about males with autism’ (p. 351).

The aim of Study II was to study reading and spelling skills (including rates of reading and writing impairments) among girls with a main diagnosis of ASD or ADHD and among typically developing girls, respectively. Besides categorical group comparisons, the study also examines the predictive value of autistic and ADHD features on components of the literacy skill using correlation and regression analyses in the whole sample. It was asked (i) whether the correlations between measures of autistic features and ADHD features were the same vis-

à-vis the literacy measures, and (ii) whether both autistic and ADHD symptomatology scores negatively predict text reading comprehension once word decoding, oral vocabulary and nonverbal cognitive ability are controlled for in forced-order regression analyses.

Study III. Patterns of language and discourse comprehension skills in school-aged children with autism spectrum disorders

The idea of a discourse comprehension impairment in ASD has been proposed in previous research. Yet there is a need to more thoroughly consider the specificity of such a proposed difficulty. More specifically, it is important to examine whether discourse comprehension presents a *particular* challenge for school-aged children with ASD or if difficulties with connected discourse are mirrored in poor comprehension of individual words and sentences, i.e. poor basic language comprehension skills. Furthermore, prior research on comprehension in ASD indicates that inferencing appears to be an area of relative, or perhaps even specific, weakness.

The first aim was to examine skills in listening comprehension at the *word, sentence* and *narrative discourse* levels in school-aged children with ASD and in a slightly younger group of typically developing children matched for nonverbal ability. The second aim was to examine whether there were particular patterns of the discourse comprehension ability in the groups, regarding comprehension of stated versus inferential meaning and regarding comprehension for main ideas versus narrative details. It was predicted from the weak central coherence theory that children with ASD would generally perform poorly at discourse comprehension, and that they would display particular difficulties with inferential meaning relating to main ideas in stories, while comprehension of stated meaning relating to narrative details could be a psycholinguistic strength.

Study IV. Dyslexic, delayed, precocious or just normal? Word reading skills of children with autism spectrum disorders

In some previous studies (Nation et al., 2006; White et al., 2006), as well as in Study I and Study II of this thesis, a great variability in word reading performance has been noted among children with ASD, with a subgroup displaying difficulties. Although the cognitive reason for such difficulties is not well studied, White et al. found that the poor word readers with ASD in their study also displayed phonological processing difficulties.

The overall aim of Study IV was to take a closer look at word reading skills among children with ASD, and to examine the cognitive and psycholinguistic basis for individual differences in these skills. The study set out to answer the following research questions: At what level do children with ASD read words as compared to chronological age-matched typically developing peers? Is there a subgroup of children with ASD who read words poorly, as suggested in some previous research? If so, are they identifiable by a specific psycholinguistic signature, and even so if reading level is controlled for in a reading-level matched design? We were particularly interested in whether such a group of poor word readers with ASD display dyslexia-related impairments in phonological processing and/or rapid automatized naming, or more general weaknesses in cognitive resources involved in language and/or nonverbal reasoning. We were also interested in whether severity of autistic features correlate negatively with word reading skills in the ASD group.

Study V. Discourse comprehension intervention for high-functioning students with autism spectrum disorders: Preliminary findings from a school-based study

A reasonable assumption, based on previous findings and results from Study III, is that difficulties comprehending connected (narrative) discourse is a ‘psychoeducational profile’ characteristic for many school-aged children with ASD. Discourse-level comprehension could consequently be an important area to target in school-based interventions. Moreover, there appears to be a broad understanding in the autism education field that students with ASD often need to learn explicitly what other children acquire intuitively in every day school interactions (Jordan, 2003).

An effective approach for supporting discourse comprehension in children with ASD was assumed to include: (i) providing teachers and students with a shared and explicit set of concepts for talking and thinking about the activity of comprehension, that (ii) can structure the child’s activity of discourse comprehension (i.e. locating information, integrating different sources of linguistic information within narratives, and integrating story information with prior knowledge) under scaffolding and modelling from the teachers. Pedagogical material developed by Franzén (1997) was considered well suited to this end. This Swedish material is based on a teaching framework called “Question-answer-relations” (QAR) in the English-speaking world (Raphel & Pearson, 1985; Raphael et al., 2006). In this teacher-delivered intervention study, we asked whether a concentrated usage of the Swedish material for four weeks would improve discourse comprehension skills according to test results and teacher perceptions. We were also interested in the students’ perception of the training.

Method

Participants

Study I. A total of 77 children ranging in age from 7 to 14 years participated: 37 with ASD, 21 diagnosed with DAMP (according to the criteria described in Gillberg and Hellgren, 1996) and in the comparison group 19 without known disabilities. None had an intellectual disability (i.e. < 70) according to full scale IQ from Wechsler scales of intelligence for children (WISC-III, 1977). The three groups were not significantly different in average mental or chronological age, but they did differ in full scale IQ.

Study II. A total of 110 girls participated, all meeting the following criteria: (i) chronological age in the 8 - 17 years range, and (ii) a full scale IQ above 70 as measured with the Wechsler Intelligence Scale for Children-Third Edition (WISC-III, Wechsler, 1992). Twenty girls were diagnosed with an autism spectrum disorder and 36 with ADHD, while 54 girls had no known disabilities. Of the 20 girls with a main diagnosis of ASD, comorbid ADHD was diagnosed in 19 cases. The three groups were not significantly different in chronological age, performance IQ or parental education, but they did differ in full scale IQ.

Study III. A total of 32 children participated in the study. All had Swedish as their first language. Sixteen participants (five girls) had a previous clinical diagnosis within the autism spectrum. Their ages ranged from 10;9 to 15;8 years. None had hearing difficulties according to a questionnaire completed by parents. The comparison group consisted of 16 children recruited from regular schools in the western part of Sweden. Their ages ranged from 7;7 to 14;8 years. These participants were free from known disabilities according to parents and/or teachers. The two groups were matched for nonverbal ability (see instruments), and norm-based performance indicated approximately age-typical functioning in both groups.

Study IV. A total of 33 children participated in the study. All had Swedish as their first language. Fifteen children aged 10;9-15;8 years and months participated in the ASD group. Eighteen comparison children without known disabilities participated in the comparison group. Fourteen of these children (aged 10;5-14;9) were selected to be roughly equivalent to the ASD group in terms of age mean and range, and these participants thus formed the chronological age-matched group. Data from the other four comparison group children (aged 7;6-9;2) was collected to add to the pool of participants for reading level matching.

Study V. Twelve children with ASD and their five teachers participated in the intervention study. One student had Swedish as a second language. Eleven of the children participated in Study 3 as well. All children attended either of two special school units for non-intellectually disabled children with ASD or language/communication disorders at a school located outside Stockholm. The participants had a previous diagnosis within the autism spectrum. Data on the matrices subtest from WASI (Wechsler, 1999) and a Swedish translation of PPVT (Dunn & Dunn, 1997) were collected for background information regarding nonverbal ability and receptive vocabulary, respectively. Norm-based performance indicated approximately age-typical functioning on both measures.

Instruments and assessment

All testing was done individually.

Study I. The following measures and instruments were used:

1. Literacy tests. A shortened version of the wordchains test (Jacobsson, 1996) was used to measure word decoding ability and fluency. The task in the wordchains test is to mark with a pencil where divisions should be made in a chain of words without inter-word blank spaces (e.g. carhousetree). A shortened version of the Swedish translation of the OS 400-test (Soegård & Bording Petersen, 1974, reedited by Tornéus, 1983) was administered to assess the ability to comprehend written words. To assess reading comprehension of sentences and short passages, a shortened version of the S 50-test (Soegård & Bording Petersen, 1972, reedited by Tornéus, 1983) was used.
2. Memory-functions. Two free recall tasks were also administered as memory indicators. One test was a verbal (auditory) free recall, the other an object (visual) free recall.
3. Verbal ability. The verbal IQ from WISC III was used as a measure of verbal ability.

Study II. Standardised tests with norms were used to assess literacy skills and predictors. For the literacy tests, performance was expressed in standard scores based on the normative mean of 100 and a standard deviation of 15, with a standard score floor of 50. Reading and writing disorder was defined as an outlying standard score of below 75 on tests of word decoding, reading comprehension or spelling. All testing was done individually.

The following instruments and measures were used and collected in Study II:

1. Literacy tests. Timed tests of single, out of context, word reading were chosen as a measure of word decoding efficiency. The H4 test (Franzén, 1997b) was used for girls in grades 2-6 (8–12 years), while the LS test (Johansson 1992) was used for the older girls. The test *Stavning* ('Spelling'; Rockberg & Johansson, 1994) was used for girls in grades 2 - 6, while the LS test was used for older girls. Both tests measure the ability to spell a target word presented in a sentence context. The tests *Diagnostiska läs- och skrivprov* ('Diagnostic reading and writing tests'; Björkquist & Järpsten, 1975/1976; Järpsten & Taube, 1997) were used to assess reading comprehension in grades 2-6. The LS test (Johansson, 1992) was used for the older girls. These tests tap reading comprehension of connected text.
2. Oral vocabulary. The vocabulary subtest from WISC-III (Wechsler, 1992) was used to index oral vocabulary.
3. Nonverbal ability. Performance IQ from WISC-III (Wechsler, 1992) was used.
4. Inattention and hyperactivity/impulsivity (ADHD - symptomatology). Ratings of DSM-IV (APA, 1994) symptoms for inattention (9 criteria) and hyperactivity/impulsivity (9 criteria) were collected from teachers and parents using the Conners' Teacher Rating Scale-Revised: Long Form (Conners, Sitarenios, Parker & Epstein, 1998) and the 'Five to Fifteen' questionnaire (Kadesjö et al., 2004), respectively. An ADHD symptomatology factor was calculated by first converting teacher and parent ratings of inattention and hyperactivity/impulsivity into z-scores.
5. Autistic symptomatology. The Autism Spectrum Screening Questionnaire (ASSQ; Ehlers, Gillberg & Wing, 1999) was administered to the parents of all the girls. Higher scores on the ASSQ indicate higher degrees of autism-related features.

Study III. The following tests and measures were used:

1. Non-verbal cognitive ability. Raw and T-scores on the matrices subtest from the Wechsler Abbreviated Scales of Intelligence (WASI) (Wechsler, 1999) were used as a measure of nonverbal ability. Raw scores on this measure was the matching variable.
2. Basic language comprehension. A Swedish translation of the Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 1997) was used to assess receptive vocabulary. A shortened and translated version of Test for the Reception Of Grammar-2 (TROG-2) (Bishop 2003) was used to assess reception of grammar.
3. Narrative discourse comprehension. Eight texts with comprehension questions from the Discourse Comprehension Test (DCT) (Brookshire & Nicholas 1993) were translated into Swedish and audiotaped by a female native speaker for listening comprehension testing. The

test stimuli in the DCT consist of stories of about 180-210 words in length. Eight questions of four different types follow the presentation of each story in the DCT. The questions tap comprehension of narrative details or main ideas that are either implied by the text or explicitly stated, and results are expressed in the global score as well as subscores.

Study IV. The following tests and tasks were used:

1. The H4 test (Franzén, 1997b) was used to assess reading of real words. The task in H4 is to read single words out of context aloud from a list. Nonword reading was assessed using a test by Jacobson and Svensson (unpublished). Norms were not available for the age ranges represented in the study for either test. Scores from the two tests were used to create an overall word reading factor.
2. Three phonemic awareness tasks were used to create a phonological processing factor:
 - a. A sound deletion task adopted from the test battery LOGOS. The experimenter presented a word verbally and asked the child what word would be left if a given initial (n = 5), end (n=5) or middle (n = 5) sound was deleted.
 - b. A regular spoonerism task consisting of 8 pairs of regular Swedish words, with the task being to switch the first sounds in the two words, for example *röd sol* → *söd rol* ('red sun → sed run') (Jacobson & Svensson, unpublished).
 - c. A nonword spoonerism task containing 8 word pairs that conformed to Swedish phonology but carried no meaning ('nagro piv → pagro niv') (Jacobson & Svensson, unpublished).
3. Receptive vocabulary. A Swedish translation of the PPVT (Dunn & Dunn, 1997) was administered.
4. Rapid naming (RAN). An unpublished task devised by Johansson (forthcoming) was used. The task consisted of a list of 50 digits, with 10 digits on each of 5 rows.
5. Nonverbal ability. The matrices subtest from WASI was used.
6. Autistic symptomatology. ASSQ (Ehlers et al., 1997) ratings were collected from parents (n = 11) or teachers (n = 4) of children in the ASD group.

Study V. To evaluate the effect of the intervention, the following measures were collected:

1. The Discourse Comprehension Test (DCT; Brookshire and Nicholas, 1993) in the pre and post condition. Two sets of stories were counterbalanced in conditions (see Study III).
2. Teacher ratings after the intervention.
3. A nonword decoding task (Jacobson & Svensson, unpublished) was also administered in the pre and post conditions as a 'control measure'; decoding skills were not targeted in the

intervention and no improvement was expected for this test. Data on this measure is lacking for two students due to visual problems that could not be fully corrected for with glasses in one case and speech sound difficulties in the other.

4. Students were asked about their perception of the training, i.e. whether they found it (i) fun/tedious, (ii) easy/difficult and (iii) instructive/non-instructive.

Intervention in Study V. A training material containing 13 stories from Franzén (1997) of increasing length were put together into booklets and subsequently provided to all participating children. At the end of each story there were questions pertaining to the situation described in the story. The task for the students was (i) to answer these questions and (ii) to decide question type based on the necessary information source for the answer. Questions appeared in three different types, and below is a translated text excerpt with completed tasks and task descriptions.

A flock of birds sat in a tree singing.

A man passed the tree.

Suddenly all birds were gone.

Q.1 Where did the birds sit?

Correct answer: They sat in a tree

Question type: 'Right there' (in Swedish *Precis där*) (i.e. information that constitute the basis for the answer is explicitly mentioned in one and the same sentence in the text.)

Q2. What happened while the birds sang?

Correct answer: A man passed by

Question type: 'Reflect and search' (*Tänk efter och leta*) (i.e. integrating different sentence passages using text-connecting inferences.)

Q3. Why were there no more birds in the tree?

Correct answer: The man scared them away

Question type: 'On your own' (*På egen hand*) (i.e. information has to be inferred using world knowledge (bridging).)

Partly depending on the word reading level of the child and group, the students read independently, took turns in reading parts of the text or the teacher read aloud. The training thereby included both reading and listening comprehension. In the beginning of the training period, the teaching involved more direct explanations and definitions, with teachers modelling the strategies involved in answering the questions and classifying them based on information source. This was followed by guided independent practice. Students worked with the material together with their teachers for two to three days per week over a period of four weeks, with each training session lasting approximately 20-30 minutes.

Results

Study I

Tendencies for ceiling effects in the comparison group on the comprehension measures somewhat complicates the analyses of overall group differences. Nevertheless, the ASD group performed significantly lower on the reading comprehension tests than did the comparison group. There was a clear tendency for the children with DAMP to perform below the comparison group in sentence reading comprehension ($p = .09$). The three groups did not differ in word decoding. No statistical difference was obtained between the children with ASD and DAMP on any measure. These findings are in accordance with prior research (e.g. Nation et al., 2006), where the reading ability among children with ASD has been characterised by relatively better word decoding than reading comprehension.

Subgroups were created to further characterise the reading skills of the groups and to test what hindered proficient reading comprehension in the groups. Subgroups of children with poor sentence comprehension and with ASD and DAMP were compared to proficient readers with ASD and DAMP, respectively, on chronological age, mental age, memory measures, word decoding and verbal ability. The only obtained significant differences were on the wordchains test of word decoding, where the poor sentence comprehenders performed at a lower level in both groups. Thus it is apparent that poor word decoding skills are an important bottleneck to reading comprehension among children with ASD, and also in children with DAMP. This result was further confirmed using partial correlation analyses.

Study II

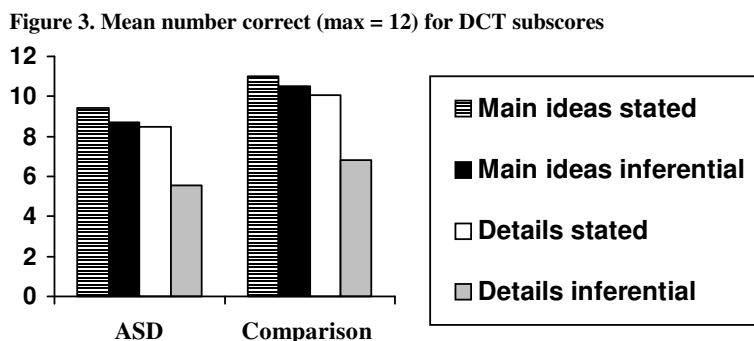
Girls with ASD did not differ statistically from girls with ADHD or the comparison group in reading comprehension, word decoding or spelling. However, the rate of reading and writing impairment (defined as a standard score < 75) was high in the ASD-group: 8/20 girls (40%) had at least one reading and writing impairment according to tests of reading comprehension, word decoding or spelling, which was statistically different from the 6% rate in the comparison group. The girls with ADHD had an average performance on the literacy tests about one standard deviation below the normative population mean, and had significantly lower result than the comparison group on all three tests of literacy. Fifty-six percent of the ADHD sample had a reading and writing impairment.

When using autistic features as a continuous measure in correlation analysis, in the total sample, this measure was negatively related to reading comprehension in bivariate analysis, but was not significantly related to word decoding or spelling. The degree of ADHD symptomatology was also significantly negatively related to word decoding and spelling besides to reading comprehension in bivariate analyses. To test whether autistic and ADHD symptomatology were independently linked with reading comprehension, these factors were entered into step-wise regression analyses after the influence of oral vocabulary, word decoding and nonverbal ability were controlled for. Both degree of autistic and of ADHD symptomatology still explained significant, albeit rather small, proportions of variance in reading comprehension. ADHD contributed to the variance in reading comprehension once autistic symptomatology (along with oral vocabulary, word decoding and nonverbal ability) was controlled for, but the opposite was not true.

Study III

As compared with the performance of the typically developing comparison group, significantly lower performance was found for narrative discourse comprehension in the ASD group. However, this was not the case for receptive vocabulary or reception of grammar. Furthermore, the group difference for discourse comprehension remained significant when these factors were controlled for in an ANCOVA. The difficulty with discourse level comprehension appeared to be of a general nature, as no evidence was found for the hypothesis that participants with ASD would find comprehension for inferential and gist-related discourse information disproportionately more difficult than stated information, or for the hypothesis that discourse processing in ASD would be characterised by an elevated

processing of explicit details. See Figure 3 for roughly similar profiles of the comprehension ability in the two groups, albeit with an overall lower performance in the ASD group.



Study IV

All raw scores were corrected for age. The full group with ASD did not differ statistically from an age-matched comparison group on a composite word reading score, but a poor-readers subgroup ($n = 5$) who displayed relative difficulties (performance in the 10th percentile of the comparison group) was identified. There was no group of poor readers without ASD. Normal readers with ASD ($n = 10$) did not differ from the comparison group in word reading, nonverbal ability, phonological processing, rapid naming or receptive vocabulary. However, the poor readers performed below on all measures ($p < .05$) except nonverbal ability. When poor readers with ASD were matched for reading level with younger controls, no difference was found on any reading-related skill, but the poor readers with ASD tended to score higher in receptive vocabulary. No significant correlation was found between autistic symptomatology and word reading within the ASD group.

Study V

Comparison data was available based on the performance of the 16 typically developing children who comprised the comparison group in Study 3. In the pre condition, the ASD group (intervention group) scored significantly lower than the comparison group in discourse comprehension, but similar in terms of receptive vocabulary and nonword decoding raw scores. Only the ASD group participated in the intervention. Comparison of pre and post condition scores on the global discourse comprehension test, with counterbalanced test versions, revealed a significant improvement after training for the ASD group ($p = .02$). In contrast, no difference between pre and post condition test results was found for the control

measure of nonword decoding ($p = .64$, negative direction). Once the focus sample had received comprehension training, the difference relative to the comparison group was not significant both for nonword decoding and for discourse comprehension, although the ASD group was still marginally poorer in discourse comprehension. This latter contrast should be interpreted cautiously.

Except one student who found the training to be tedious at times, students found the training fun (6 out of 12) or 'in-between fun' (5 out of 12). The students found the material instructive (3 out of 12) or 'in-between instructive' (9 out of 12), and easy (4 out of 12) or 'in-between easy' (8 out of 12) to work with. One participant – a boy with Asperger's disorder – expressed the benefits of the training in the following way: 'You learned how words are connected to what happens'. In general, however, it was difficult to interview the students deeply, and students mostly gave answers like 'it was good' or 'it was pretty fun'. Teachers reported – among other things – that the training helped children to identify information and to infer. Teachers also reported that they would continue to use the same or similar comprehension instruction for 11 out of 12 students. For one student the training was considered too abstract, and for two students the material was considered too easy to have an apparent effect on comprehension development according to the teachers.

General discussion

It is of importance for clinical and educational intervention and practice to learn more about the interactions between developments of language, communication, behaviour and literacy. Further, studies on typical and atypical development of language and literacy – the most uniquely human of all human abilities – have a grand value from a scientific point of view.

The first two studies formed a descriptive basis for Studies III-V. Similarities but also a number of differences between the first two studies were found in terms of results. Before interpreting such differences, it is important to address some potentially important methodological differences between the first two studies. First, there were differences in the instruments used to assess reading comprehension (cf. Keenan et al., 2008) and word decoding in the studies. The usage of tests without norms – as in Study I – in a group of children with such a wide age range also presents a problem, as evident in the ceiling effect in reading comprehension in the comparison group. Obviously, only girls participated in Study II, while a majority of the participants in Study I were boys. Another difference concerns the diagnostic criteria utilised, with DSM-IV criteria being used only in Study II. Furthermore,

different matching criteria were used in Studies I and II. Finally, whereas a categorical handling of diagnosis was used for the analyses in Study I, both categorical diagnoses and dimensional measures (through symptomatology ratings) were used in Study II.

The results attained in the studies, their consequences and weaknesses of the studies will be discussed below. Although ASD is the focus of this thesis, I will begin the discussion with attention disorders, thereby reflecting the appearance of this group in the two first studies. Suggestions for future research will be provided.

Word decoding and spelling in attention disorders

In Study I, the children with DAMP did not differ statistically from the mental age-matched comparison group on the wordchains test. In Study II, however, participants with ADHD performed below the comparison group of typically developing children and age norms on word reading as well as on spelling, and roughly half of the sample had impaired performance. It was also interesting to note in Study II that the correlation between word decoding and the dimensional measure of ADHD features, $r = .33$, fell right in the middle of the .2 – .4 range, which Willcutt et al. (2006) reported was typical in samples of school-aged children. These data point to the importance of monitoring and supporting word reading and spelling development in children with these conditions, and suggest that the conclusion is valid also for Swedish-speaking girls. Furthermore, when researchers and clinicians try to understand the functional outcome of ADHD (in terms of, for example, educational attainment, employment and capability), they should not overlook potentially confined literacy skills. Not much information is, however, provided in the present thesis about the cognitive bases of word decoding or spelling difficulties among children with attention disorders. On the other hand, seminal research on the behavioural, cognitive, neurological and genetic overlap between ADHD and word decoding/encoding difficulties is currently being studied in well-renowned labs around the world.

Comprehension in attention disorders

The comprehension abilities of children with attention disorders were poor, and thereby reflect the children's word decoding abilities. Importantly however, when treated as a dimensional condition in Study II, ADHD features explained significant proportions of variance in reading comprehension even after controlling for word decoding, oral vocabulary and performance IQ, which appears to be a new finding. Based on the present data it is not

possible to more exactly pinpoint why attention disorders were connected with reading comprehension difficulties. A look at prior research may give a clue. McInnes et al. (2003) studied listening comprehension in different groups of children, and demonstrated that impaired listening comprehension for discourse and impaired working memory were present in samples with ADHD independently of comorbid language impairment. While closer attention to the overlap between oral language impairments and attention disorders is an important avenue for future research, the study by McInnes et al. indicates that also memory functions need to be examined closely. Better insight into the relative importance of different cognitive factors could hopefully be attained by experimentally manipulating memory load in comprehension and integration tasks (cf. Spooner, Gathercole & Baddeley, 2006). Furthermore, children with ADHD often have difficulties with attentional control, sustained attention and self-regulation (cf. Barkley, 1997; Westby, 2004). Such difficulties could be particularly disastrous when processing longer stretches of text or discourse, and there is evidence that the length of reading passages is inversely related to comprehension in children with ADHD (Cherkes-Julkowski [1995], as cited in Ghelani et al., 2004). Interestingly, Connors (in press) recently suggested that 'reading instruction should include emphasis not only on developing decoding and language comprehension skills [...] but also on developing attentional control within the reading context'. An important topic for future work is therefore to specify this idea in research on children diagnosed with ADHD, and to create and evaluate comprehension interventions adapted for students with attention disorders.

Word decoding and spelling in ASD

Regarding word reading skills, there were no significant differences between the comparison groups and the full samples with ASD in any of the studies. Furthermore, the correlations between autistic features and word decoding and spelling were not significant in Study II. Considering the many difficulties typically experienced by children with ASD, both as a function of the main disorder and due to correlated difficulties, word reading indeed appears to be an area of relative strength. Interestingly, Nation (1999) writes that the word reading process capitalises on cognitive strengths in ASD. While ASD thus appears to be largely unrelated to these aspects of the written language ability, the pattern contains notable exceptions at an individual level. Specifically, in Studies I, II and IV it was evident that some children with ASD performed poorly in word reading. Furthermore, according to results in Study I, such difficulties appear to constrain reading comprehension. The bases of word reading difficulties in ASD were explored in Study IV, and it was found that poor word

reading was accompanied by poor performance on a number of cognitive and psycholinguistic skills known to be important correlates to and/or predictors of word reading among children without autism: phonological awareness, oral vocabulary and rapid naming. The conclusion of Study IV is that there does not seem to be anything ‘ASD specific’ in the cognitive and psycholinguistic basis of individual differences in word reading. Specifically, proficient word reading ability in ASD was backed up by skills considered important for word reading generally, while the profile of the poor readers group with ASD conformed to a ‘normally impaired’ pattern. A potential corollary of this ‘normal pattern’ of skilled and unskilled reading is that children with ASD may benefit from the same type of word reading instruction given to children without ASD with differing reading skills (Høien & Lundberg, 2000).

No core impairment emerged when poor readers with ASD were compared to younger readers matched for reading level. Potentially, this result means that it is inaccurate to characterise the poor word reading ability of this group as ‘dyslexic’ in nature, if this term is taken to imply a causal model involving these factors. However, such null findings must also be interpreted with caution (Bryant & Goswami, 1986), especially in the context of our small sample size. Furthermore, recent multiple risks models of developmental disorders have also challenged the view of ‘core impairments’ more broadly. In the context of dyslexia, Snowling (2008) recently asserted that ‘phonological deficits alone are insufficient to explain literacy difficulties, and it is children with multiple deficits (including language problems) that are more likely to succumb to reading failure’ (p. 142). Dyslexia is thus a complex condition in itself, and there is, of course, no reason to believe that the situation will be simpler when a word reading impairment co-occurs with an autism spectrum disorder. One possible way to conceptualise the data from Study IV within a multiple risk perspective is to recognise that vocabulary difficulties, phonological difficulties and naming difficulties are present in a substantial minority of school-aged children with ASD, and when a critical number of such skills are impaired, the reading system’s natural compensation mechanisms might be blocked, possibly resulting in word reading impairment. Finally, it is important to note that the causal directions between word reading and these reading-related skills are not settled, and are likely to be reciprocal.

Comprehension in ASD

In Study I, children with ASD scored lower on the reading comprehension measures as compared to the typically developing group. In Study II, girls with ASD did not differ in average performance from the comparison group, but reading comprehension impairment was

common. Apparently, not all children with ASD perform poorly in reading comprehension (see Nation et al. [2006] for a similar finding). While this could be more specific for girls with ASD, such a conclusion is premature considering that no boy group was included in Study II. Further, when treating ASD as a dimensional condition, the general picture of a connection between autistic features and weaker reading comprehension was obtained also in Study II. In addition, autistic symptomatology continued to predict significant proportions of variance in reading comprehension once oral vocabulary, word decoding and non-verbal ability were controlled for. While this remaining effect was small, it is an important finding as the measure of autistic features was based on one parent rating scale, and the effect remained despite strict control for a number of other important variables. Furthermore, such a connection has never been reported in prior research.

The general patterns of weaker comprehension skills in ASD were confirmed and explored in Studies III and V, but a listening comprehension test paradigm was used. There are good reasons for using this approach, as listening comprehension tests appear more sensitive to comprehension impairments than reading comprehension tests (e.g. Catts et al., 2006). This would seem to be particularly true if the samples, like the present ones, are expected to perform heterogeneously in word reading (due to age and/or ability). Consequently, I believe that much can be learned regarding the background of both reading and listening comprehension by using this methodology.

In Study III, nonverbal ability, receptive grammar and receptive vocabulary were ruled out as full causes of the discourse comprehension difficulties seen in children with ASD, which also appears to be a unique finding. Specifically, while receptive vocabulary and grammar skills were similar to those of the nonverbal ability-matched comparison group, discourse comprehension lagged considerably in the ASD group. Obviously, this does not exclude the possibility that some school-aged children with ASD also experience basic language comprehension difficulties. Yet, an important conclusion of Study III is that it matters how ‘language’ and ‘comprehension’ skills are operationalised when studying the development of children with ASD. Furthermore, the presented results have clinical and educational implications, as the findings suggest that children with ASD would benefit from being offered specific support for their discourse processing difficulties.

Why, then, do children with ASD exhibit difficulties with discourse comprehension? As mentioned in the introduction, such difficulties have been discussed for many years (e.g. Kanner, 1943), but they have not been widely examined empirically. Typically, the observations have been framed in terms of difficulties integrating information into coherent

wholes, and factors that are considered to be cognitive correlates to ASD may be involved. For example, the weak central coherence theory of ASD has previously been used to interpret patterns of discourse comprehension in this population (e.g. Norbury & Bishop, 2002). This theory was used in Study III to form new predictions of patterns of the comprehension ability, but no support was found for these predictions. Specifically, no evidence was found for the hypotheses of *specific* patterns regarding gist/detail-related or inferential/stated comprehension in the group. Instead, the difficulty with discourse level comprehension appeared to be of a more general nature. One clue as to the reasons for this result might come from Study II, in which autistic symptomatology failed to predict reading comprehension once the ADHD symptomatology factor was controlled for (along with word decoding, oral vocabulary and performance IQ) in regression analysis. This is an interesting, but hard to interpret, finding. First, a large overlap was also found between the autistic and ADHD features ($r = .71$). The result could therefore possibly be a statistical artefact. Second, and more importantly, it is still not clear conceptually what controlling for ADHD features in the ASD phenotype actually means (see e.g. Sinzig et al., 2009). Nevertheless, this result in Study II is interesting and indicates that it may be enlightening to examine the mediating effects of cognitive factors associated with *both* ADHD and ASD, e.g. executive functions, in future research on the link between reading/discourse comprehension and autistic features/ASD. The dimensional approach to ASD, which was successfully introduced in Study II, opens up new statistical possibilities for such mediational analyses. Besides executive functions, also cognitive measures of central coherence and social cognition/ theory of mind could be included in the analyses. There are still reasons to believe that one or more of these factors might be involved. Specifically, a number of recent studies have addressed ‘default’ or spontaneous types of cognitive processes in ASD (e.g. Senju, Southgate, White & Frith, 2009). Potentially, comprehenders with ASD do not spontaneously strive for coherence, unless instructed to do so or consciously deciding to do so (Jolliffe & Baron-Cohen, 1999). Likewise, ‘theory of mind’ abilities may be involved in the appreciation of the ‘point’ in a text or other connected discourse. Specifically, spontaneous social cognitive processes regarding author intentions may provide a general interpretative frame for the comprehension activities (cf. Gibbs, 1999), and also act motivationally for continued reading/listening. This is a field that warrants research involving individuals with and without ASD, and such studies will hopefully make us better understand the causal mechanisms that link ASD to reading and discourse comprehension difficulties. Such research would potentially also forward our understanding of the comprehension process more generally.

At the same time it is important to remember that the cognitive basis and etiology of oral and written comprehension impairments in children without autism have been hard to determine unambiguously (cf. Snowling & Hulme, 2008; Cain & Oakhill, 2007). Also for comprehension abilities, the story might be at least as complex in the case of ASD. Before more clarity of the background of comprehension abilities and disabilities is attained, the following three issues should also be minded.

First, for children with ASD we need to be specific when we talk about ‘reading’ and ‘comprehension’. This is important not only for scientific, but also educational progress. For example, Newman et al. (2007) report a depressing anecdote in their hyperlexia study. One of their participants was reported to be enrolled in a specialised reading instruction programme in school. However, it was not comprehension instruction but instead a word decoding programme that had been developed in the context of dyslexia education. Consequently, the child received special educational treatments for the same circumscribed skill he or she already excelled in.

Second, while the present thesis has partly confirmed prior research demonstrating that comprehension difficulties often appear in the face of proper word reading skills in children with ASD, we should be careful not to take for granted any particular pattern of skills in a child with ASD. Taken together, the studies in the present thesis also indicate that word reading skills are not necessarily well developed among children with ASD, and that reading comprehension skills are not confined in all children (at least girls) with ASD.

Third, and as a correlate of the points made above, this componential approach suggests that we need to look at the individual level in future research. However, success in such research depends on access to standardised, valid and reliable tests, the lack of which definitely has been a challenge in the present work. This latter issue will be discussed more in the limitations section.

In the fifth study of the thesis, a group of students with ASD and poor discourse comprehension skills at the group level received four weeks of school-based intervention. This study was inspired by three strands of research and theorising. The first strand was that of explicit comprehension instruction (e.g. Yuill & Oakhill, 1991). The second was cognitive research on the learning styles and difficulties in ASD (e.g. Powell, 2000), and the third inspiration was that of matching psychological tools (signs) with the psycho-educational profile of certain disability groups in order to support learning. This idea has been described by special needs researchers in the cultural-historical tradition (e.g. Gindis, 2003; Kozulin & Gindis, 2007; Vygotsky, 1993). From these three perspectives, an educational material and

method developed by Franzén (1997) was predicted to be effective. The study provided initial suggestions that this could be an effective way to work in schools, with positive and specific improvement on the expected test and mostly positive reports from teachers and students.

Conclusions

Pliszka and colleagues note that "there is probably more confusion over the comorbidity of learning disorders than any other topic" (1999, as cited in Aaron et al., 2002). Neither in this series of studies was a completely clean and coherent whole found. A larger number of studies need to be conducted before the research results can start to converge into more stable patterns. This thesis has hopefully contributed to such a pool of studies within this particular field. However, some careful conclusions and a synthesis based on the findings presented in this specific thesis are also possible to sum up. Specifically, the findings presented in this thesis indicate that one can expect to see difficulties in reading comprehension and/or listening comprehension of connected discourse in children with ASD and children with ADHD at the group level. For children with attention disorders (at least ADHD), such difficulties often co-occur with word decoding and spelling difficulties. Word decoding skills were more variable for students with ASD, yet typically unimpaired. When difficulties in word decoding were observed in children with ASD, such difficulties appeared, in terms of underlying cognitive and psycholinguistic skills, to conform to a 'normal pattern'. Furthermore, poor word decoding skills constrained reading comprehension among children with ASD and attention disorders in the same manner as they have been described to do among children without these conditions. Finally, for children with ASD, discourse level comprehension appears to be more difficult than what one would expect from non-verbal cognitive level and basic language comprehension skills, but there were also initial indications that the discourse comprehension skills in ASD were amenable of positive change through educational intervention.

Limitations and future directions

Weaknesses and limitations of this thesis can serve to highlight important avenues for future work.

First, considering the high prevalence of ADHD in samples of children diagnosed with ASD (as reported in e.g. Study II), the diverging pattern of literacy skills in children with these diagnoses is somewhat perplexing. One might wonder if the presence of ASD somehow acts as a protective factor for word reading development in children with attention disorders

and other developmental disabilities. Nation's (1999) idea that the word decoding process capitalises on cognitive strengths in ASD appears partly consistent with this idea, and there are numerous reports of children with ASD who have developed specialised interests in word decoding (e.g. Atkin & Perlman Lorch, 2006). However, to really answer such a question, the comorbid group (ASD plus ADHD) needs to be contrasted to equally challenged but 'pure' diagnostic groups, which were not available in the studies of this thesis.

Second, assessing complex cognitive and psycholinguistic skills in children with communication and/or behavioural difficulties was not always easy, and I have sometimes doubted that the chosen modes of assessment were ideal. For example, another reading comprehension test was used for (but not reported in) this thesis as it was evident that many children with ASD just did not understand the instructions to this particular task. Further, the wordchains test of word decoding ability appeared to be difficult for some of the children. Specifically, some children marked the lines between the words very neatly, which put them at a disadvantage in terms of time. These observations also underline the importance of knowledge and experience of children with ASD when designing studies, assessing students and evaluating interventions in the field of comprehension and literacy for this group of students.

Third, in the first four studies there were a number of differences in measures of word decoding, language/listening/verbal skills and reading comprehension, making comparisons across the studies more complex. Further, I have not been fully consistent in my conceptualisations of these constructs in the studies. Moreover, it would be beneficial for the quality of future research to include a broader range of standardised and reliable instruments, with reasonably recent norms, than what was the case in the present series of studies. This is especially critical for reading, listening and language comprehension. However, there are very few instruments available in Sweden in this field, and the tests that exist typically come in slightly new forms for each grade. One possible reason for this shortage of Swedish instruments is that they are developed for school and screening purposes, and not for research. As mentioned above, I also attempted to use instruments that did not put the focus sample in a disadvantaged position.

Fourth, with the exception of Study V, the present studies captured only snapshots in time of the children's abilities. In a number of places in the studies, different included factors, e.g. poor vocabulary and ADHD symptomatology, have been treated as likely causes of (reading) comprehension difficulties but the directions of some of the relations reported are actually not straightforward. For example, while previous research has disconfirmed the idea

of reading difficulties as a primary cause of ADHD (e.g. Pennington, 2006), inattentive and hyperactive behaviours could possibly develop in a dynamic and reciprocal relation to reading impairment. To account for such reciprocal and dynamic relations in development, longitudinal designs are typically considered superior.

Finally, the fifth study needs to be replicated using a greater number of outcome measures and a more robust design (i.e. a randomised control group), which in turn presupposes a larger sample. Yet, against a backdrop of almost non-existing prior research in this field, the findings in Study V are important and positive, and replications appear, indeed, worthwhile. Furthermore, given the heterogeneity among children with (and without) ASD, future research should try to steer away from the ‘one-size fits all’ logic that is still dominant in the educational intervention field. Indeed, teachers from Study V noted that two of the students had comprehension skills that were higher than the challenges presented by the intervention. For these students the training programme failed to tap into their ‘zone of proximal development’ (Vygotsky, 1978). Furthermore, little or no data on the classroom interaction and instruction is provided. There was no possibility in Study V to follow the everyday interactions in all the classrooms to the desired extent. The close collaboration between an educational setting and research also raised a number of ethical issues. For example, ethics prevented us from recording the naturalistic classroom instruction, based on the fact that (i) this was not part of the ethical approval and that (ii) not all students in the classes agreed to participate in the research.

Moving on with school-based studies on learning and teaching for children with developmental disabilities, I will try to (i) better acknowledge the institutional functions of schools (Olson, 2003) and ethical issues linked to these when planning and evaluating the intervention, (ii) link outcome from assessments and the intervention closer together, and (iii) tie the planned treatments to each individual student’s study plan in collaboration with school staff, the student, and his or her parents. Another issue worthy of further research is how teachers appropriate interventional methods originating from research, and then transform these into classroom practice. This is by no means a simple issue of ‘delivery’, as the teacher has a host of situational and personal factors to take into account. Or in the words of William James (1958):

You make a great, a very great mistake, if you think that psychology, being the science of the mind’s laws, is something from which you can deduce definite [...] methods of instruction for immediate schoolroom use. Psychology is a science,

and teaching is an art; and sciences never generate arts directly out of themselves. An intermediary inventive mind must make the application, by using its originality (pp. 23–24).

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