

B

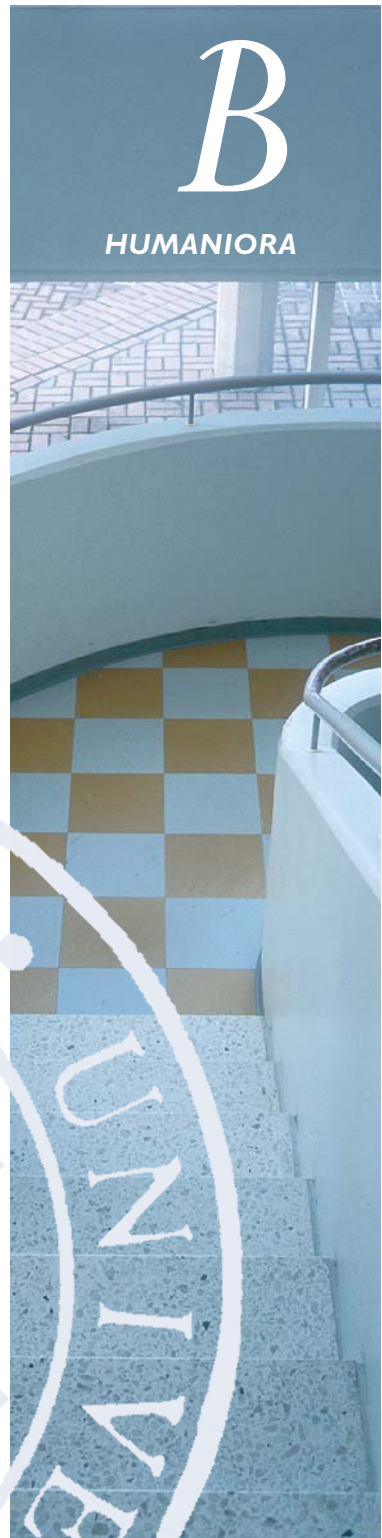
HUMANIORA

Soile Loukusa

THE USE OF CONTEXT IN
PRAGMATIC LANGUAGE
COMPREHENSION IN
NORMALLY DEVELOPING
CHILDREN AND CHILDREN
WITH ASPERGER SYNDROME/
HIGH-FUNCTIONING AUTISM

AN APPLICATION OF RELEVANCE THEORY

FACULTY OF HUMANITIES,
DEPARTMENT OF FINNISH, INFORMATION STUDIES AND LOGOPEDICS,
DEPARTMENT OF PAEDIATRICS,
UNIVERSITY OF OULU



ACTA UNIVERSITATIS OULUENSIS
B Humaniora 80

SOILE LOUKUSA

**THE USE OF CONTEXT IN PRAGMATIC
LANGUAGE COMPREHENSION IN
NORMALLY DEVELOPING CHILDREN
AND CHILDREN WITH ASPERGER
SYNDROME/HIGH-FUNCTIONING
AUTISM**

An application of relevance theory

Academic dissertation to be presented, with the assent of
the Faculty of Humanities of the University of Oulu, for
public defence in Keckmaninsali (Auditorium HUI06),
Linnanmaa, on October 20th, 2007, at 12 noon

OULUN YLIOPISTO, OULU 2007

Copyright © 2007
Acta Univ. Oul. B 80, 2007

Supervised by
Professor Matti Lehtihalmes
Professor Eeva Leinonen
Professor Irma Moilanen

Reviewed by
Professor Kaisa Launonen
Professor Matti Leiwo

ISBN 978-951-42-8577-6 (Paperback)
ISBN 978-951-42-8578-3 (PDF)
<http://herkules.oulu.fi/isbn9789514285783/>
ISSN 0355-3205 (Printed)
ISSN 1796-2218 (Online)
<http://herkules.oulu.fi/issn03553205/>

Cover design
Raimo Ahonen

OULU UNIVERSITY PRESS
OULU 2007

Loukusa, Soile, The use of context in pragmatic language comprehension in normally developing children and children with Asperger syndrome/high-functioning autism. An application of relevance theory

Faculty of Humanities, Department of Finnish, Information Studies and Logopedics, University of Oulu, P.O.Box 1000, FI-90014 University of Oulu, Finland, Department of Paediatrics, University of Oulu, P.O.Box 5000, FI-90014 University of Oulu, Finland

Acta Univ. Oul. B 80, 2007

Oulu, Finland

Abstract

This research explored, within the framework of relevance theory, how normally developing 3- to 9-year-old children and two age groups (age 7–9 and age 10–12) of children with Asperger syndrome or high-functioning autism (AS/HFA) and their 7- to 9-year-old control group used context when answering questions and giving explanations for their correct answers. The children were asked questions targeting the pragmatic processes of reference assignments, enrichments, routines, implicatures and feelings. They were also asked to explain their correct answers to routine, implicature and feeling questions to elicit understanding about their awareness of how they had derived the answers from the context.

In normally developing children the largest increase in correct answers occurred between the ages of 3 and 4 in all question types except feeling questions, where rapid development continued until age 5. After that development progressed more gradually until the age of 8 when the children performed near the ceiling level in all of these question types. Giving explanations for correct answers developed gradually between the ages of 3 and 9, indicating that becoming aware of the information used in inferencing has a longer developmental timeframe. Children's incorrect answers and explanations showed that, as children develop, their answering strategies become more sophisticated as they increasingly utilise context in different ways.

Children with AS/HFA were able to answer all the question types. However, compared to the control group, the younger AS/HFA group did less well when answering contextually demanding questions, and the performance of the older AS/HFA group fell in between the younger AS/HFA group and the control group. Both AS/HFA groups had difficulties when giving explanations for their correct answers, showing difficulty in articulating explicitly how they had used context in arriving at the correct answer. Incorrect answers and explanations indicated that, usually, all the children tried to utilise contextual information, although the attempt failed somehow. For children with AS/HFA it was more typical to continue with their answer after first giving a correct answer or explanation, which then led to an irrelevant answer, suggesting that these children had difficulties with stopping processing at the relevant point.

Keywords: Asperger syndrome, comprehension strategies, context, high-functioning autism, inference, pervasive developmental disorders, pragmatic comprehension, pragmatic language development, relevance theory

Loukusa, Soile, Kontekstin hyödyntäminen kielen pragmaattisessa ymmärtämisessä normaalisti kehittyneillä lapsilla sekä lapsilla, joilla on Aspergerin oireyhtymä / hyvätasoinen autismi. Relevanssiteorian soveltaminen

Humanistinen tiedekunta, Suomen kielen, informaatiotutkimuksen ja logopedian laitos, Oulun yliopisto, PL 1000, 90014 Oulun yliopisto, Lastentautien klinikka, Oulun yliopisto, PL 5000, 90014 Oulun yliopisto

Acta Univ. Oul. B 80, 2007

Oulu

Tiivistelmä

Tutkimuksessa tarkasteltiin, kuinka normaalisti kehittyneet 3–9-vuotiaat lapset ja kaksi ikäryhmää lapsia (7–9-vuotiaat ja 10–12-vuotiaat), joilla on Aspergerin oireyhtymä tai hyvätasoinen autismi (AS/HFA) ja heidän 7–9-vuotiaista koostuva kontrolliryhmänsä, käyttivät kontekstia vastatessaan kysymyksiin ja perustellessaan oikeita vastauksiaan. Tutkimus tehtiin relevanssiteorian viitekehkeksessä. Lapsilta kysyttiin pragmaattista prosessointia vaativia kysymyksiä, jotka arvioivat viittausten, epätäydellisten lauseiden, rutiinien, implikatuuri- ja tunnetilojen ymmärtämistä. Lisäksi heidän tuli perustella oikeat vastaukset rutiini-, implikatuuri- ja tunnekysymyksiin, jotta nähtiin, olivatko lapset tietoisia, kuinka he olivat johtaneet vastauksensa kontekstista.

Normaalisti kehittyneillä lapsilla oikeiden vastausten määrä lisääntyi nopeasti 3. ja 4. ikävuoden välillä kaikissa kysymystyypeissä. Tunnekysymyksiin vastaamisessa tämä nopean kehityksen kausi jatkui 5. ikävuoteen saakka. Tämän jälkeen kehitys jatkui hitaampana 8 vuoden ikään saakka, jolloin lapset suoriutuivat lähes kaikista kysymyksistä kaikissa eri kysymystyypeissä. Perustelujen antaminen oikeisiin vastauksiin kehittyi asteittain 3. ja 9. ikävuoden välillä, mikä kertoi, että vastauksessa käytetyn informaation tiedostamisen kehittyminen tapahtui pitemmällä aikavälillä. Lasten virheelliset vastaukset ja perustelut osoittivat, että iän lisääntyessä lasten vastausstrategiat muutuivat kehittyneemmiksi ja he hyödynsivät kontekstia monin eri tavoin.

Lapset, joilla oli AS/HFA, osasivat vastata kaikkiin esitettyihin kysymystyypeihin. Kuitenkin nuorempi AS/HFA-ryhmä suoriutui kontrolliryhmää heikommin ja vanhemman AS/HFA-ryhmän suoriutumisen sijoittui nuoremman ikäryhmän ja kontrolliryhmän suoriutumisen puoliväliin. Molemmilla AS/HFA-ryhmillä esiintyi vaikeuksia oikeiden vastausten perustelussa, mikä kertoi vaikeudesta ilmaista, kuinka he olivat käyttäneet kontekstia oikeaan vastaukseen pääsemiseksi. Virheelliset vastaukset ja perustelut osoittivat, että yleensä kaikki lapset pyrkivät kontekstin hyödyntämiseen vaikka epäonnistuivatkin siinä. Lapsille, joilla oli AS/HFA, oli tyypillisempää jatkaa vastaamista vielä oikean vastauksen tai perustelun antamisen jälkeen, mikä lopulta johti aiheesta syrjäyttämiseen. Tämä kertoi vaikeudesta lopettaa prosessointi relevantissa kohdassa.

Asiasanat: Aspergerin oireyhtymä, hyvätasoinen autismi, konteksti, laaja-alaiset kehityshäiriöt, pragmaattinen kielen kehitys, pragmaattinen ymmärtäminen, päättely, relevanssiteoria, vastausstrategiat

To Lauri and Jalo

“Learn from yesterday, live for today, hope for tomorrow. The important thing is not to stop questioning.”

- Albert Einstein -

Acknowledgements

This thesis was carried out at the Department of Finnish, Information Studies and Logopedics and the Department of Paediatrics of the University of Oulu, Finland, during the years 2002–2007 in cooperation with the Department of Psychology, University of Hertfordshire, UK.

I would like to start by thanking my supervisor Professor Eeva Leinonen for her valuable comments concerning pragmatic research. She made my research possible by introducing me to the field of relevance theory and by helping me in designing test material. During these years, her scientific enthusiasm and supportive comments have given me encouragement to do this study. With her assistance I was also given the possibility to analyse my data at the Psychology Department at the University of Hertfordshire as a visiting research fellow. I wish to thank my supervisor Professor Matti Lehtihalmes with whose help I started to plan this study and who open-mindedly gave me possibility and support to start studying an area where only few earlier studies exist. I also thank warmly my supervisor Professor Irma Moilanen for all the encouragement and support she has given me during these years. She has always been available for help when I have needed advice. She has gently taught me scientific thinking and her comments have been inspiring. With her help I have learnt to observe my study findings from different perspectives. I also thank Professor Pirjo Korpilahti for supervising me at the beginning of this study and for all comments and help that she has given me.

I would like to express my special thanks to Sirpa Lampela (née Sakko), MA, and Kati Tauriainen, MA, who collected the data of normally developing children aged 4 to 6 years. I also thank them for reanalysing part of my data in order to test interrater reliability and for many interesting discussions concerning this issue. I am likewise thankful to Nuala Ryder, PhD, who has guided me in my scientific English writing during our many meeting hours. In addition, I have very much enjoyed our inspiring discussions concerning the use of relevance theory in developmental and disordered language studies. I had the privilege to collect data concerning children with Asperger syndrome or high-functioning autism as part of the study project Genetic Study of Asperger Syndrome in Northern Finland. In this study project, children were carefully diagnosed by Marja-Leena Mattila, MD, and Katja Jussila, MPsych. It has been a pleasure to watch their careful work. I sincerely thank them from various comments, support and help in the preparation of the original papers. I also wish to thank Sanna Kuusikko, MPsych, who performed three subtests of NEPSY to the children with Asperger syndrome and high-functioning autism for

this study. She also helped me with many practical arrangements in collecting the data. I am also thankful to Docent Hanna Ebeling, PhD, for her valuable comments on studies of Asperger syndrome and high-functioning autism.

I warmly thank the official reviewers of this thesis, Professor Kaisa Launonen and Professor Emeritus Matti Leiwo, for their constructive criticism and comments. Their comments have helped me substantially to improve the final version of this thesis.

I thank Risto Bloigu, MSc, and Jouko Miettunen, PhD, for their valuable help with statistical analysis and Anna Vuolteenaho, MA, for reviewing the language of this thesis and original papers.

I wish to thank the staff of the Department of Finnish, Information Studies and Logopedics. Especially, Docent Sari Kunnari, PhD, Terhi Hautala, MA, Leila Paa-vola, PhD, Eira Jansson-Verkasalo, PhD, Taina Välimaa, PhD, and Kaisa Kosola have given me help, advice and support during this work. Additionally, I thank the staff of the Department of Psychology at the University of Hertfordshire and the staff of the Department of Phoniatics and Department of Paediatrics, University Hospital of Tampere, for comments and support concerning this study. I am also thankful to all the people who have given me comments concerning this study at different seminars and meetings.

I am deeply grateful to a large number of children who participated in this study and their parents. I warmly thank the staff at the schools, Oulun normaalikoulu and Rajakylän ala-aste, and the staff at the day nurseries of the City of Oulu for their cooperation and for all practical arrangements concerning data collection.

My warmest thanks are also due to my friend and colleague Elina Kykyri, who has given me support and many moments of joy during all these years. Goals are difficult to achieve without a bit of madness! We have had many interesting and open-minded discussions in the area of logopedics, and she has also reanalysed part of my data for interrater reliability testing. I also want to thank all of my other friends and colleagues who have given me encouragement and joy during these years.

I owe special thanks to my brother Raine who drew the test pictures for this study. He, his wife Anu and their daughter Ria as well as my other brother Heikki, his wife Anna Kaisa and their children Enni and Konsta have given me lots of delight in my life. I also thank Anna Kaisa for checking the language of the Finnish abstract. I warmly thank my mother Maire whose loving support and encouragement has been enormous all through the years. In addition, my mother-in-law Anna-Maija and father-in-law Matti have given me encouragement for this study.

Finally, I want to express my dearest thanks to my husband Lauri. His support has been endless. His loving encouragement and belief in me has given me strength at all stages of this study. He has also helped me with technical problems, and he created an electronic test sheet that helped me significantly, especially in the calculation of children's scores. His open attitude and curiosity towards life has made it possible to do this study partly abroad, which has given me a lot of new and inspiring experiences. He and our precious baby Jalo and our dogs Rosi and Piitu have given me much happiness and love in my everyday life.

This study was supported by the Finnish Cultural Foundation, the Helsingin Sanomat Centennial Foundation, Finland, the Päivikki and Sakari Sohlberg Foundation, Finland, the Alma and K.A. Snellman Foundation, Oulu, Finland, the Finnish Association of Speech Therapist, the Friends of the Young Association, Oulu, Finland, the National Alliance for Autism Research (NAAR) grant of Professor David Pauls from Massachusetts General Hospital and Harvard Medical School, USA, the Langnet Graduate School in Language Studies, the Graduate School of Circumpolar Wellbeing, Health and Adaptation and the Graduate School of Culture and Interaction, University of Oulu. All of these supporters are warmly thanked.

Abbreviations

ADI-R	The Autism Diagnostic Interview-Revised
ADOS	The Autism Diagnostic Observation Schedule
AS	Asperger syndrome
ASD	Autism spectrum disorders
ASSQ	The High-Functioning Autism Spectrum Screening Questionnaire
CD	Conduct disorder
HFA	High-functioning autism
ICD-10	International Classification of Diseases 10
IQ	Intelligence quotient
ITPA	The Illinois Test of Psycholinguistic Abilities
NEPSY	The Developmental Neuropsychological Assessment
PDD	Pervasive developmental disorders
PDD-NOS	Pervasive developmental disorder not otherwise specified
PIQ	Performance intelligence quotient
PLI	Pragmatic language impairment
RLD	Receptive language disorder
SES	Socio-economic status
SLI	Specific language impairment
SPD	Semantic-pragmatic disorder
ToM	Theory of mind
VIQ	Verbal intelligence quotient

List of original publications

This thesis is based on the following articles which are referred to in the text by their Roman numerals. In addition, this thesis includes some unpublished data.

- I Loukusa S, Leinonen E & Ryder N (2007) Development of pragmatic language comprehension in Finnish-speaking children. *First Language* 27(3): 281–298.
- II Loukusa S, Ryder N & Leinonen E (accepted for publication) Answering questions and explaining answers: A study of Finnish-speaking children. *Journal of Psycholinguistic Research*.
- III Loukusa S, Leinonen E, Kuusikko S, Jussila K, Mattila ML, Ryder N, Ebeling H & Moilanen I (2007) Use of context in pragmatic language comprehension by children with Asperger syndrome or high-functioning autism. *Journal of Autism and Developmental Disorders* 37(6): 1049–1059.
- IV Loukusa S, Leinonen E, Jussila K, Mattila ML, Ryder N, Ebeling H & Moilanen I (2007) Answering contextually demanding questions: Pragmatic errors produced by children with Asperger syndrome or high-functioning autism. *Journal of Communication Disorders* 40(5): 357–381.

Contents

Acknowledgements

Abbreviations

List of original publications

Contents

1	Introduction	21
2	Review of literature	23
2.1	Definition of pragmatics	23
2.2	Acquisition of pragmatic language	24
2.2.1	Development of the use of context	24
2.2.2	Factors behind an ability to answer contextually complex questions.....	31
2.2.3	Children's explanations	34
2.3	Asperger syndrome and high-functioning autism.....	35
2.3.1	Definition of Asperger syndrome and high-functioning autism ...	35
2.3.2	Pragmatic difficulties in Asperger syndrome and high-functioning autism	35
2.3.3	Explanations for pragmatic deficits in Asperger syndrome and high-functioning autism	41
2.4	Cognitive approach to assess pragmatic language comprehension.....	42
2.4.1	Definition and assumptions of relevance theory.....	42
2.4.2	Pragmatic subtasks in comprehension process	44
2.4.3	Experimental studies utilising relevance theory as a study framework	46
3	Aims of the study	47
4	Method	49
4.1	Participants.....	49
4.1.1	Participants in the data of normally developing children	49
4.1.2	Participants in the data of children with Asperger syndrome or high-functioning autism.....	50
4.1.3	Ethical consideration.....	53
4.2	Material	54
4.3	Procedure.....	59
4.4	Analysis.....	59
4.4.1	Correct/incorrect scoring.....	59
4.4.2	Categorisation of errors.....	60

4.4.3	Interrater reliability	62
4.4.4	Statistical analyses	63
5	Results	67
5.1	Use of context in question answering in normally developing 3- to 9-year old children	67
5.1.1	Comparison between language tests and sum of answers to reference assignment, enrichment and implicature questions (I)..	67
5.1.2	Effect of gender on scores consisting of answers to reference assignment, enrichment and implicature questions (I).....	67
5.1.3	Answers to contextually demanding questions in 3- to 9-year-old children (I, II, unpublished data).....	67
5.1.4	Incorrect explanations for initially correct answers in normally developing children (II, unpublished data).....	75
5.2	Performance of children with AS/HFA.....	79
5.2.1	Answers to pragmatically demanding questions in children with AS/HFA (III, IV)	79
5.2.2	Incorrect explanations for initially correct answers in children with AS/HFA (III, IV)	84
5.2.3	Topic drifts after first answering or explaining an answer correctly (IV).....	86
5.3	Overview of results	87
5.3.1	Summary of total pragmatic answer scores	87
5.3.2	The relationship between correct answers and their correct explanations	89
6	Discussion	93
6.1	Performance of normally developing children.....	93
6.1.1	Use of context in question answering in normally developing children.....	93
6.1.2	Development of the ability to explain correct answers in normally developing children	96
6.2	Performance of children with AS/HFA.....	97
6.2.1	Answers to contextually demanding questions in children with AS/HFA	97
6.2.2	Incorrect explanations for correct answers in children with AS/HFA	99
6.2.3	Topic drifts after correct answers and explanations in children with AS/HFA	100

6.3 Critical appraisal of the study	102
6.3.1 Methodological considerations	102
6.3.2 Subjects	102
6.3.3 Theoretical framework	104
6.4 Clinical Implications	106
6.5 Future research	108
6.6 Conclusions	109

References

Appendices

Original publications

1 Introduction

Linguistic skills alone are not enough for successful communication. In communicative situations, listeners need to work out the meaning of a linguistic expression on the basis of the contextual factors of the situation and on the basis of their world knowledge and experiences. Pragmatic comprehension is seen as an ability to utilise context in comprehension. (Sperber & Wilson 1995, Leinonen *et al.* 2000.) Thus, communicating successfully calls for the ability to go beyond the information given linguistically. Children's ability to interpret the meaning that is not explicitly encoded in the linguistic expression begins to develop from an early age. At first, children's language comprehension relies heavily on the physical context in which the communication takes place (Bishop 1997). As children develop they become more able to utilise more diverse contextual information in their communication in a flexible way (Robinson & Whittaker 1987, Lloyd *et al.* 1995, Ryder & Leinonen 2003). There has not, however, been much systematic research into how children's ability to interpret meanings in context develops over time.

Asperger syndrome (AS) and high-functioning autism (HFA) are characterised by communication problems which are best described as affecting pragmatic aspects of language (Ramberg *et al.* 1996, Landa 2000). Pragmatic difficulties may even be the most stigmatising and handicapping aspect of these syndromes (Landa 2000). However, there are relatively few investigations of pragmatic functioning in children with AS or HFA. In addition, one problem is that there are very few optimal standardised assessment methods to measure pragmatics (Klin *et al.* 2000). There are no tests published for pragmatic comprehension in Finnish.

Theoretical frameworks of pragmatic comprehension studies vary widely. In this study pragmatic comprehension is approached from a framework based on relevance theory (Sperber & Wilson 1995) that aims to explain how the hearer interprets speaker's meaning on the basis of contextual factors. Relevance theory is based on the assumption that the purely linguistic form often does not give the intended meaning and is therefore not sufficient for the comprehension of utterances. Utterances usually have many possible interpretations that are compatible with the linguistic information. However, all of these interpretations are not equally likely to come to a hearer's mind at any one point, because comprehension is driven by a *search for relevance*, and the hearer therefore utilises only relevant contextual information when interpreting the meaning of an utterance.

Pragmatic comprehension and its development is a complex process. Being able to engage in contextual processing when taking part in communication is an

important ability, yet relatively little is known about how it develops and how this development can go wrong. The research in this thesis examines the development of pragmatic comprehension abilities using questions with different contextual complexity focusing on a large sample of normally developing Finnish-speaking children and children with AS/HFA. The relevancy of the answers given by the children was assessed on the basis of relevance theory; here, relevant thus not only means that an answer is on topic, but the answer was also expected to show that the child had utilised a part of the context that was relevant in relation to the question. In addition, this study examined children's ability to explain their initially correct answers in order to gain knowledge about whether they were aware of how they had derived an answer from the context.

2 Review of literature

2.1 Definition of pragmatics

Definitions of pragmatics vary according to the theoretical background and focus of the study; for instance, studies about turn-taking or story-telling define pragmatics differently compared to studies about implied meaning (Leinonen *et al.* 2000). However, regardless of differences in definitions there is a consensus that natural language understanding and use belong to the field of pragmatics, and that social and cognitive factors affect pragmatic aspects of language comprehension and expression. In this study, pragmatics is defined as the study of language in *context*, and specifically how context affects the interpretation of utterances (Blakemore 1992, Sperber & Wilson 1995). Meaning of the same linguistic expression can vary in different situations, and therefore in comprehension it is necessary to go beyond information given linguistically by utilising contextual factors of the situation (Donaldson 1992, Sperber & Wilson 1995, Ervin-Tripp 1996, Gibbs & Moise 1997, Verschueren 1999).

Definition of context varies according to type of study, and there is thus not just one correct way of defining context. However, it is obvious that context in communication is not just linguistic information that surrounds an utterance. In the study of communication, context is usually conceived as an extensive and multidimensional concept, which includes social, cognitive, cultural, linguistic, physical, and other non-linguistic context (Prutting 1982, Milosky 1992, Klippi 1995, Sperber & Wilson 1995, Mercer 2000). Therefore, context can be said to encompass all the information that the hearer utilises when interpreting language expressions. For example, the hearer's knowledge and beliefs of what the communication partner knows helps in interpretation of his/her utterances. When interpreting contextual factors, there is a need to make connections between information and to link information together. Therefore, inference plays a significant role in the pragmatic comprehension process (Leinonen *et al.* 2000, Sperber & Wilson 2002).

2.2 Acquisition of pragmatic language

2.2.1 Development of the use of context

Development of pragmatic ability can be defined as children's progressing ability to use context in language comprehension and expression (Leinonen *et al.* 2000). Children use context as soon as they start to communicate. Children first comprehend utterances by relying heavily on the physical context in which the communication takes place, and their first communicative attempts are thus closely connected with the physical "here and now", often based on routine communications with others. (Milosky 1992, Bishop 1997.) When interpreting utterances young children rely strongly on knowledge of their world rather than the meaning given by the linguistic expression (Strohner & Nelson 1974, Hudson & Nelson 1983, Marinac & Ozanne 1999) or the speaker's intended meaning (Robinson & Whittaker 1987).

Shatz (1977) has shown that during a play session even 2-year-old children are able to respond by performing an appropriate action to indirect requests (e.g., "Are there any more suitcases?"; intended meaning "Find another toy suitcase"). This is argued to be possible because an action-based response does not require the child to engage in complex contextual processing. Responding to action-focused questions requires more basic conceptual manipulation of the linguistic expression for the purposes of locating the intended meaning. According to O'Neill (1996), from the age of 2 children can already consider parents' contextual needs in a well-defined communicative situation where they have to ask for parents' help in retrieving a toy. When the parent had not seen where the toy was, the children more often named the toy and named and gestured its location in order to get help in retrieving it. This is a significant pragmatic achievement for young children.

It is clear that from an early age, children are able to take context into account when formulating and interpreting linguistic expressions (e.g., Maratsos 1973, Donaldson 1978, O'Neill 1996, Bezuidenhout & Sroda 1998, Jaswal & Markman 2001). However, even if children start to utilise contextual information already in their first communicative attempts, only after development continues do children begin to be able to utilise more diverse contextual information in their communication in a flexible way (Hassibi & Breuer 1980, Robinson & Whittaker 1987, Becker 1990, Lloyd *et al.* 1995, Ryder & Leinonen 2003). It can be shown that processing demands differ according to the pragmatic complexity of indirect utterances, and the child's performance is affected by these processing demands.

In a study by Bucciarelli *et al.* (2003), simple direct requests (e.g., “Please, take a seat”) and simple indirect requests (e.g., “Sorry, could you close the window?”) were equally easy to comprehend by children from 2;6 to 7 years. However, complex indirect utterances were more difficult for all age groups (e.g., an adult answers: “We don’t have any money” when a child asks if he could get a game from a shop). Elrod (1987) compared children aged 3;2 to 4;7 years to children aged 4;8 to 6;4 years and found that compared to the younger children, older children had a better understanding of indirect utterances (e.g., “These cookies are for our guests tonight”). However, both age groups performed similarly when responding to direct requests (e.g., “Please, don’t eat the cookies”). Elrod concluded that the younger children in his study were not yet able to understand the less explicit type of indirect requests, and that this ability progresses with age. These findings (Elrod 1987, Bucciarelli *et al.* 2003) suggest that different ‘degrees’ of contextual processing are required by the child to answer different types of indirect questions. That is why, even if young children do have an ability to utilise contextual information in simple familiar situations, they have difficulties in more complex tasks where they have to consider and connect information from different, more demanding and less familiar sources (Bezuidenhout & Sroda 1998, Ryder & Leinonen 2003).

In their research utilising relevance theory as a framework, Ryder and Leinonen (2003) examined children aged 3;6 to 5;6 years by using questions in a storybook context. They discovered that the ability to use contextual information when answering questions demanding comprehension of referents, enriching semantically incomplete utterances and recovering implicatures (see definitions of these terms in chapter 2.4.2, pp. 46–47) is related to age. The ability to form contextually appropriate inferences started to develop after the age of 3;6 and it still continued after the age of 5;6. Three-year-old children were able to utilise context when interpreting pronominal reference (about 55% correct answers) and showed an emerging ability to answer enrichment questions (about 25% correct answers), but they had not yet developed an ability to answer questions which required the processing of contextually demanding implicatures requiring consideration of prior context, world knowledge and verbally given information. The results indicated that comprehension of enrichment questions and questions demanding processing of implicatures developed rapidly after the age of 4, as 5-year-olds answered about 70% of the enrichment questions and about 60% of the implicature questions correctly. Previous studies about children’s ability to utilise contextual information in language processing are listed in Table 1.

Table 1. Previous studies about the use of context in normally developing children.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
Strohmer & Nelson, 1974	The effect of event probability, nonverbal context, syntactic forms and strategies on sentence comprehension.	Study 1: 3;1 to 3;7 years, $n = 15$. 4;1 to 4;6 years, $n = 15$. 5;0 to 5;6 years, $n = 15$. Study 2: 4-year-olds, $n = 89$.	Study 1: Children had to act out the presented active and passive sentences (probable, improbable, reversible) using puppets. Study 2: Children were tested before and after training session where pictures were used to show both probable and improbable events.	Study 1: Comprehension improved with progressing age. If the child failed to understand information based on syntactic structure, he/she did not guess randomly, but used event-strategy or actor-action-object strategy. Study 2: Children's tendency toward actor-action-object strategy in probable and improbable sentences depended on the nonverbal context. When pictures were used to show both probable and improbable events, the actor-action-object strategy was rarely used. Training did not affect the use of this strategy. Children had an ability to answer both direct and indirect requests by action.
Shatz, 1977	Comprehension of indirect requests.	1;7 to 2;4 years, $n = 5$.	During the play session mothers presented direct and indirect requests to their children.	Children had an ability to answer both direct and indirect requests by action.
Nelson, 1978	Study 1. Comprehension of script-based events. Study 2. Development of scripts by controlling the amount of experiences.	Study 1: 4;0 to 5;1 years, $n = 8$. Study 2.: Preschool children, $n = 14$. Half of the children were new to the day care centre and half of them returned from the previous year.	Study 1: Three assessment sessions which focused on different types of eating situations (e.g., eating at McDonalds). First a child was asked to tell about the eating situation. After that he/she had asked to show it using toys. Study 2: Concerning lunch situation at the day care centre children had been interviewed within their first opening week in the fall and then again 3 months later.	Study 1: Children's knowledge about eating situations fit to the script model (good control of knowledge of routines). Study 2: With increasing experiences, the situation of eating in the day care centre was expressed in a more coherent and detailed way. Both studies showed that script structure is an important representation of children's knowledge.
Eson & Shapiro, 1982	Development of becoming able to draw inferences about intentions and apply discourse rules.	2;0 to 6;1 years, $n = 57$.	Toys were used to present target utterances which were a literal form of prohibitive (don't).	Two youngest subjects did not understand utterances (2;0 and 2;2-year-olds). Children between 2;4 and 4;0 years were found to be literally obedient. Children between 4;6 and 6;1 understood the intention of an utterance and children between 4;0 and 4;6 were transitional.

Table 1. Continued.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
Hudson & Nelson, 1983	Children's use of scripts in story recall.	4;4 to 5;2 years, <i>n</i> = 29. 6;2 to 7;2 years, <i>n</i> = 30.	Children had to recall stories that differed from each other on the basis of the amount of familiarity, goal information and temporal structure.	Both age groups recalled more story units from the stories about familiar events. Recalled stories about logically organised events were better sequenced. Group differences were evident, suggesting that younger children's event knowledge is more schema-bound, but when age increases children become more flexible in their script use.
Umstead & Leonard, 1983	Children's resolution of pronominal reference.	3;2 to 3;9 years, <i>n</i> = 10. 4;6 to 5;0 years, <i>n</i> = 10. 5;7 to 6;1 years, <i>n</i> = 10.	After stories were told to the children, questions were asked that required finding an object where pronoun <i>he</i> referred to.	Children's ability to interpret references increased with age. Type of reference affected children's performance (not all references were as easy to resolve).
Elrod, 1987	Children's ability to understand indirect requests.	3;2 to 6;4 years, <i>n</i> = 78.	Children were asked to answer questions concerning direct and indirect requests.	Young children understood direct request better than indirect requests. Non-linguistic context did not play a significant role in understanding.
Hudson & Slackman, 1990	Children's ability to use scripts in inferential text processing.	4;1 to 5;5 years, <i>n</i> = 42. 5;10 to 7;5 years, <i>n</i> = 41.	Children listened and recalled stories about familiar events and then answered questions that demanded script-based, invited and logical inferencing.	Younger age group performed better in script-based inferences than in invited and logical inferences. Older age group performed better in script-based and invited inferences than in logical inferences. This suggests that development of knowledge affects children's ability to make inferences.
Lloyd <i>et al.</i> , 1995	Children's referential communication skills	6;1 to 6;9 years Italian children, <i>n</i> = 32. 9;1 to 9;9 years Italian children, <i>n</i> = 32. 6;0 to 7;0 years English children, <i>n</i> = 32. 9;1 to 10;0 years English children, <i>n</i> = 32.	Using coloured picture cards about familiar items, children's referential communication skills were tested in the speaker condition and in the listener condition.	Speaker condition: 9-year-olds were better speakers compared to 6-year-olds. There was more redundancy in descriptions of Italian children compared to descriptions of English children. Listener condition: All children performed well with adequate message but with ambiguous messages there was an age, sex, SES and culture effect.

Table 1. Continued.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
O'Neill, 1996	Toddlers' sensitivity to parent's knowledge.	Study 1: 2;6 to 2;10 years, $n = 16$ and 16 parents. Study 2: 2;3 to 2;4 years, $n = 16$ and 16 parents.	Study 1: First, a new toy was introduced to a child and after that the toy was placed on a high shelf. Parent either saw this situation or not. In order to get a toy the child had to ask for help from his/her parent. Study 2: Children had to ask the parent for help in getting a sticker from one of two containers, which were placed in the far corners of the table. Again, the parent either saw or did not see in which container the sticker was put.	Study 1: Children were able to take into account parent's state of knowledge when asking for help in retrieving a toy. When the parent did not see where the toy was put, children more often named the toy, named its location and showed its location using gestures. Study 2: Results were similar as in Study 1. When asking for help, children used pointing gestures more often when parents did not see where the sticker was put. Results suggest that young children already had an ability to assess the knowledge of others.
Vieiro & García-Madruga, 1997	Children's ability to produce spoken and written summaries.	Children in third grade (about 8-year-olds), $n = 40$. Children in fifth grade (about 10-year-olds), $n = 40$.	After reading the text half of the children in each grade gave a verbal summary and the other half wrote a summary.	Verbal summaries included the use of inferences and combination of information from different sources. Written summaries were mostly literal recalls from the text. Older children had a more sophisticated ability to utilise the story schema both in verbal and written summaries.
Bezuidenhout & Sroda, 1998	Children's ability to resolve speaker's intended referent.	2;11 to 3;11 years, $n = 40$. 4;0 to 4;11 years, $n = 59$. 5;0 to 6;6 years, $n = 77$.	Children were presented either a control story (The Tortoise and the Hare) or an experimental story. The experimental story included situations where the speaker produced a referentially correct and incorrect messages and the listener answered in different ways depending on that. The idea of experimental story was to teach children how they should answer to a referentially inadequate message. Two days after that, children were tested in an experimental room in two conditions (barrier and no barrier) in order to see how children understood information which was available for the speaker.	Experimental story group did not perform better than the control story group. When determining speaker's intended referent, even 3-year-old children were capable of taking into account information about speaker's perspective, suggesting that the children were not egocentric communicators.

Table 1. Continued.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
Marinac & Ozanne, 1999	The development of children's comprehension strategies.	3;0 to 3;5 years, n = 30. 3;6 to 3;11 years, n = 45. 4;0 to 4;5 years, n = 31.	Children were presented the Reynell test of verbal comprehension and their incorrect responses were categorised according to comprehension strategies used.	There was a developmental hierarchy in the comprehension strategies used. The youngest children used a random answering strategy, after which came probable reasoning strategy, while the last strategy was semantic probability.
Spencer, 2001	The role of eye gaze and pointing gestures in understanding complex pragmatic communication.	Experiment 1: 3;1 to 4;1 years, n = 14. 4;2 to 6;2 years, n = 15. Experiment 2: 3;7 to 4;4 years, n = 13. 4;5 to 5;11 years, n = 14.	Experiment 1: Children were presented target sentences (speech only and speech + nonverbal) during the video story. Experiment 2: Children were presented target sentences (speech only, nonverbal only and speech + nonverbal) in loosely structured playing session.	Experiment 1: Nonverbal pointing behaviour supported understanding of indirect request. Experiment 2: When verbal cues were the only information, children misunderstood the requests or interpreted them literally. When nonverbal cues were the only information children responded with action, but the action did not necessarily reflect the intentions of the experimenter. When both verbal and nonverbal cues were presented simultaneously, children understood and acted out the intentions correctly.
Bucciarelli <i>et al.</i> , 2003	Children's performance in different kind of pragmatic comprehension tasks.	2;6 to 3;0 years, n = 40. 3;6 to 4;0 years, n = 40. 4;6 to 5;6 years, n = 40. 6;0 to 7;0 years, n = 40. In each group half of the children were randomly selected to the linguistic protocol and other half of children to the gestural protocol.	Children were shown videotaped stories of everyday communicative interactions. Stories included different types of pragmatic phenomena: direct, simple indirects, simple deceits, simple ironies and complex indirects. The only difference between the protocols was that a critical act in the linguistic protocol was presented through speech and in the gestural protocol through communicative gestures.	Children's ability to interpret different pragmatic meanings increased with age. Both of the protocols had similar results. Simple direct and simple indirects were equally easy to comprehend, and they were easier than simple deceits, which were easier than simple ironies. Results suggest that difficulty of comprehension depends on the mental representation and inferential processes involved in it.

Table 1. Continued.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
Ryder & Leinonen, 2003	Children's performance in answering questions with contextual demands.	3;1 to 3;11 years, <i>n</i> = 15, 4;5 to 4;8 years, <i>n</i> = 15, 5;5 to 5;7 years, <i>n</i> = 15.	A story was read to the children and they were asked questions with different contextual demands as suggested by relevance theory.	Ability to use contextual information increased with age. Children's performance supported the opinion that there are different degrees of processing demands within different question types: reference assignment < enrichment < implicature.

Note. Reynell test = Reynell Developmental Language Scales; SES = socio-economic status.

With increasing age children get new experiences that they can utilise in the interpretation of utterances (Milosky 1992). Significance of former experiences is shown especially clearly in the development of routine answers. Repeated experiences from the same kind of situations make it possible for children to use internalised routines or schemas in utterance interpretation. (Strohner & Nelson 1974, Hudson & Slackman 1990.) It has been suggested that awareness of routines develops before the age of 4, since 4-year-old children have an ability to describe sequential structures of familiar events (Nelson 1978).

In addition to an increase in relevant answers, change in incorrect/irrelevant answer types reflects increasing ability to use relevant contextual information (Marinac & Ozanne 1999, Letts & Leinonen 2001, Ryder & Leinonen 2003). With increasing age, children's answers no longer rely so strongly on their knowledge of how objects generally function in the world (Strohner & Nelson 1974, Hudson & Slackman 1990). As children develop, they focus more and more on relevant contextual factors only (Ryder & Leinonen 2003) and start to provide answers that take the listener's needs into account (Shatz & McCloskey 1984, Anselmi *et al.* 1986). Between the ages of 5 and 9 children start to express themselves more "economically" since they learn to focus on relevant information and start to recognise that there is no need to tell the listener everything (Karmiloff-Smith 1986).

At the moment, there has not been much systematic research into how children's ability to utilise contextual information develops over time. Thus, there is a need for studies with a wide age distribution of children to chart the developmental course of the processing of contextual information. In addition, almost all earlier studies have been done with English children and there is thus a need to study how the comprehension of contextual information develops in children speaking different languages and with different cultural backgrounds. It is currently unclear whether the results of the performance of English children can be generalised (Adams 2002).

2.2.2 Factors behind an ability to answer contextually complex questions

Ability to answer pragmatically demanding questions is dependent on many developmental factors. However, because of the complex nature of communication, it is not possible to represent all factors affecting communication, which is why the focus here is only on some of the basic factors (Figure 1).

Sensory-motorical functions such as auditive and visual perception and articulatory ability make a ground for communication. Linguistic ability makes it possible to understand linguistic information of an utterance and formulate a verbal answer. Therefore, children's question answering is connected with their ability to deal with the linguistic structure of questions and ability to understand the meanings of words. However, in everyday communication situations linguistic skills are not enough since without cognitive abilities necessary for pragmatic understanding, utterance interpretation remains problematic.

When utilising contextual information, a child needs the ability to pay attention to relevant factors (Wilson & Sperber 1988, Buckley 2003). In addition, an ability to operate and store information is essential, and development of memory is therefore one factor supporting the development of utterance comprehension (Oakhill 1984, Wilson & Sperber 1988, Cohen 1989, Gathercole & Baddeley 1993, Baddeley 1996). For instance, long-term memory has an important role in recording and storing new knowledge and experiences (Catania 1992), while working memory works as a tool when integrating information from different sources (Oakhill 1984, Cohen 1989, Baddeley 1996). Inference can be seen as a cognitive process to connect information from different sources. It is an especially important ability when deriving an implied meaning of an utterance, as shown by studies about text comprehension in children (Oakhill & Yuill 1986, Cain & Oakhill 1999, Cain *et al.* 2001).

In the interpretation of utterances children's own world knowledge and beliefs play an important role. Children achieve knowledge for instance by playing, asking, watching, and listening. Over time, they gradually construct a complex belief system, which they are able to utilise in future situations (Donaldson 1992). The belief system is flexible and develops along with children's new experiences (Milosky 1992, Robinson 1994, Sperber & Wilson 1995, Nelson 1996).

When interpreting indirect utterances, mind-reading (i.e. theory of mind, ToM) ability is also needed (e.g., Baron-Cohen 1995, Bara *et al.* 1999, Wilson 2000, Sperber & Wilson 2002, Papp 2006). This is considered to be an ability to infer one's own and other's beliefs, intentions and emotions (Baron-Cohen 2000). Mind-reading ability should not only be seen as an ability to answer questions concerning the knowledge of others, as generally used false belief tasks, but it should be seen as a general concept to interpret the contents of mind (Muris *et al.* 1999, Bloom & German 2000, Eisbach 2004). In addition to understanding of mental states, mind-reading ability thus includes an ability to understand mental activities, such as understanding of one's own and others' thought processes

(Eisbach 2004). In general, the basic understanding of mind develops in children between the ages of 3 and 5 years (Siegal & Beattie 1991, Bloom & German 2000, Wellman & Lagattuta 2000, Wellman *et al.* 2001), which is the age when the development of pragmatic comprehension progresses actively (e.g., Bucciarelli *et al.* 2003, Ryder & Leinonen 2003). According to Pillow (1999), during the preschool years children start to understand that people’s different perceptual experiences may cause differences in their knowledge. In Pillow’s study, 4-year-old children had the ability to make deductive inferences about themselves, but they were not yet able to make knowledge-based inferences about other observers, as could 6-year-olds. This suggest that, approximately at the age of 6, children achieve an ability to recognise that knowledge can be achieved by integrating perceptual experience with earlier experiences via inference.

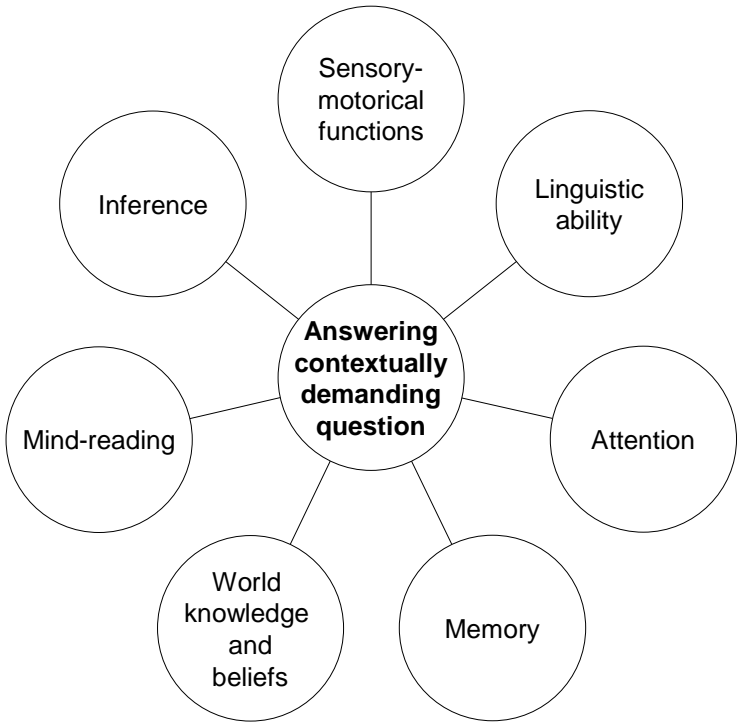


Fig. 1. Factors behind an ability to answer a contextually demanding question.

2.2.3 Children's explanations

There may be situations where a child understands an utterance but cannot express why or how he/she knows it. Although the ability to explain can be seen as a verbal activity, the ability to give a relevant explanation demands many cognitive abilities, such as an ability to distinguish between cause and result, action and intention, and between pieces of evidence and conclusion (Donaldson 1986). Therefore, explanations can reveal how children are or are not aware of the information that they have utilised in the comprehension of utterances. When a child is asked to give an answer to a "How do you know that?" question, he/she is asked to give some evidence for his/her answer. According to Schank (1986), consciousness is the only difference between utterance understanding and giving explanation. When deriving the meaning of an utterance, one has to seek relevant contextual factors, and understanding thus emerges from the creation of a new explanation. In comprehension, utilisation of contextual factors can be unconscious whereas when giving explanations, one has to be conscious of the factors one has utilised.

By studying children's spontaneous language use it has been found that children occasionally start to explain their own inferences as early as just before the age of 3 years. At that time children begin to use verbs such as *think*, *know* and *wonder* in their own speech, for instance "I think Marky wants to get out. He wants to get out 'cause he splashes" (Bartch & Wellman 1995, p. 59). These results suggest that even 3-year-old children realise that mental states exist in their own and others' minds. However, this ability is not fully developed and young children lack the ability to generalise from this knowledge. It is a developmentally long process to become fully aware of one's own processing in different situations and to be able to give a verbal explanation when it is asked for (Donaldson 1986, Letts & Leinonen 2001). In a study by Donaldson (1986), it was found that although 3-year-old children can distinguish between cause and effect, it is only until the age of 8 when children have the ability to use *because* and *so* when giving deductive explanations. In deductive explanations children used *so* when introducing a conclusion and *because* when giving evidence supporting a conclusion.

There are very few studies about how children explain their own correct answers. Developmental studies investigating the relationship between children's answers and their explanations are lacking (if a child knows the answer, can he/she explain why or how he/she knows it). This kind of information could give more knowledge about the time when children start to become aware of contextual

factors they have utilised in comprehension and the time when their understanding of others' thought processes develops (see Eisbach 2004).

2.3 Asperger syndrome and high-functioning autism

2.3.1 Definition of Asperger syndrome and high-functioning autism

According to the ICD-10 (World Health Organization 1993) Asperger syndrome (AS) and high-functioning autism (HFA) belong to a group of neurobiological conditions known as pervasive developmental disorders (PDD). These disorders are characterised by impairments in the development of communication and social skills and the presence of stereotyped behaviour, interests and activities. Diagnoses of AS and HFA are based on a combination of particular impairments. In ICD-10 criteria both autism and AS share the same criteria in impairments in reciprocal social interaction and restricted, repetitive and stereotyped patterns of behaviour, interests and activities (see ICD-10 diagnostic criteria in Appendix 1). According to ICD-10 criteria, AS differs from autism primarily in that it does not contain general delay in language or cognitive development. Thus, in AS there may or may not be problems in communication similar to those associated with autism, but significant language delay would rule out the diagnosis.

Many recent studies have shown that the distinction between these two disorders is not clear and early development may not be an adequate criterion for separating individuals into different diagnostic categories (e.g., Ramberg *et al.* 1996, Mayes & Calhoun 2001, Hippler & Klicpera 2003, Howlin 2003, Frith 2004, Lewis *et al.* 2007, Mattila *et al.* 2007). Developmental traits later in adolescence or adulthood are not necessarily connected with early developmental traits (Eisenmajer *et al.* 1996, 1998, Gilchrist *et al.* 2001, Bishop & Norbury 2002). However, there is a consensus that both AS and HFA are severe pervasive disorders and pragmatic language difficulties are one of the salient disabling features of these disorders (e.g., Ozonoff & Miller 1996, Ramberg *et al.* 1996, Landa 2000).

2.3.2 Pragmatic difficulties in Asperger syndrome and high-functioning autism

AS and HFA are characterised by pragmatic difficulties in both language expression and comprehension (Ozonoff & Miller 1996, Ramberg *et al.* 1996,

Dennis *et al.* 2001, Adams *et al.* 2002, Norbury & Bishop 2002, Losh & Capps 2003, Geurts *et al.* 2004). Individuals with AS and HFA have a tendency to interpret utterances literally (Attwood 1998, Kaland *et al.* 2002, Rapin & Dunn 2003, Bogdashina 2005). Difficulties have been found in tasks that require the understanding of idioms (Kerbel & Grunwell 1998), humorous material (Ozonoff & Miller 1996, Emerich *et al.* 2003), ambiguous sentences (Jolliffe & Baron-Cohen 1999b) or metaphors and irony (Happé 1993, 1995). Difficulties are evident when there is a need to utilise contextual information and to integrate information from different sources (Ozonoff & Miller 1996, Hewitt 1998, Jolliffe & Baron-Cohen 1999a, 1999b, 2000, Dennis *et al.* 2001, Norbury & Bishop 2002, Noens & van Berckelaer-Onnes 2005). Dennis *et al.* (2001) found in their study that, compared to normally developing control children, children with AS/HFA showed specific pragmatic inference deficits affecting their ability to infer the implication of an utterance and to make inferences about social scripts, metaphors and speech acts. The differences between the groups increased in relation to the amount of inferencing and intentionality of the tasks. In the study by Norbury and Bishop (2002), story comprehension tasks were presented to children with normal development, children with HFA, children with specific language impairment (SLI), and children with pragmatic language impairment (PLI). They were asked questions about the literal content of the story and questions requiring inferencing. The results showed that the group of normally developing children performed better than the clinical groups in these tasks, and that the scores between the clinical groups were quite similar. However, the children with HFA most typically gave answers that were irrelevant to the story context.

Language use of individuals with AS or HFA can be characterised by inappropriate prosodic features (Ramberg *et al.* 1996, Shriberg *et al.* 2001, Paul *et al.* 2005) and deficiencies in narrative and discourse abilities (e.g., Adams *et al.* 2002, Losh & Capps 2003, Volden 2004, Bellon-Harn & Harn 2006). They have difficulties in producing thematically integrated narratives independently (Losh & Capps 2003), in using the gist of the story when organising their narratives (Diehl *et al.* 2006) and in using clear cohesive links in expressions (Fine *et al.* 1994), and they have a tendency to change the topic into their preferred topic area (Attwood 1998, Quinn & Malone 2000). It has also been found that in structured conversation children with AS or HFA predominantly refer to their desires and make less references to their thoughts and beliefs when compared to children with SLI and normally developing children (Ziatas *et al.* 2003). Using applied discourse analysis, it has been shown that children with AS respond to questions and

comments, but the content of their responses is often pragmatically problematic both in general and emotionally focused conversation (Adams *et al.* 2002). The responses of children with AS did not fit well to the social or communicative context as compared to children with severe conduct disorder (CD). There were answers that reflected problems in knowing what other people know about the subject (shared information). Eales (1993) analysed conversation samples of individuals with autism and developmental receptive language disorder (RLD) using methods developed by Bishop and Adams (1989) in their study concerning conversation characteristics of children with language impairment. Eales found that impairment of relevant communicative intentions and stereotyped language use was more typical in individuals with autism compared to those with RLD. These disordered communicative areas of individuals with autism were connected to the difficulties found earlier by Bishop and Adams (1989) in children with semantic-pragmatic disorder (SPD).

Even if pragmatic difficulties are recognised to be one salient feature in AS and HFA, more studies are needed to explore children's pragmatic difficulties in order to understand better the nature and developmental factors of these difficulties. At the moment, most of the studies have been made with adults and there are no studies that compare pragmatic language comprehension between children with AS/HFA of varying ages. Studies concerning the ability to interpret pragmatic meaning or utilise contextual information in language use in individuals with AS or HFA are listed in Table 2.

Table 2. Previous studies about pragmatic language in individuals with Asperger syndrome or high-functioning autism.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
Eales, 1993	To assess what types of pragmatic impairments are typical in autism and in developmental receptive language disorder.	21- to 26-year-old adults with childhood diagnosis of autism, $n = 15$. 21- to 28-year-old adults with severe developmental receptive language disorder, $n = 17$.	Audiotaped conversation samples were analysed using the categorisation system developed by Bishop and Adams (1989).	Individuals with autism had greater pragmatic impairments that were not explicable by verbal skills. Pragmatic impairments were mostly caused by difficulties in forming contextually relevant communicative intentions. There was a connection between an ability to form relevant communicative intentions and reciprocal social behaviour.
Happé, 1993	To test how relevance theory works when studying comprehension of intentions in individuals with autism.	Individuals with autism were divided into 3 groups according to their performance in theory of mind tasks: 1) Failed in first-order false belief tasks (no-ToM group), age from 10 to 28 years, $n = 6$. 2) Passed only first-order false belief tasks (1st-ToM group), age from 9 to 25 years, $n = 6$. 3) Passed also second-order false belief tasks (2nd-ToM group), age from 11 to 25 years, $n = 6$. Control group of individuals with moderate learning difficulties, age from 12 to 38 years, $n = 14$.	Experiment 1: Task material contained similes, metaphors and synonyms. Subjects were asked to choose a word from a list in order to finish a sentence. Experiment 2: Stories were read to the subjects and they were asked questions concerning ironic and metaphorical utterances.	Experiment 1: In metaphor tasks the No-ToM group performed weaker than 1st-ToM, 2nd-ToM and control group. This fulfilled the predictions made by relevance theory that representation of intentions is necessary for understanding of metaphors. Experiment 2: The No-ToM group performed less well than other groups in metaphor tasks. In irony tasks both No-ToM and 1st-ToM groups performed less well than 2nd-ToM group and control group. Results supported the expectation that second-order metarepresentation is necessary for comprehension of irony.
Jolliffe & Baron-Cohen, 1999a	An ability to interpret nonliteral statements in adults with AS and HFA.	19- to 46-year-old adults with HFA, $n = 17$. 18- to 49-year-old adults with AS, $n = 17$. 18- to 49-year-old healthy adults, $n = 17$.	The participants were presented Happé's Strange Stories Test that consisted of 6 physical control stories and 18 mental stories which targeted the understanding of double bluff, figure of speech, joke, lie, misunderstanding, persuasion, pretending, sarcasm, and white lie.	Groups did not differ in understanding of physical control stories but a difference was found in mental stories. Answers of individuals with AS or HFA tended to concentrate on utterances in isolation.

Table 2. Continued.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
Jolliffe & Baron-Cohen, 1999b	An ability to make contextually meaningful connections between linguistic information (local coherence) in adults with HFA and AS.	19- to 46-year-old adults with HFA, <i>n</i> = 17. 18- to 49-year-old adults with AS, <i>n</i> = 17. 18- to 49-year-old healthy adults, <i>n</i> = 17.	<p>Study 1: Participants were presented sentences that involved homographs with a rare pronunciation and homographs with a common pronunciation.</p> <p>Study 2: Participants were presented pairs of sentences and a statement, which was presented as a question along with three answer choices.</p> <p>Study 3: Using a tape recorder, the following sentences were presented to participants: lexically ambiguous sentences with a rare interpretation, lexically ambiguous sentences with a common interpretation, syntactically ambiguous sentences with a rare interpretation and syntactically ambiguous sentences with a common interpretation.</p>	<p>Study 1: Compared to the control group, individuals in HFA and AS groups were less likely to use sentence context spontaneously when providing a context appropriate pronunciation of a homograph.</p> <p>Study 2: Compared to the control group, individuals in HFA and AS groups were less likely to select the most coherent inference from given alternatives.</p> <p>Study 3: Compared to control group, individuals in HFA and AS groups demonstrated difficulties in context utilisation when interpreting lexically and syntactically ambiguous sentences with rare interpretation.</p>
Jolliffe & Baron-Cohen, 2000	Integration of information in linguistic processing in adults with AS or HFA.	19- to 46-year-old adults with HFA, <i>n</i> = 17. 18- to 49-year-old adults with AS, <i>n</i> = 17. 18- to 49-year-old healthy adults, <i>n</i> = 17.	<p>Experiment 1: Participants had to arrange sentences coherently in order to make a sensible story.</p> <p>Experiment 2: Participants were presented short stories. After that three questions (global inference, desire and comprehension) and a memory task were presented.</p>	<p>Experiment 1: Compared to control group, HFA and AS groups were less able to arrange sentences in a sensible way in order to make a coherent story.</p> <p>Experiment 2: Groups differed on the global inference questions suggesting that individuals with AS and HFA have difficulties in making context-relevant inferences.</p>

Table 2. Continued.

Author(s), year of publication	Theme of research	Participants	Methods	Main results concerning pragmatic comprehension
Dennis <i>et al.</i> , 2001	Inferential language ability in high-functioning children with ASD.	Children diagnosed either AS or HFA, mean age 9;9 years ($SD = 1.6$), $n = 8$. Control groups: 3 groups of children age-matched with children with AS/HFA. Every control group did 1–2 parts of tasks so control data came from different children.	Children were given noninferential and inferential tasks. Noninferential tasks concerned vocabulary and ambiguity. Inferential tasks concerned mental state verbs (presupposition and implication), scripts, metaphors and speech acts.	Children with AS/HFA group were less able to make inferences involving implication, scripts, metaphors and speech acts. Differences between groups increased in relation to the amount of inference and intentionality of the tasks.
Adams <i>et al.</i> , 2002	Pragmatic difficulties in language use in children and adolescents with AS.	11- to 19-year-old boys with AS, $n = 19$. Boys with conduct disorder (CD) who were age-matched to subjects with AS, $n = 19$.	Using discourse analysis, two types of conversation samples were analysed. These types differed from each other on the basis of emotional content.	The groups showed similar rates of overall responsiveness, but boys with AS showed more pragmatically problematic responses than boys with CD in both types of conversation samples. These problematic responses were suggested to be caused by difficulties in understanding emotional concepts needed in conversation.
Norbury & Bishop, 2002	Inferential processing and story recall in children with specific language impairment (SLI), pragmatic language impairment (PLI) and HFA.	Children with SLI, mean age 9;3 years ($SD = 0.95$), $n = 16$. Children with PLI, mean age 8;8 years ($SD = 0.99$), $n = 24$. Children with HFA, mean age 8;9 years ($SD = 1.31$), $n = 10$. Control group of typically developing children, mean age 8;5 years ($SD = 0.99$), $n = 18$.	Story comprehension tasks were presented to children and they were asked questions about the literal content of the story and non-literal questions that required text-connecting and gap-filling inferences. After that the children were asked to recall the final story.	Control group performed better than clinical groups in these comprehension tasks, but the results of clinical groups were quite similar. However, children with HFA gave more answers that were irrelevant to the story context. Groups did not differ in story recall, but there was a connection between story recall and comprehension, suggesting that good comprehension aided story recall.
Martin & McDonald, 2004	Causes of non-literal language problems in individuals with AS.	18- to 24-year-old adults with AS, $n = 14$. 18- to 33-year-old control adults (first year psychology students), $n = 24$.	Cognitive tasks which targeted weak central coherence processes, social inference or ToM and the ability to interpret ironic remarks.	Weak central coherence was not connected with the ability to interpret irony or ability to perform in ToM tasks. In contrast, second-order ToM reasoning was connected with the ability to interpret irony.

Note. AS = Asperger syndrome; CD = conduct disorder; HFA = high-functioning autism; PLI = pragmatic language impairment; SLI = specific language impairment; ToM = Theory of mind.

2.3.3 Explanations for pragmatic deficits in Asperger syndrome and high-functioning autism

Even if there is a consensus that difficulties in making contextually relevant inferences and using contextually relevant utterances belong to AS and HFA, researchers do not entirely agree on the causes of these difficulties. One of the most commonly suggested explanations for the comprehension difficulties of individuals with AS or HFA is weak central coherence, which means that they have a tendency to interpret utterances in isolation and problems in integrating information from many sources (e.g., Jolliffe & Baron-Cohen 1999a, 1999b, 2000, Norbury & Bishop 2002, Noens & van Berckelaer-Onnes 2005). In contrast, according to Martin and McDonald (2004), weak central coherence cannot explain the pragmatic comprehension problems. Their study indicated no relation between a local-information processing bias and the comprehension of ironic meanings in young adults with AS. However, a connection was found between ToM ability and ironic understanding, suggesting that the ability to understand other's belief states is essential to pragmatic comprehension. Therefore, Martin and McDonald argue that lacking ToM causes pragmatic comprehension difficulties. This opinion is supported by many other studies (Happé 1993, 1995, Bara *et al.* 1999, Beaumont & Newcombe 2006).

Weak central coherence and lacking ToM are the most widely used explanations for pragmatic language difficulties in PDD. However, some other explanations are also argued to be behind these difficulties. It has been suggested that executive function deficits may underlie symptoms of PDD (Ozonoff & Griffith 2000, Bíró & Russell 2001). Executive dysfunction of individuals with AS or HFA affects planning and mental flexibility, and, therefore, also affects pragmatic expression and comprehension that demand a sophisticated ability to use and interpret language in a flexible way according to the situation (Hill 2004) and to direct one's attention to relevant factors (Papp 2006). Especially in earlier studies, it has been suggested that children with autism might be overselective to one stimulus, which can inhibit accessing other stimuli (Lovaas & Schreibman 1971, Gersten 1980, Koegel *et al.* 1982). These studies about stimulus overselectivity were often done with children with autism and intellectual disability. Because it has been found that stimulus overselectivity is connected with general intellectual abilities, the effect of stimulus overselectivity in individuals with AS and HFA is questioned (Gersten 1980, Matthews *et al.* 2001).

It may also be that there is not just one factor underlying pragmatic difficulties in AS and HFA but that they are caused by a generalised disorder of complex information processing, since it has been found that basic language abilities differ a lot from more complex and interpretative language abilities in individuals with HFA (Minschew *et al.* 1995). Finally, it might be the case that there is no possibility to identify an isolated cause for pragmatic difficulties. According to an emergent account of pragmatics, difficulties are caused by an imbalance or combination of linguistic, cognitive and sensory-motor factors rather than one underlying factor (Perkins 2002, 2005, Damico & Nelson 2005).

2.4 Cognitive approach to assess pragmatic language comprehension

In pragmatic studies, definitions of pragmatics and study frameworks vary quite widely, which may be due to the multidisciplinary nature of pragmatics. In linguistic studies, it has been common to use theories of pragmatics, such as speech act theory (Austin 1962, Searle 1975), Grice's maxims (Grice 1975) and relevance theory (Sperber & Wilson 1995). In contrast, most of the clinical studies of deviant language have not studied pragmatics from some specific framework, but have concentrated on a specific pragmatic function, such as gestures and eye gaze, or focused on studying connections between a specific pragmatic task (e.g., comprehension of irony) and a cognitive function (e.g., ToM).

However, there are also studies concerning disordered language that have used cognitively oriented pragmatic theories as a framework. These studies have shown that cognitively oriented theories can help to understand the nature of pragmatic deficits and find factors behind communication failures (e.g., Surian *et al.* 1996, Leinonen & Kerbel 1999, Leinonen *et al.* 2003). Because theories try to explain how expression and recognition of intentions happens in natural communication situations, they offer fruitful background when seeking abnormalities in language use and comprehension. In this study, the framework of relevance theory is used because it has already been successfully utilised in studies concerning disordered pragmatic language (Happé 1993, Leinonen & Kerbel 1999, Leinonen *et al.* 2003).

2.4.1 Definition and assumptions of relevance theory

Relevance theory (Sperber & Wilson 1995) is a cognitive account of pragmatic understanding and it belongs to the theories of inferential pragmatics, since it aims

to explain how the hearer interprets speaker's meaning on the basis of contextual factors. It is based on Grice's (1969, 1975) central claim that the expression and recognition of intentions are essential features of most human communication, and the assumption that utterances automatically create expectations which guide the hearer towards the meaning of the speaker.

In order to understand the speaker's intention, the hearer has to utilise the information communicated directly and indirectly, but also the information that is not communicated at all, such as information about the speaker's culture (Sperber & Wilson 1997). According to relevance theory, utterances usually have many possible interpretations which are compatible with the linguistic information, but these interpretations are not equally accessible in a given situation. This means that all possible interpretations are not equally likely to come to a hearer's mind. According to relevance theory, human communication is driven by *search for relevance* (Sperber & Wilson 1982, 1995, Wilson & Sperber 1993, 2002, 2004). When processing language, people utilise relevant contextual information when they are deriving the meaning of an utterance. People automatically pay attention to information that is relevant to them, and therefore they do not try to process all available information. This way, people can use maximal cognitive effect for minimal processing effort. The ability to be automatically geared towards relevant information is known as the cognitive principle of relevance (Sperber & Wilson 1995, 2002, Wilson 2000, Wilson & Sperber 2004). However, even if people are automatically geared towards relevant information, in order to achieve interpretation of an utterance, information processing also demands attention, memory and reasoning (Wilson & Sperber 1988).

Because the search for relevance is a basic feature of human cognition, people aim to use relevant utterances only. Every expressed utterance should be relevant enough to be worth processing. This means that every expression conveys a presumption of its optimal relevance (communicative principle of relevance). This optimal relevance means that an utterance is relevant enough for the hearer to make it worth processing and clear enough so that the speaker can manifest his/her intention. Processing effort is seen as a negative factor; therefore, the greater the processing effort, the lower the relevance of the utterance. The communicative principle of relevance activates the relevance-theoretic comprehension procedure, which means that the hearer follows a path of least processing effort when accessing contextual information and stops when interpretation meets his/her expectations. (Sperber & Wilson 1995, Wilson 2000, Wilson & Sperber 2004.)

2.4.2 Pragmatic subtasks in comprehension process

When comprehending utterances, many contextual subtasks need to be processed because language is often indeterminate. These subtasks are hierarchical in terms of contextual complexity (Sperber & Wilson 1995, Leinonen *et al.* 2003, Ryder & Leinonen 2003). However, when processing the meaning of an utterance, these subtasks are not sequentially ordered, but processing of different contextual subtasks happens in parallel (Wilson & Sperber 2004). Here, the aim is not to attempt to explain the whole comprehension system; the focus is on those contextual subtasks which are included in this study and which are suggested to be central when contextual meaning of an utterance is processed (e.g., Hudson & Slackman 1990, Sperber & Wilson 1995, Marmaridou 2000, Leinonen *et al.* 2003, Ryder & Leinonen 2003, Wilson & Sperber 2004).

In terms of contextual demands *reference assignment* is the easiest task because the hearer just has to find out the object of reference from the context, and therefore no processing beyond the given information is needed. However, even if this is an easy task, utilisation of context is necessary because, for example, pronouns without context are meaningless (Leinonen *et al.* 2000). In the process of *enrichment* a non-propositional form of an utterance is expanded into a propositional form by enriching empty slots of the utterance using contextual information. For example, before children start to cross a busy road their mother says to them: “Remember to watch out”; the children can enrich the utterance into something like “when you, children, are starting to cross the road, remember to watch out that there are no cars coming”. Without such expansion it is not possible to understand what the children have to watch out for. Reference assignment and enrichment are directed by the cognitive principle of relevance so that the hearer chooses the first contextually relevant interpretation. Processing reference assignment and enrichment helps in working out an utterance’s explicature (propositional form), which means that the hearer can resolve the semantic meaning of an expression (Sperber & Wilson 1995).

In everyday communication, indirect utterances are often used and in these cases understanding of the utterance’s propositional form is not enough in order to understand the intended meaning. Thus, extra processing is needed in order to recover *implicature* (implicated meaning) of an utterance. This kind of utterance contains meaning(s) which have to be worked out by retrieving and integrating contextual information, such as world knowledge, physical context and prior verbal information, via deduction following the cognitive principle of relevance

(Sperber & Wilson 1995). For example, when a man is mowing grass with a lawn mower and a woman says to him “There are flowers growing in the middle of the grass so remember to be careful”, the man should know that the intended meaning of the woman is that he must not mow down the flowers with the lawn mower. This meaning is possible to understand by combining world knowledge (women usually like flowers and if you drive across flowers with a lawn mower, they will be mowed down) with physical and verbal context (“there are flowers in the middle of the grass” and “remember to be careful”). When comparing resolving explicature and implicature, resolving implicature is suggested to demand more cognitive processing (Leinonen *et al.* 2003, Ryder & Leinonen 2003, Ryder *et al.* in press). However, all implicatures are not equal, but the strength of implicatures may vary between utterances depending on inferential aspect and familiarity of an utterance (Wilson 2000, Wilson & Sperber 2002).

It is generally agreed that when a communicative situation is familiar to a child, the inferential load of the utterance is smaller because the child has the possibility of using internalised *routines* in inferencing (Strohner & Nelson 1974, Hudson & Slackman 1990, Gillam & Bedore 2000). Thus, when a child gets enough experiences about the use of the same utterance in the same kind of situation, he/she does not need to derive the meaning of an utterance using contextual processing, but understanding happens routinely (Wilson & Sperber 2002). This kind of routine situation might be, for instance, when a mother calls her children inside to eat repeatedly in everyday life by saying “Dinner will be ready soon”.

When the target is to understand the *feelings* of another person there is also need for contextual processing by retrieving and connecting information from different sources. According to Sperber and Wilson (2002) the universal cognitive tendency to seek relevance makes it possible to predict mental states in others (i.e., mind-reading ability) since the speaker can predict which stimulus is likely to attract the hearer’s attention, which background information the hearer utilises when processing the stimulus, and which inferences the hearer is likely to draw. According to Wilson (2000), mind-reading ability feeds the comprehension process because, for instance, information about the speaker’s mood affects the interpretation of his/her utterance.

2.4.3 Experimental studies utilising relevance theory as a study framework

Recent experimental studies have tested and confirmed key consequences of relevance theory, such as cognitive and communicative principles of relevance and subtasks in the comprehension process (Van der Henst *et al.* 2002, Leinonen *et al.* 2003, Ryder & Leinonen 2003, Van der Henst & Sperber 2004). Relevance theory is used in different kind of pragmatic language studies, for example, in the area of normal pragmatic language development (Bezuidenhout & Sroda 1998, Foster-Cohen 2000, Ryder & Leinonen 2003), second language teaching (Wolf 1999, Foster-Cohen 2004, Zegarac 2004), pragmatic disabilities in children with SLI and PLI (Leinonen & Kerbel 1999, Leinonen *et al.* 2003, Ryder *et al.* in press) and in individuals with autism (Happé 1993).

In the study by Happé (1993), the ToM levels of individuals with autism were compared with the levels of understanding similes, metaphors and irony. According to relevance theory, similes can be understood at a purely literal level, while metaphors require some understanding of intentions, whereas irony requires understanding of second-order metarepresentation. As suggested by relevance theory, the results showed that the degree of metarepresentation ability had an association with the degree of comprehension of figurative language. The deficits of individuals with autism were restricted to inferential communication, whereas the ability to use code communication was relatively normal. Later Surian *et al.* (1996) confirmed this result by comparing children with normal development, children with SLI and children with HFA in tasks demanding the detection of utterances that violated conversational maxims. The results showed that children with HFA had difficulties in detecting pragmatic violations, but not with control tasks demanding the detection of grammatical violations. Performance in pragmatic tasks was connected with false belief reasoning.

The studies concerning pragmatic language acquisition and/or impairments have shown that pragmatic language abilities are closely connected with cognitive (dys)functioning, such as inference (Leinonen *et al.* 2003) and ToM (Happé 1993, Papp 2006). Additionally, the study of Bezuidenhout and Sroda (1998) confirmed that world knowledge and experiences occupy a central role when interpreting the meanings of utterances.

3 Aims of the study

The purpose of this study was to find out how normally developing children and children with AS or HFA answer contextually demanding questions and how they explain their initially correct answers. The specific aims were as follows:

1. To compare how 3- to 9-year-old children perform when answering contextually demanding questions and explaining their answers (Studies I and II).
2. To recognise the content of incorrect answers and explanations in normally developing children (Study II).
3. To analyse whether the ability to answer contextually demanding questions and explain correct answers differs between two age groups of children with AS/HFA (7–9 years and 10–12 years) and normally developing control children (7–9 years) (Study III).
4. To compare the contents of incorrect answers and explanations between two age groups of children with AS/HFA and control children (Study IV).
5. To describe how relevance theory can explain pragmatic difficulties of children with AS/HFA (Studies III and IV).

4 Method

4.1 Participants

4.1.1 *Participants in the data of normally developing children*

The normally developing children of this study were Finnish-speaking and lived in the city of Oulu in Finland. The age range of the children was from 3 to 9 years. The children came from eight day nurseries and two mainstream schools. Parents of 248 children gave permission for the study. Only children with normal development were accepted. This was verified by asking the children's parents to fill in a preliminary data sheet, where questions were asked about their child's developmental history, mostly concerning their language development (Appendix 2). The child was excluded if the parents reported any developmental problems.

In addition to the preliminary data sheet, parents of school-aged children (7-year-olds and older) were asked to complete the High-Functioning Autism Spectrum Screening Questionnaire (ASSQ, Ehlers *et al.* 1999) to ensure that there were no children with autism spectrum disorder (ASD) in the group. The ASSQ sheet that was used in this study was first translated from Swedish into Finnish by two clinical psychologists and then backtranslated into Swedish by an official Swedish translator. After comparison the final Finnish version was completed by experienced specialists in the PDD field. If parents of a school-aged child marked more than 7 points in the ASSQ, the child was excluded from this research. If parents gave a child 5–7 points in the ASSQ, the child's teacher was also asked to fill out the ASSQ forms, and if the teacher's points exceeded 5, the child was excluded. These criteria were based on the studies of Ehlers and Gillberg (1993), Ehlers *et al.* (1999), and Mattila *et al.* (2001), and were agreed by two child psychiatrists, Professor Irma Moilanen and docent Hanna Ebeling, and paediatrician, Marja-Leena Mattila. Parents of the younger children did not complete the ASSQ, because there are no normative data available for children younger than 7 years, and because some traits in ASSQ are acceptable in younger children. Therefore, younger children's normal development and behaviour was confirmed by their nursery school teachers. On the grounds of the preliminary data sheet and ASSQ, 35 children were excluded from the study.

After collecting the preliminary data, 213 children participated in this study. In addition to pragmatic material, the Boston Naming Test (Kaplan *et al.* 1983, Laine *et al.* 1997) and the auditory association subtest of the Illinois Test of

Psycholinguistic Abilities (ITPA, Kirk *et al.* 1968, Blåfield & Kuusinen 1974) were administered to the participants to ensure normal language development. The Boston Naming Test is one of the best-known measures of expressive vocabulary. It consists of 60 pictures that are shown in difficulty order. The test has been translated from English into Finnish, but for children it is only standardised as suggestive (Laine *et al.* 1993, 1997). The auditory association is a subtest of ITPA which is standardised and translated from English into Finnish (Blåfield & Kuusinen 1974). The subtest contains verbal analogies (e.g., Grass is green, sugar is... white) and it is meant to assess the child's verbal reasoning abilities. Although the subtest is old, it is still much used in the assessment of the language abilities of Finnish children.

In the research situation three children (aged 3, 4 and 7) demonstrated motivation or language problems and were excluded from the data because of that. All in all, the data of 210 children were analysed (Table 3).

Table 3. Characteristics of the normally developing children as a function of age group.

	3 yrs	4 yrs	5 yrs	6 yrs	7 yrs	8 yrs	9 yrs
Number	30	30	30	30	30	29	31
Boys/girls	15/15	17/13	9/21	10/20	11/19	7/22	18/13
Age							
<i>M</i>	3;5	4;6	5;5	6;4	7;5	8;7	9;6
<i>SD</i>	0.40	0.35	0.35	0.36	0.30	0.35	0.33
Naming ^a							
<i>M</i>	17.8	29.1	31.7	36.3	38.5	42.7	45.7
<i>SD</i>	6.90	6.99	5.01	5.82	7.24	7.15	6.53
Auditory association ^b							
<i>M</i>	6.2	13.6	17.7	22.6	25.9	31.5	33.0
<i>SD</i>	5.40	6.76	6.43	6.20	6.53	6.58	5.77

^aThe Boston Naming Test (max 60). ^bSubtest of ITPA (max 42).

4.1.2 Participants in the data of children with Asperger syndrome or high-functioning autism

A total of 42 children diagnosed or suspected with AS or HFA living in the area of Northern Ostrobothnia Hospital District in Finland took part in this study. They were drawn from three different routes. 1) 25 children with a clinical diagnosis of AS and 5 children diagnosed as having "traits of AS" were invited from the patient

records of Oulu University Hospital. The diagnoses had been set based on ICD-10 criteria with the exception that development in the first three years of life had not been taken into consideration, and differential diagnosis between AS and HFA had thus not been made. The diagnosis traits of AS had been set when the child had features of HFA, AS or pervasive developmental disorder not otherwise specified (PDD-NOS), but the final ICD-10 diagnosis was not complete. 2) With parents' suspicion of AS, 3 siblings of outpatient children were also included, and 3) 6 children diagnosed with AS and 3 children diagnosed with HFA by using ICD-10 criteria in an epidemiological study (Mattila *et al.* 2007). All these children had Finnish as their first language and full-scale IQ (Wechsler scale) in or above the normal range.

In this study, the children's symptom history was collected by using the Autism Diagnostic Interview-Revised (ADI-R, Lord *et al.* 1995) and the children's communication and behaviour skills were observed by using the Autism Diagnostic Observation Schedule (ADOS, Lord *et al.* 2000) by paediatrician Marja-Leena Mattila or psychologist Katja Jussila, both trained in the use of the ADI-R and the ADOS. Before investigations, the ADI-R was first translated into Finnish by two clinical psychologists and then backtranslated into English by an official English translator. The final Finnish version was completed by a group of professionals in the PDD field. The ADOS was translated into Finnish by an official English translator and then checked by the paediatrician. After careful investigations the diagnoses were (re)defined by the paediatrician (M-LM) or the psychologist (KJ), consulting other specialists in the cases where second opinion was needed, by using ICD-10 criteria based on all the available information. This time development during the first three years of life was also taken into account in order to differentiate children with AS and HFA.

In these evaluations 27 children met the ICD-10 diagnosis for AS and 13 children met the diagnosis for HFA. Two children did not meet any diagnostic criteria for PDD (both outpatients' siblings with parents' suspicion of AS) and they were excluded from this study. In the language test situation one child diagnosed with HFA had great cooperation difficulties and he was excluded from the study. Finally, there were 39 children (27 children with AS and 12 children with HFA) whose test results were analysed in this study. Because several studies have recently shown that the distinction between AS and HFA is not clear (e.g., Mayes & Calhoun 2001, Hippler & Klicpera 2003, Howlin 2003, Frith 2004), the two diagnostic groups were combined in order to maximise the sample size. This also made it possible to divide the children into two groups according to their ages,

7- to 9-year-olds ($n = 16$) and 10- to 12-year-olds ($n = 23$). These groups were named the younger AS/HFA group and the older AS/HFA group.

By using three subtests (comprehension of instructions, narrative memory and comprehension of sentence structure) of the Developmental Neuropsychological Assessment (NEPSY, Korkman *et al.* 1997) it was verified that difficulties in linguistic understanding or auditory memory problems did not affect the performance of the AS/HFA groups. NEPSY is a neuropsychological assessment tool for 3- to 12-year-old children used to investigate children's neurocognitive development. It is based on Luria's neuropsychological investigation method (Christensen 1975). The comprehension of instructions subtest evaluates linguistic comprehension and auditory working memory, the narrative memory subtest measures verbal short-term memory, but also verbal comprehension and expression, and the comprehension of sentence structure subtest evaluates knowledge of syntactic structures. Standardisation data of NEPSY ($n = 400$) were collected in 1993 and 1994, and the data follow the stratification of the Finnish population structure (Korkman 2000). Standard values of NEPSY were used when it was ensured that the children with AS/HFA did not have linguistic comprehension difficulties. Additionally, the children's normal language development was verified by the Boston Naming Test and the auditory association subtest of ITPA (Table 4).

The group of control children consisted of 23 healthy 7- to 9-year-old children from two mainstream schools in Oulu, Finland. These control children were randomly selected from the group of 90 normally developing children aged 7 to 9 years who participated in the study of normal pragmatic development (see chapter 4.1.1, pp. 51–52). Random selection was done using the command "Random sample of cases" of the SPSS 12.0.1 for Windows software. The age range of the control group was chosen to be equal with the younger AS/HFA group. This way it was verified that the control children did not have more experiences than the children with AS/HFA, which could have affected their answers to the pragmatic questions. Because normally developing 8- and 9-year-old children performed near the ceiling level when answering pragmatic questions in this study, older control children were not used.

Table 4. Characteristics of the younger AS/HFA group, older AS/HFA group and control group.

	Younger AS/HFA group	Older AS/HFA group	Control group
Number	16	23	23
Boys/girls	12/4	16/7	15/8
Age			
<i>M</i>	8;6	11;2	8;7
<i>SD</i>	0.73	0.56	0.85
Naming ^a			
<i>M</i>	46.9	52.2	45.7
<i>SD</i>	5.29	6.06	6.23
Auditory association ^b			
<i>M</i>	31.1	37.3	32.9
<i>SD</i>	7.42	2.88	6.44
Comprehension of instructions ^c			
<i>M</i>	11.4	11.8	-
<i>SD</i>	2.63	2.41	-
Narrative memory ^c			
<i>M</i>	9.6	9.3	-
<i>SD</i>	1.82	3.34	-
Comprehension of sentence structure ^c			
<i>M</i>	10.6	11.7	-
<i>SD</i>	4.06	1.89	-
VIQ			
<i>M</i>	106.3	114.2	-
<i>SD</i>	11.2	20.8	-
PIQ			
<i>M</i>	100.2	104.6	-
<i>SD</i>	11.0	18.2	-

^aThe Boston Naming Test (max 60). ^bSubtest of ITPA (max 42). ^cSubtest of NEPSY. NEPSY's standard scores: 9–11 normal range, 7–8 low middle-level, 12–13 good middle-level.

4.1.3 Ethical consideration

Permission to study normally developing children in eight day nurseries was first asked from the Head of the Day-Care and Family Work Unit of the City of Oulu. Willingness to participate in this study was then asked individually from the head of each day nursery. After that, teachers of the day nurseries gave written information and consent sheets to parents of healthy children. Parents then returned the written consent to their child's day nursery. In the case of normally

developing school-aged children permission was asked from the heads of two primary schools in Oulu. After that, teachers handed out written information and consent sheets to the children who gave them to their parents, after which the children returned the written consent to their own teachers.

Children with AS/HFA were investigated as part of the ongoing multidisciplinary research project (A Genetic Study of Asperger Syndrome in Northern Finland) at the Clinic of Child Psychiatry in Oulu University Hospital. The Ethical Committee of Northern Ostrobothnia Hospital District approved the study concerning pragmatic comprehension abilities as part of this multidisciplinary research project. The participation was on voluntary basis.

4.2 Material

The methodology in this study was based on relevance theory and the tasks were constructed to investigate pragmatic comprehension abilities as predicted by relevance theory (Sperber & Wilson 1995). The test material used was designed for this study. However, earlier studies (Happé 1993, Letts & Leinonen 2001, Ryder & Leinonen 2003) were utilised when the questions were constructed. Questions targeted pragmatic processing with varying contextual complexity as suggested by relevance theory. Test questions and scenarios were planned to measure context utilisation of Finnish children and thus some of the questions may be culture-bound (e.g., one question demanded knowledge about ‘candy day’). The given context consisted of pictures, short scenarios and a story that was presented in short sections to minimise memory requirements. Questions were kept grammatically as simple as possible. The picture set was designed by the researcher and drawn by Raine Loukusa. The pictures were then scanned into a computer and coloured using Adobe Photoshop 7.0. Prior to the actual study, the material was tested in two pilot studies with a small group of normally developing children. The material was revised on the basis of these pilot studies (Figure 2).

After the material was revised, the children were tested. The children’s answers to every question were analysed independently in order to check that the questions measured what they were meant to measure. For these analyses a test sheet was generated with Microsoft Excel 2000 by Lauri Anttonen. This test sheet automatically calculated the scores of each child and summarised the classifications of answers and explanations. Every child had his/her own sheet in order to obtain a thorough analysis of each child’s performance. This sheet removed the possibility of calculation errors and made it possible to analyse the

data in a flexible way. Individual and group analyses made it possible to see the developmental validity of questions. In these analyses it was noticed that there were three questions (one enrichment, one implicature and one feeling question) that many children understood in a different way than was expected. Because these questions did not measure what was planned, they were excluded from analyses. In these preliminary analyses it was also noticed that normally developing 8- and 9-year-old children performed near the ceiling level when answering questions. Therefore, it was not reasonable to test older normally developing children in this study.

Finally, the material contained 41 questions: 9 reference assignment, 9 enrichment, 9 implicature, 9 routine, and 5 feeling questions. Reference assignment questions required the child to find an object verbally referred to. These questions were the easiest in terms of contextual demands because the child just had to find the object of reference from the given verbal and/or pictorial context, and no processing beyond the given information was therefore needed. To answer enrichment questions the child had to enrich incomplete semantic information on the basis of the given verbal and/or pictorial context and his/her world knowledge.

The questions targeting the recovery of implicature required the child to connect his/her world knowledge with the given visual and/or verbal context in order to derive the intended meaning. The routine questions required the children to process an answer concerning a familiar everyday context, which may lead to automatic accessing of routine answers. The only difference between the implicature and the routine questions was the amount of contextual familiarity. Implicature questions had familiar themes, such as getting wet when it rains, whereas routine questions had a context which could be considered part of everyday routines (very familiar context), such as calling children to dinner, so it was possible to follow a familiar pattern of answering. Feeling questions targeted the feelings of someone in the scenario. Also in the case of feeling questions the child had to connect his/her world knowledge with the information given (e.g., knowing that it is embarrassing to put your shirt on the wrong way without noticing). Thus, feeling questions involved processing of implicature as well. Examples of different question types are presented in the following (see more examples of different question types and examples of children's answers in Appendices of Studies I, II, III and IV):

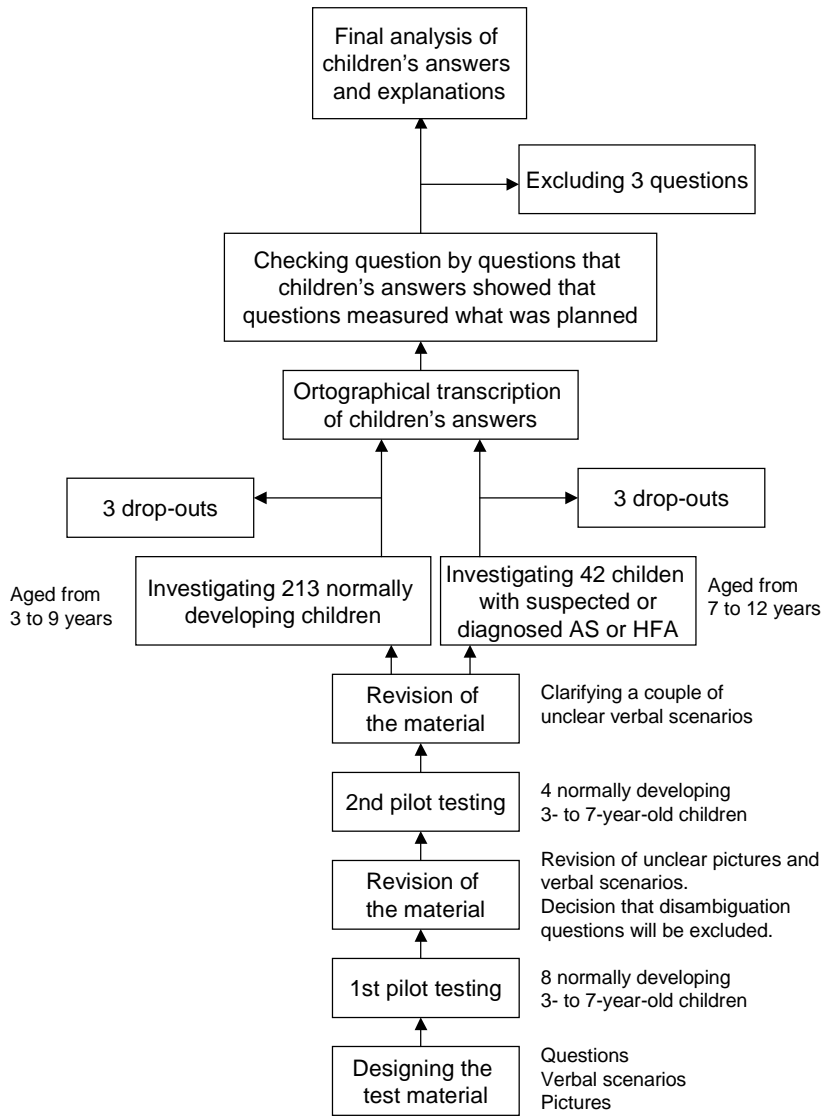


Fig. 2. The development of the test material.

Reference assignment question

Scenario: A woman comes home after work. The woman's dog is waiting at home. It has been alone for the whole day and it has to go for a wee. The woman takes the dog out.

Question: *Who has been alone for the whole day?*

Given context (verbal): The woman's dog is waiting at home. It has been alone for the whole day and it has to go for a wee.

Knowledge: It refers to the dog mentioned in the earlier sentence.

Answer: The dog.

Enrichment question

Picture and scenario: The children are waking up.

Question: *What time might it be?*

Given context: The children are waking up. The picture shows that the children are getting out of their beds. They have pushed their covers off. They have pyjamas on.

Knowledge: When people have pyjamas on and they are waking up, it is usually morning.

Conclusion: It is morning. On the basis of earlier verbal context (children are waking up) and/or pictorial information (children are getting out of their beds), the question needs to be enriched into something like "What *time of the day* might it be in the picture?" Without the expansion it is difficult to understand what is meant by *time* in the utterance.

Implicature question

Picture and scenario: Here is a picture of a village on a rainy day. There are many cars driving on the road. A boy is walking over a zebra crossing. (Point to the boy.)

Question: *Why is the boy holding a book over his head?*

Given context (verbal & picture): It is raining. The boy has not got a raincoat.

Knowledge: People do not want to get wet when it rains. Holding something large enough over your head can stop you from getting wet.

Conclusion: The boy has a book over his head so he does not get wet.

An answer to implicature questions can be derived from the context. Answering requires linking of given context and general knowledge via inference.

Routine question

Picture and scenario: Children are playing in the garden. A boy has a ball in his hand. The mother calls out to the children: "Dinner will be ready soon."

Question: *What does the mother mean?*

Given context (verbal & picture): The children are playing in the garden. The mother comes out to say that dinner will be ready soon.

Knowledge: *Ready soon* means that it must soon be eaten.

Conclusion: The children have to stop playing and go inside to eat.

The scenarios for routine questions are probably very familiar to the children, and they are likely to have many experiences of such situations (i.e., being told dinner is nearly ready). Therefore, it may be that children can use a familiar schema when answering routine questions: an adult says food is almost ready → children have to go inside to get ready to eat.

Feeling question

Scenario: A boy has put his shirt on inside out by mistake. Classmates laugh at him at school.

Question: *How does the boy feel?*

Given context: (verbal, sentences read aloud to child)

Knowledge: If a shirt is put on inside out, it looks funny. Having classmates laugh at you when you have not made a joke can be embarrassing/knowing that you have put your shirt on the wrong way without noticing it is embarrassing/it is not nice to be laughed at in that way.

Conclusion: The boy might feel bad/embarrassed.

In addition to these questions, the children were asked to give *explanations* for their correct answers to routine, implicature and feeling questions in order to see if they were aware of how they had derived answers from the context. The follow-up questions requiring explanations were in one of two forms depending on the question: "How do you know that?" or "Why do you think so?" (*know* was best suited for some questions, *think* was more appropriate for others). One of the implicature questions did not have a follow-up question. In that question, after hearing the whole story about an escaped dog who did not obey a woman, the children were asked what they thought would happen next in the story. In their answers the children often referred to an earlier part of the story, and a follow-up

question was therefore not reasonable. Thus, the material contained 22 questions (9 routine, 8 basic implicature, and 5 feeling questions) where a follow-up question was presented if a correct answer was given.

4.3 Procedure

Each participant was tested individually in a quiet room. Normally developing children aged from 3 to 6 years were tested in their day nurseries and children aged 7 to 9 years in their schools. Investigations of 3-, 7-, 8- and 9-year-old children were performed by the researcher, and those of children aged 4-, 5- and 6-year-olds by one of two students of logopedics (Sirpa Sakko or Kati Tauriainen). All children with AS/HFA were tested in Oulu University Hospital's outpatient clinic by the researcher. Test materials were presented on a table directly in front of the child. The children were told that the researcher would ask some questions about pictures and stories and they were asked to listen very carefully. The pragmatic comprehension material was always presented first, followed by the auditory association subtest of ITPA and finally by the Boston Naming Test. Children with AS/HFA were also tested by three subtests of NEPSY (comprehension of instructions, narrative memory and comprehension of sentence structure). This was done by psychologist Sanna Kuusikko in a different test situation during the same day.

4.4 Analysis

4.4.1 Correct/incorrect scoring

The data collection sessions were videotaped. A total of 249 children's answers were later orthographically transcribed by the researcher from the videotapes. The scoring was done from these transcriptions. It was determined whether the children's answers were correct (appropriate) or incorrect (inappropriate). Relevance theory was utilised when assessing whether an answer was appropriate or not, and answer possibilities were carefully listed beforehand.

4.4.2 Categorisation of errors

Incorrect answer and incorrect explanation categories

The children's incorrect answers and incorrect explanations were analysed in order to explore how the children used available contextual information. In normally developing children answers and explanations to questions that required deriving implicature, routine and feeling were categorised (Study II). In children with AS/HFA and their control children answers and explanations to questions that required deriving enrichment, implicature, routine and feeling were categorised (Study IV). The subcategories were modified on the basis of earlier studies by Letts and Leinonen (2001) and Ryder and Leinonen (2003). Some influence had also been taken from the study of Marinac and Ozanne (1999). Even though different question types were used in the analyses of correct answers, it did not make sense to analyse the incorrect answers and incorrect explanations in such a fine-grained way, as this would have yielded very small sample sizes because of the small number of incorrect/irrelevant answers per individual question type. Therefore, in order to maximise sample size, categorisation was made from the total sum of incorrect answers and explanations within each group. Subcategories were as follows (see examples of children's answers in Appendices of Studies II and IV):

Incorrect focus

The answer shows understanding of what is happening in the scenario, but fails to address the focus of the question accurately, so the answer remains inaccurate and cannot therefore be accepted as being correct. Although the child is not able to answer the question accurately, the answer does not show any utilisation of an irrelevant part of the context. Compared to the other categories, the incorrect answers classified into this category are closest to the correct answers.

Knowledge

The child gives general information or talks about his/her own experiences, which are in some way loosely semantically connected to the question, but do not fit into the particular context of the question. Therefore, the answer shows that the child has used world knowledge in an inadequate way without utilising specific contextual information relevant for this particular question.

Given information

The child uses the given pictorial or verbal information inappropriately. The answer refers to some aspect of the picture or the verbal scenario, but the aspect is not relevant to this particular question.

Don't know

The child answers, "I don't know".

Irrelevant

An answer does not contain anything that the researcher could connect with the context of the question.

Tautology

The child repeats the question or part of it.

Turn-taking

The child uses a routine phrase to answer. For example, when asking a why-question (Why do you think so?) the child answers simply "Because", and when asking a how-question (How do you know that?) the child answers "Like that". (This category is not included in the analysis of incorrect answers of children with AS/HFA (IV), because there were no answers fitting into the turn-taking category).

No answer

The child gives no reply and does not take his/her turn.

Other

The child's answer does not fit into any of the categories above.

Topic drifts after first giving a correct answer

In the case of the AS/HFA groups and their control group, the focus of interest was also to capture *topic drifts* that took place after a child had given a correct answer or a correct explanation but continued the answer inappropriately, which ultimately led to irrelevance (Study IV). In these answers the child's inferencing was first successful (first classified as a correct answer or an explanation), but then the child drifted away from the original answer and the answer ultimately became irrelevant. The data are subcategorised although it was obvious that subcategorisation of these data produces small sample sizes. However, it was informative to explore these data in more detail in order to gain a better

understanding of the children's communicative failures. The data are classified into four subcategories, the first two of which are aspects of over-utilisation of world knowledge.

Own experience

Context of the question evokes some experience which the child starts to talk about. In most instances, one experience launches a train of thoughts triggering other related experiences that the child then mentions one after another.

General information

The child starts to say something about his/her general knowledge, which is somehow connected with the irrelevant part of the context. In some answers the topic drift seems to be triggered by some aspect of the picture that seems to be used as a bridge to some specific general information the child wants to tell the researcher about. In this kind of situation the child's answer is classified into this category (general information) because it was thought that the child's wish to say something about his/her knowledge is the main reason for the topic drift, rather than the pictorial information the child first used as a bridge to the interest.

Given information

The child starts to tell about or comment on something about the given context that is irrelevant to the question. These answers are usually connected with the information in the picture.

Other

The child makes a comment that is totally irrelevant for the researcher in terms of the topic of the question. These irrelevant answers are usually quite short, but their content is felt as being quite distracting.

4.4.3 Interrater reliability

Interrater reliability (intraclass correlation coefficient) was calculated between two raters in order to check reliability of scoring. When scoring topic drifts, interrater reliability was calculated between the researcher and a speech and language therapist (Elina Kykyri) and in other cases between the researcher and one of two students of logopedics (Sirpa Sakko or Kati Tauriainen) who were familiar with relevance theory. Interrater reliabilities for correct/incorrect scoring of answers and explanations consisted of total sum of answers and explanations. In categorisation, interrater reliability was calculated for each of the answer and

explanation categories, and the final categorisation value consisted of the mean value of these individual category values. Interrater reliability values indicated that scoring and categorisation of children's answers and explanations were reliable (Table 5).

Table 5. Interrater reliabilities between two raters in studies I, II, III and IV.

The Study	Random sample	Scoring	Intraclass correlation coefficient
Study I	21 children	Total answer scores consisting of reference assignment, enrichment and implicature questions.	0.996
Study II	21 children	Total answer scores consisting of implicature, routine and feeling questions.	0.996
		Total explanation scores.	0.995
		Categorisation of incorrect answers.	0.870 ^a
		Categorisation of incorrect explanations.	0.913 ^b
Study III	12 children	Total answer and explanation scores consisting of all questions.	0.996
Study IV	12 children	Total answer and explanation scores consisting of enrichment, implicature, routine and feeling questions.	0.990
		Categorisation of incorrect answers.	0.899 ^a
		Categorisation of incorrect explanations.	0.890 ^b
		Categorisation of topic drifts.	0.897 ^c

^aAn average value of interrater reliabilities of different answer categories. ^bAn average value of interrater reliabilities of different explanation categories. ^cAn average value of interrater reliabilities of different topic drift categories.

4.4.4 Statistical analyses

The age range of normally developing children was large, which meant that the data were not normally distributed and variances were unequal. Variance within age group was especially large among 3-year-olds when compared to other age groups, and distributions of older age groups were skewed because they performed near the ceiling. There was an attempt to transform the data using logarithmic transformation, but in this case it did not improve the distribution of the data, and therefore, non-parametric tests were used in the analyses. Correlation between the Boston Naming Test, auditory association subtest (ITPA) and the sum of answers

to questions of reference assignment, enrichment and implicature were compared using Spearman's Rho, two-tailed. Kruskal Wallis test and Mann-Whitney U test were used to examine differences between age groups and between gender, and Wilcoxon Signed Rank test was used to examine the effect of pictorial support on each age group. As several age groups were compared, critical *p*-values (Bonferroni adjustment) were calculated. In cases of multiple comparisons, probability of achieving significant *p*-value increases (type 1 error) and thus, significance level had to be adjusted downwards in proportion to the number of comparisons. It was therefore possible to control type 1 error by means of using Bonferroni adjustment in age group comparisons. Because better performance was expected from the older children compared to the younger ones, one-tailed tests were used in age group comparisons. Two-tailed tests were used in all other comparisons.

When performance of children with AS/HFA was analysed, an independent t-test was used to determine the differences between the groups on pragmatic answer scores and explanation scores. When comparing the performance between the groups in different pragmatic question types, all variables did not fulfil the criteria of distribution, which was mostly due to the small number of questions within each question type and children's performance near the ceiling level in some of the question types. Therefore, group differences in different answer and explanation types were calculated with Mann-Whitney U test. Because better performance was expected from the control group and the older AS/HFA group compared to the younger AS/HFA group, one-tailed tests were used in all of the comparisons involving the younger AS/HFA group. However, it was not possible to know whether the older AS/HFA group would perform less well than the control group, and therefore two-tailed tests were used in these comparisons. In AS/HFA studies Bonferroni adjustment was not used because there were only three groups to compare, and significance level .05 was therefore used.

In analyses concerning different incorrect answer and explanation categories between groups, the percentages of different kind of incorrect answers and explanations were converted into relative frequency scores (the number of incorrect answers in the category in proportion to all incorrect answers in the group). This way, comparisons were not affected by different numbers of incorrect answers and explanations between groups and different group sizes. Relative frequency distributions between groups were then compared using Mann-Whitney U test. The number of topic drifts between the younger AS/HFA, the older AS/HFA and the control group was compared using Mann-Whitney U test. After that

the children's topic drifts were classified into different subcategories. However, the categories of topic drifts were not compared statistically because the control group had only one topic drift, and the purpose of these subcategories was simply to explore what types of topic drifts are typical of the children with AS/HFA.

5 Results

5.1 Use of context in question answering in normally developing 3- to 9-year old children

5.1.1 *Comparison between language tests and sum of answers to reference assignment, enrichment and implicature questions (I)*

There was a significant positive correlation (Spearman's Rho) between the scores in the two language tests and the scores consisting of the sum of answers to reference assignment, enrichment and implicature questions (max 27). Results in whole data were as follows: Auditory association – sum of answers (reference assignment, enrichment and implicature questions), $\rho = 0.81, p < .001$, and the Boston Naming Test – sum of answers (reference assignment, enrichment and implicature questions), $\rho = 0.79, p < .001$. Children's performances in the two language tests had a strong positive correlation with each other: $\rho = 0.81, p < .001$.

5.1.2 *Effect of gender on scores consisting of answers to reference assignment, enrichment and implicature questions (I)*

No gender differences were found in scores consisting of the sum of answers to reference assignment, enrichment and implicature questions, $U = 4821.500, p = .222$.

5.1.3 *Answers to contextually demanding questions in 3- to 9-year-old children (I, II, unpublished data)*

Age group comparisons on total pragmatic answer scores

Total pragmatic answer scores consisted of all questions asked from the children: reference assignment, enrichment, routine, implicature and feeling questions (max 41). For the total pragmatic answer scores there was a significant effect of age groups, Kruskal Wallis Test: $\chi^2 = 160.411, df = 6, p < .001$. There was significant difference in total pragmatic answer score (Mann Whitney U test, Bonferroni adjustment: $p < .003$) between all other adjacent age groups except 6- and 7-year-

olds and 8- and 9-year-olds. Even if 6-year-olds did not differ from 7-year-olds, they did differ from 8-year-old children (Table 6).

Table 6. *P* values (Mann-Whitney U test) of age group comparisons in different question types and total scores in normally developing children.

Age group comparison	Reference assignment	Enrichment	Routine	Implicature	Feeling	Total
3 and 4 yrs	<.001*	<.001*	<.001*	<.001*	.002*	<.001*
3 and 5 yrs	<.001*	<.001*	<.001*	<.001*	<.001*	<.001*
3 and 6 yrs	<.001*	<.001*	<.001*	<.001*	<.001*	<.001*
4 and 5 yrs	.515	.019	.189	.079	.001*	.002*
4 and 6 yrs	.010	<.001*	<.001*	<.001*	<.001*	<.001*
4 and 7 yrs	<.001*	<.001*	<.001*	<.001*	<.001*	<.001*
5 and 6 yrs	.054	.070	<.001*	.001*	.572	<.001*
5 and 7 yrs	<.001*	<.001*	<.001*	<.001*	.085	<.001*
5 and 8 yrs	<.001*	<.001*	<.001*	<.001*	.067	<.001*
6 and 7 yrs	.045	<.001*	.243	.134	.322	.009
6 and 8 yrs	.001*	<.001*	.367	<.001*	.174	<.001*
6 and 9 yrs	<.001*	<.001*	.206	<.001*	.060	<.001*
7 and 8 yrs	.104	.034	.060	.006	.601	.002*
7 and 9 yrs	.033	.004	.016	.001*	.286	<.001*
8 and 9 yrs	.589	.490	.822	.098	.715	.117

*Significant difference, $p < .003$ (Bonferroni adjustment).

Effect of age group on answers to different question types

The reference assignment questions were relatively easy as a question type (Figure 3). For the *reference assignment* scores there was a significant difference (Mann-Whitney U test, Bonferroni adjustment: $p < .003$) between 3- and 4-year-old children. In addition, there was a significant difference when comparing age groups of 4 and 7 years, 5 and 7 years, and 6 and 8 years (Table 6). For the *enrichment* scores (Figure 4) there was a significant difference between 3- and 4-year-olds and 6- and 7-year-olds. Differences between other age groups were

significant if they were compared to children two years older, except for 7- and 9-year-olds whose results fell just short of significance after Bonferroni adjustment.

In *routine* questions (Figure 5) there was a significant difference between 3- and 4-year-olds and 5- and 6-year-olds (Table 6). Comparisons between other age groups showed that the age group of 4-year-olds also differed from the age group of 6 years, but no other differences were found. For *implicature* questions (Figure 6) there was a significant difference between the age groups of 3 and 4 years and those of 5 and 6 years. Differences between other age groups were significant if they were compared to children who were two years older. Answers to *feeling* questions (Figure 7) showed that there was a significant difference between age groups of 3- and 4-year-olds and 4- and 5-year-olds. In answers to other question types remarkable developmental progress occurred between the ages of 3 and 4 years, but in answers to feeling questions remarkable developmental progress took place both between the ages of 3 and 4 years and between 4 and 5 years.

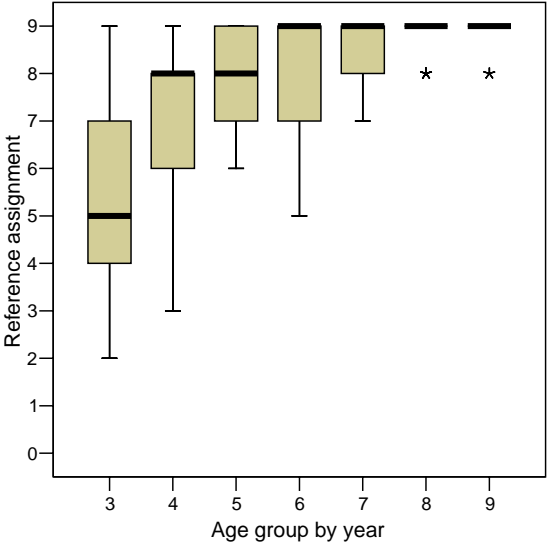


Fig. 3. Answer scores to reference assignment questions between age groups in normally developing children (max score 9).

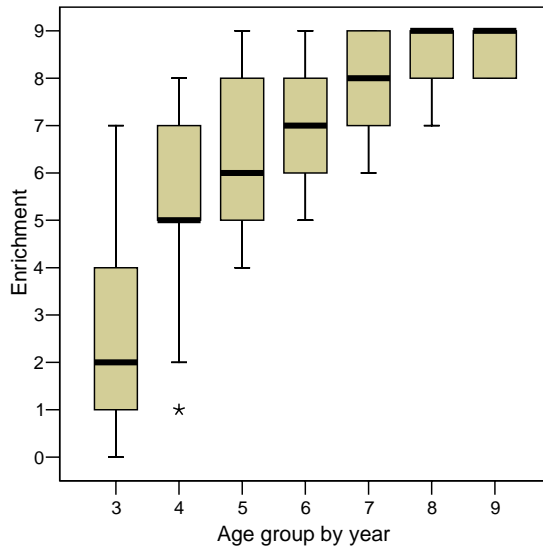


Fig. 4. Answer scores to enrichment questions between age groups in normally developing children (max score 9).

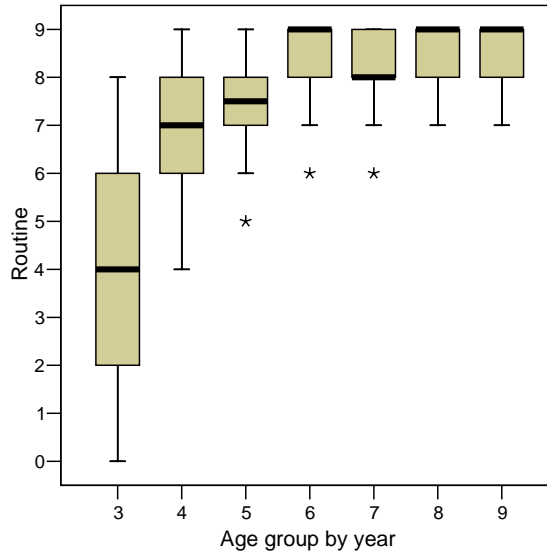


Fig. 5. Answer scores to routine questions between age groups in normally developing children (max score 9).

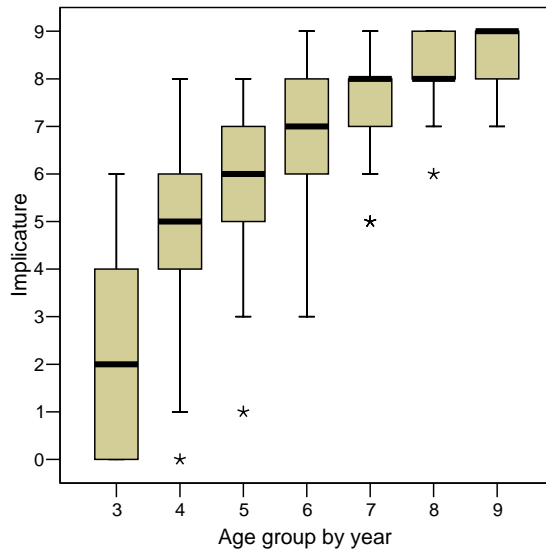


Fig. 6. Answer scores to impicature questions between age groups in normally developing children (max score 9).

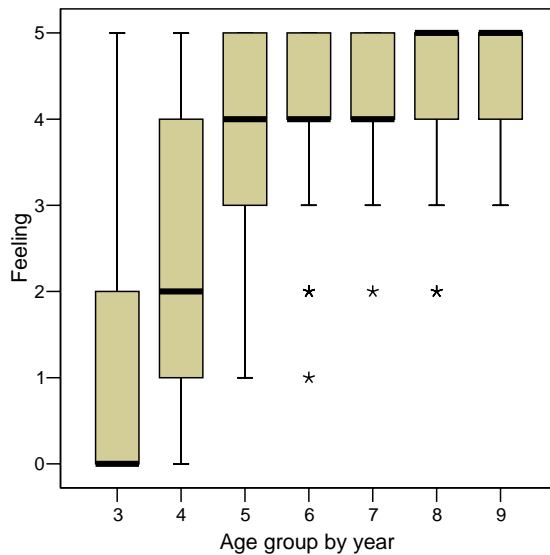


Fig. 7. Answer scores to feeling questions between age groups in normally developing children (max score 5).

The older children (7- to 9-year-olds) had only a few incorrect answers, and these comparisons were therefore made between the children aged 3 to 6 years only. Because the number of visual and non-visual questions was not the same (4 or 5), percentages were used in these comparisons. The analysis revealed that a greater proportion of correct answers was elicited from questions with a visual context. For reference assignment scores there was a significant effect (Wilcoxon Signed Rank Test, Bonferroni adjustment: $p < .0125$) of pictorial support in each age group from 3 to 6 years (Table 7). For enrichment scores there was a significant effect of visual support in children aged 3, 4 and 5 years. In 6-year-olds the effect of pictorial support did not quite reach significance. The percentage of correct implicature answers given by the 3-year-olds was insufficient for this group to be included in comparisons (not enough correct answers). An analysis of other age groups showed that for implicature scores the effect of visual support was significant in 4- and 6-year-old children.

Table 7. Effect of visual support in reference assignment, enrichment and implicature question types in normally developing children in age groups from 3 to 6 years.

Age group	Reference visual / non-visual		Enrichment visual / non-visual		Implicature visual / non-visual	
	<i>p</i>	<i>z</i>	<i>p</i>	<i>z</i>	<i>p</i>	<i>z</i>
3 yrs	<.001*	3.854	<.001*	3.796	—	—
4 yrs	<.001*	3.996	<.001*	4.032	<.001*	3.489
5 yrs	.001*	3.284	.001*	3.219	.073	1.795
6 yrs	.001*	3.341	.015	2.434	<.001*	3.823

*Significant difference, $p < .0125$ (Bonferroni adjustment), Wilcoxon Signed Rank Test for related samples.

Incorrect answer categories in children aged 3 to 7 years

This categorisation has been made from the total sum of incorrect answers to routine, implicature and feeling questions (max 23). As shown earlier, the 8- and 9-year-old children performed near ceiling (> 90% correct), and their incorrect answer categories are therefore not analysed. More incorrect answers were elicited from younger children in all incorrect answer subcategories, and the number of incorrect answers within each category diminished with progressing age. In order to compare incorrect answers between the age groups, scores were converted into

relative frequency scores (Table 8). This kind of proportional comparison allowed analysis of differences in answer categories between the age groups (i.e., if the child answered incorrectly, what kind of information was being used in the answer).

‘Don’t know’ answers were common in all age groups, and it was the most common category for 3-, 6- and 7-year-old children. For 3-year-old children it was also quite common to give no answer at all. The ‘no answer’ category was also quite common in the age groups of 5 and 6 years. Most of the answers of children aged 4 and 5 were categorised as incorrect use of ‘knowledge’. After the age of 5, totally ‘irrelevant’ answers were rare. Pairwise comparisons (Mann-Whitney U test, Bonferroni adjustment: $p < .01$) of relative frequency distributions showed a significant effect of age group between children aged 3 and 4 years in the ‘turn-taking’ category ($U = 269.500, p = .001$), children aged 4 and 5 years in the ‘irrelevant’ category ($U = 243.000, p = .001$), children aged 5 and 6 in the ‘knowledge’ category ($U = 252.000, p = .002$) and children aged 6 and 7 years in the ‘no answer’ category ($U = 312.500, p = .003$). Although the proportions of other categories differed between age groups, these differences were not significant between adjacent age groups (comparing 3-year-olds with 4-year-olds, 4-year-olds with 5-year-olds, 5-year-olds with 6-year-olds, and 6-year-olds with 7-year-olds).

Table 8. Absolute and relative frequencies of incorrect answer categories in normally developing children as a function of age group.

Answer category	3 yrs		4 yrs		5 yrs		6 yrs		7 yrs	
	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b
Incorrect focus	34	7.4	45	16.4	31	16.5	16	14.4	21	22.3
Knowledge	61	13.3	59	21.5	53	28.2	22	19.8	19	20.2
Given information	54	11.8	28	10.2	18	9.6	9	8.1	12	12.8
Don't Know	96	21.0	51	18.5	29	15.4	39	35.1	36	38.3
Irrelevant	49	10.7	41	14.9	10	5.3	2	1.8	1	1.1
Tautology	39	8.5	18	6.5	8	4.3	2	1.8	1	1.1
Turn-taking	27	5.9	4	1.5	0	0.0	0	0.0	0	0.0
No Answer	78	17.1	25	9.1	39	20.7	20	18.0	1	1.1
Other	19	4.2	4	1.5	0	0.0	1	0.9	3	3.2
Total	457	100	275	100	188	100	111	100	94	100

Note. $N = 30$ in each age group. ^aAbsolute frequency of incorrect answers of the whole age group in the category (f). ^bRelative frequency = $(f/y) \cdot 100\%$; where y means total number of incorrect answers within each group.

5.1.4 Incorrect explanations for initially correct answers in normally developing children (II, unpublished data)

Effect of age group on explanation scores

Children who initially gave a correct answer were not always able to provide an adequate explanation. Explanation scores consisted of implicature, routine and feeling questions where follow-up question was presented (max 22, one implicature question did not contain a follow-up question). For the explanation scores there was a significant effect of age group, Kruskal Wallis Test: $\chi^2 = 163.387$, $df = 6$, $p < .001$. As expected, the scores of older children were higher than those of younger children (Table 9). Although the 8- and 9-year-olds performed near ceiling for correct answers, they did not perform quite as well in providing explanations for their correct answers. Pairwise comparisons by Mann-Whitney U test (Bonferroni adjustment: $p < .008$) indicated that when comparing adjacent age groups, a significant difference in explanation scores was evident between the 3- and 4-year-olds ($U = 169.500$, $p < .001$), 4- and 5-year-olds ($U = 230.000$, $p = .001$), 6- and 7-year-olds ($U = 198.000$, $p < .001$), and 8- and 9-year-olds ($U = 256.000$, $p = .004$). Results fell just short of significance for the 5- and 6-year-olds ($U = 275.000$, $p = .009$) and 7- and 8-year-olds ($U = 268.500$, $p = .011$).

Table 9. Correct explanations of different question types in normally developing children as a function of age group.

Age group	Explanation type (max scores)			
	Routine (9)	Impicature (8)	Feeling (5)	Total (22)
3 yrs				
<i>Mdn</i>	0.0	0.0	0.0	0.0
<i>M</i>	0.7	0.3	0.2	1.2
<i>SD</i>	1.29	0.83	0.68	2.18
4 yrs				
<i>Mdn</i>	2.5	1.0	0.0	4.5
<i>M</i>	2.6	1.3	0.8	4.7
<i>SD</i>	2.10	1.29	1.26	3.84
5 yrs				
<i>Mdn</i>	4.0	3.0	2.5	9.0
<i>M</i>	3.9	2.1	2.5	8.4
<i>SD</i>	2.01	1.62	1.63	4.28
6 yrs				
<i>Mdn</i>	5.5	3.0	3.5	11.0
<i>M</i>	5.2	2.9	3.2	11.4
<i>SD</i>	2.08	2.13	1.68	4.67
7 yrs				
<i>Mdn</i>	7.0	5.0	4.0	16.0
<i>M</i>	6.9	4.7	3.9	15.6
<i>SD</i>	1.60	1.23	0.98	2.76
8 yrs				
<i>Mdn</i>	8.0	6.0	5.0	18.0
<i>M</i>	7.6	5.5	4.3	17.3
<i>SD</i>	1.38	1.35	1.00	2.72
9 yrs				
<i>Mdn</i>	8.0	7.0	5.0	19.0
<i>M</i>	8.1	6.7	4.4	19.2
<i>SD</i>	0.93	1.2	0.67	1.71

Note. Explanation question was only asked if a correct answer was given.

Effect of age group on incorrect explanations for initially correct impicature, routine and feeling answers

Age group comparisons of incorrect explanations for initially correct answers to impicature, routine and feeling questions were done by comparing adjacent age groups (Mann-Whitney U test, Bonferroni adjustment: $p < .008$) (Table 9). In explanations of answers to *routine* questions the difference was significant between 3- and 4-year-olds ($U = 188.500, p < .001$) and 6- and 7-year-olds ($U = 237.500, p = .001$). Non-significant trend was found between 4- and 5-year-olds ($U = 296.000, p = .021$) and 5- and 6-year-olds ($U = 285.000, p = .014$). In

explanations for *implicature* answers the significant difference was found between 3- and 4-year-olds ($U = 235.000, p < .001$), 6- and 7-year-olds ($U = 211.500, p < .001$), and 8- and 9-year-olds ($U = 231.000, p = .001$). In addition, non-significant trend was found between 4- and 5-year-olds ($U = 320.500, p = .049$) and 7- and 8-year-olds ($U = 288.000, p = .022$). In explanations for answers to *feeling* questions significant difference was found between 3- and 4-year-olds ($U = 302.500, p = .007$) and 4- and 5-year-olds ($U = 198.000, p < .001$).

Incorrect explanation categories of normally developing children

The incorrect explanations of all age groups were analysed as no age group performed near the ceiling. Categorisation has been made from the total sum of incorrect explanations to routine, implicature and feeling questions (max 22). Because an explanation was only requested when a correct answer was given, it was not reasonable to compare the number of incorrect explanations in different categories (younger children had a small number of incorrect explanations because they had fewer correct answers). Thus, scores were converted into relative frequency scores in order to illustrate what types of incorrect explanations were elicited most often in each age group (Table 10).

Table 10. Absolute and relative frequencies of incorrect explanation categories in normally developing children as a function of age group.

Explanation category	3 yrs		4 yrs		5 yrs		6 yrs		7 yrs		8 yrs		9 yrs	
	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b
Incorrect focus	5	3.0	14	5.3	36	15.1	32	14.3	18	13.2	13	14.4	18	29.0
Knowledge	26	15.7	61	23.2	57	23.9	40	17.9	32	23.5	9	10.0	11	17.7
Given information	8	4.8	18	6.8	29	12.2	35	15.6	19	14.0	11	12.2	7	11.3
Don't Know	27	16.3	35	13.3	20	8.4	27	12.1	25	18.4	36	40.0	11	17.7
Irrelevant	13	7.8	7	2.7	4	1.7	2	0.9	1	0.7	0	0.0	0	0.0
Tautology	17	10.2	13	4.9	11	4.6	11	4.9	3	2.2	2	2.2	2	3.2
Turn-taking	46	27.7	100	38.0	44	18.5	45	20.1	30	22.1	16	17.8	10	16.1
No Answer	20	12.0	15	5.7	36	15.1	30	13.4	7	5.1	3	3.3	3	4.8
Other	4	2.4	0	0.0	1	0.4	2	0.9	1	0.7	0	0.0	0	0.0
<i>Total</i>	<i>166</i>	<i>100</i>	<i>263</i>	<i>100</i>	<i>238</i>	<i>100</i>	<i>224</i>	<i>100</i>	<i>136</i>	<i>100</i>	<i>90</i>	<i>100</i>	<i>62</i>	<i>100</i>

Note. $N = 30$ in age groups from 3 to 7 years, $n = 29$ in age group of 8 years and $n = 31$ in age group of 9 years. Explanation question was asked only if a correct answer was given. ^aAbsolute frequency of incorrect explanations of the whole age group in the category (f). ^bRelative frequency = $(f/y) \cdot 100\%$; where y means total number of incorrect explanations within each group.

The most common incorrect explanation category for 3-, 4- and 6-year-olds was ‘turn-taking’. For 5- and 7-year-olds, incorrect explanations were most commonly classified into the ‘knowledge’ category, but the ‘turn-taking’ category was also common. For 8-year-olds the most common category was ‘don’t know’, and for 9-year-olds ‘incorrect focus’. Pairwise comparison by Mann-Whitney U test (Bonferroni adjustment: $p < .008$) showed a significant effect of age group between children aged 4 and 5 years in the ‘incorrect focus’ category ($U = 263.500$, $p = .003$) and in the ‘turn-taking’ category ($U = 283.000$, $p = .008$). Although the proportions of other categories also differed between the age groups, these differences were not significant when comparing immediately adjacent age groups.

5.2 Performance of children with AS/HFA

5.2.1 Answers to pragmatically demanding questions in children with AS/HFA (III, IV)

Group comparison on total pragmatic answer scores

Total pragmatic answer score consisted of all questions asked from the children (reference assignment, enrichment, routine, implicature and feeling, max 41). Pragmatic answer scores for the control group were higher when compared to the younger AS/HFA group, $t(37) = 4.744$, $p < .001$, and the older AS/HFA group, $t(44) = 2.426$, $p = .010$. Because there was a child who performed less well than other children in the older AS/HFA group, the comparison between the control group and the older AS/HFA group without that participant was also calculated, but the difference was still significant, $t(43) = 2.282$, $p = .014$. Additionally, the effect of age on performance was significant, since the answer scores of the older AS/HFA group were higher than the answer scores of the younger AS/HFA group, $t(37) = 2.307$, $p = .014$.

Group comparisons of answers in different question types

Reference assignment elicited the most correct answers and all groups performed at the ceiling level in these questions (Figure 8). In answers to the enrichment questions there was a significant difference between the control group and the younger AS/HFA group ($U = 84.000$, $p = .004$) and between the older AS/HFA

group and the younger AS/HFA group ($U = 66.500, p < .001$) (Figure 9). In routine answers there was a significant difference between the control group and the younger AS/HFA group ($U = 124.000, p = .050$), and between the control group and the older AS/HFA group ($U = 182.500, p = .042$) (Figure 10). For implicature answers, the control group achieved higher scores than the younger AS/HFA group ($U = 55.000, p < .001$) or the older AS/HFA group ($U = 129.500, p = .001$) (Figure 11). Even if the distribution of answers to feeling questions differed between groups, these differences did not reach significance (Figure 12).

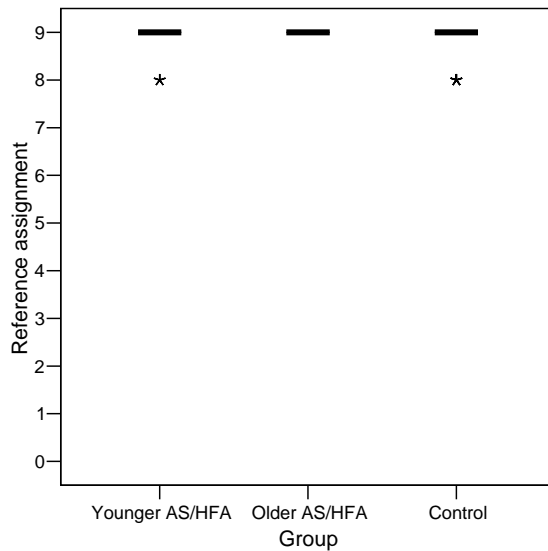


Fig. 8. Answer scores to reference assignment questions between younger AS/HFA, older AS/HFA and control group (max score 9).

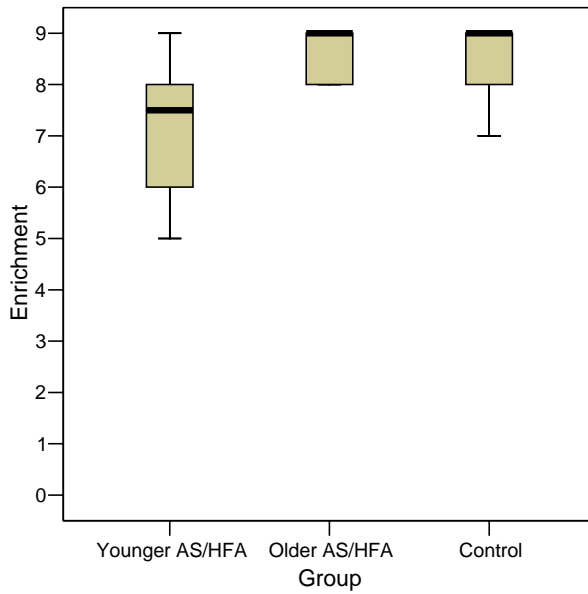


Fig. 9. Answer scores to enrichment questions between younger AS/HFA, older AS/HFA and control group (max score 9).

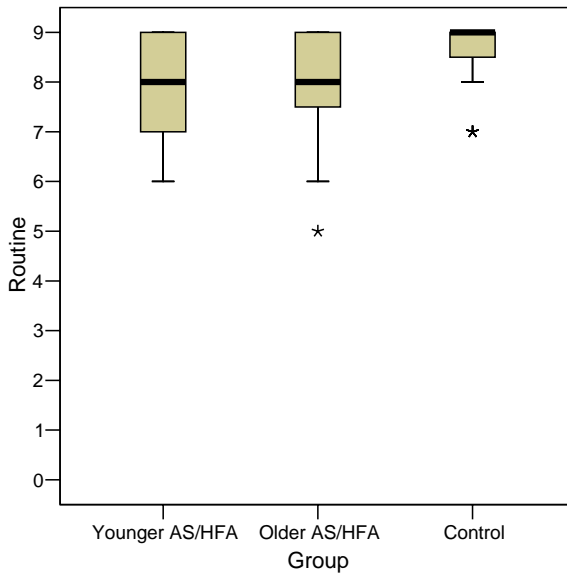


Fig. 10. Answer scores to routine questions between younger AS/HFA, older AS/HFA and control group (max score 9).

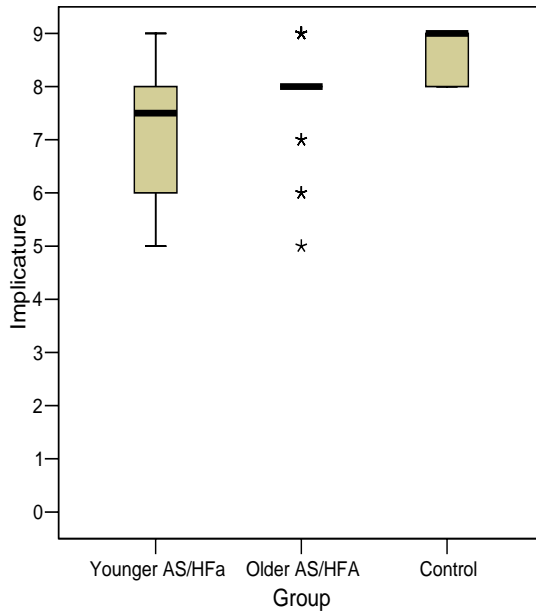


Fig. 11. Answer scores to implicature questions between younger AS/HfA, older AS/HfA and control group (max score 9).

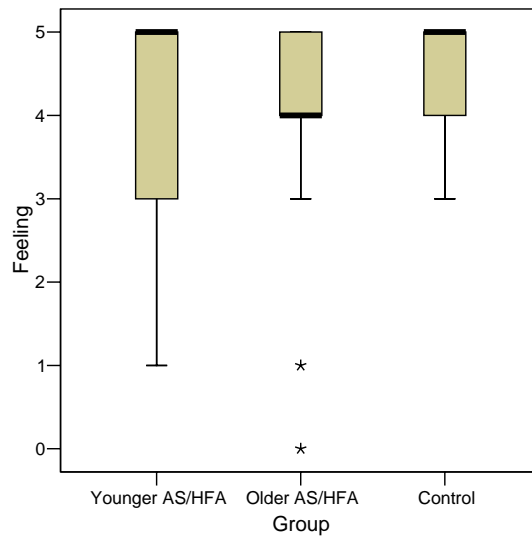


Fig. 12. Answer scores to feeling questions between younger AS/HfA, older AS/HfA and control group (max score 5).

Incorrect answer categories

Categorisation of incorrect answers was made from the total sum of incorrect answers to enrichment, routine, implicature and feeling questions (max 32). Because the number of incorrect answers and the number of subjects in the groups was not the same, scores were converted into relative frequency scores. Relative frequency scores showed that the answer categories were quite similarly divided across the groups (Table 11). In all of the groups, most of the incorrect answers were found to be in the categories ‘incorrect focus’ and ‘knowledge’. The only statistically significant differences in terms of relative frequency distribution were found in the ‘given information’ category between the control group and the younger AS/HFA group ($U = 114.000, p = .023$) and between the control group and the older AS/HFA group ($U = 161.500, p = .018$).

Table 11. Absolute and relative frequencies of incorrect answer categories in younger AS/HFA group ($n = 16$), older AS/HFA group ($n = 23$) and control group ($n = 23$).

Answer category	Younger AS/HFA group		Older AS/HFA group		Control group	
	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b
Incorrect focus	22	28.2	28	31.1	22	55
Knowledge	25	32.1	26	28.9	9	22.5
Given information	10	12.8	8	8.9	0	0
Don't know	12	15.4	15	16.7	6	15
Irrelevant	2	2.6	2	2.2	0	0
Tautology	6	7.7	9	10	1	2.5
Other	1	1.3	2	2.2	2	5
<i>Total</i>	<i>78</i>	<i>100</i>	<i>90</i>	<i>100</i>	<i>40</i>	<i>100</i>

^aAbsolute frequency of incorrect answers of the whole age group in the category (f). ^bRelative frequency = $(f/y) \cdot 100\%$; where y means total number of incorrect answers within each group.

5.2.2 Incorrect explanations for initially correct answers in children with AS/HFA (III, IV)

Group comparison of explanation scores

Explanation scores consisted of routine, implicature and feeling questions where follow-up questions were presented (max 22). Total explanation scores of the control children were higher than explanation scores of the younger AS/HFA group, $t(37) = 5.821, p < .001$, or explanation scores of the older AS/HFA group, $t(44) = 5.036, p < .001$ (Table 12). There was one child in the older AS/HFA group who performed more weakly than the other children. However, the difference between the control group and the older AS/HFA group remained significant even if the weakest child in the older AS/HFA group was excluded, $t(43) = 4.955, p < .001$.

Table 12. Correct explanations of different question types as a function of group.

Group	Explanation type (max scores)			
	Routine (9)	Implicature (8)	Feeling (5)	Total (22)
Younger AS/HFA				
<i>Mdn</i>	5.5	4.0	3.0	14.5
<i>M</i>	5.8	3.8	3.6	13.0
<i>SD</i>	1.68	1.97	1.46	3.81
Older AS/HFA				
<i>Mdn</i>	7.0	5.0	4.0	15.0
<i>M</i>	6.7	4.2	3.4	14.4
<i>SD</i>	1.47	1.67	1.37	3.33
Control				
<i>Mdn</i>	8.0	7.0	5.0	19.0
<i>M</i>	7.8	6.7	4.2	18.7
<i>SD</i>	1.20	1.15	0.73	2.73

Note. Explanation question was only asked if a correct answer was given.

Explanations for correct answers to implicature, routine and feeling questions

In explanations of answers to implicature questions the control group achieved higher scores than the younger AS/HFA group ($U = 30.500, p < .001$) or the older AS/HFA group ($U = 56.500, p < .001$) (Table 12). Also in explanations of routine

answers the control group had higher scores than the younger AS/HFA group ($U = 65.000, p < .001$) and the older AS/HFA group ($U = 142.000, p = .006$).

Incorrect explanation categories

Categorisation was made from the total sum of incorrect explanations to routine, implicature and feeling questions (max 22). Relative frequency comparisons showed that the most common incorrect explanation type in the two AS/HFA groups was the incorrect use of world knowledge (Table 13). Although the ‘knowledge’ category was also common in the control group, the number of incorrect explanations categorised as ‘knowledge’ was significantly lower in the control group when compared to the younger AS/HFA group ($U = 73.500, p = .004$) and the older AS/HFA group ($U = 97.500, p = .001$). The most common category for the control group was ‘don’t know’, and there was a significant difference between the control group and the older AS/HFA group ($U = 147.500, p = .032$). The older AS/HFA group had significantly more incorrect explanations in the category ‘given information’ when compared to the control group ($U = 107.500, p = .002$) and the younger AS/HFA group ($U = 111.500, p = .027$). The younger AS/HFA group had significantly more incorrect explanations classified into the category ‘tautology’ when compared to the control group ($U = 125.000, p = .012$) and the older AS/HFA group ($U = 208.500, p = .049$).

Table 13. Absolute and relative frequencies of incorrect explanation categories in younger AS/HFA group ($n = 16$), older AS/HFA group ($n = 23$) and control group ($n = 23$).

Explanation category	Younger AS/HFA group		Older AS/HFA group		Control group	
	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b	Abs. f^a	Rel. f^b
Incorrect focus	12	13.5	17	15.5	8	15.7
Knowledge	28	31.5	34	30.9	12	23.5
Given information	11	12.4	26	23.6	3	5.9
Don't know	12	13.5	12	10.9	14	27.5
Irrelevant	2	2.2	1	0.9	0	0
Tautology	8	9.0	7	6.4	1	2.0
Turn-taking	13	14.6	12	10.9	11	21.6
Other	3	3.4	1	0.9	2	3.9
<i>Total</i>	<i>89</i>	<i>100</i>	<i>110</i>	<i>100</i>	<i>51</i>	<i>100</i>

Note. ^aAbsolute frequency of incorrect explanations of the whole age group in the category (f). ^bRelative frequency = $(f/y) \cdot 100\%$; where y means total number of incorrect explanations within each group.

5.2.3 Topic drifts after first answering or explaining an answer correctly (IV)

Group comparison of topic drifts

When comparing the number of topic drifts after the child had given a correct answer, all groups performed differently from each other (Table 14). The control group had only one topic drift, and its performance differed therefore from that of the younger AS/HFA group ($U = 43.500, p < .001$) and the older AS/HFA group ($U = 188.000, p = .029$). Additionally, there was a statistically significant age effect between the two AS/HFA groups as the older AS/HFA group had fewer topic drifts compared to the younger AS/HFA group ($U = 100.500, p = .012$).

Table 14. Frequency of topic drifts within the younger AS/HFA group ($n = 16$), older AS/HFA group ($n = 23$) and control group ($n = 23$).

Number of topic drifts	Younger AS/HFA group		Older AS/HFA group		Control group	
	f^a	$\%^b$	f^a	$\%^b$	f^a	$\%^b$
0	3	18.8	14	60.9	22	95.7
1	3	18.8	4	17.4	1	4.3
2-3	7	43.8	2	8.7	0	0.0
4-5	1	6.3	1	4.3	0	0.0
6	2	12.5	2	8.7	0	0.0

^aNumber of children who had topic drifts. ^b% of the whole group.

Characteristics of topic drifts

Categorisation of topic drifts revealed that after giving a correct answer many children with AS/HFA began telling the researcher about their own experiences that were not relevant to the question. The ‘own experience’ category was especially common in the younger AS/HFA group. In these ‘own experience’ answers on the basis of the topic of the question, the child’s earlier experiences appeared to be triggered and were explicitly expressed. Another typical type of topic drift was an irrelevant comment (‘other’). Additionally, three children in the older AS/HFA group had a large number of ‘general information’ answers (Table 15).

Table 15. Categorisation of topic drifts within the younger AS/HFA group ($n = 16$), older AS/HFA group ($n = 23$) and control group ($n = 23$).

Topic drift category	Younger AS/HFA group		Older AS/HFA group		Control group	
	Sum ^a	Number of children ^b	Sum ^a	Number of children ^b	Sum ^a	Number of children ^b
Own experience	20	8	7	6	1	1
General information	5	2	16	3	0	0
Given information	2	1	6	4	0	0
Other	11	7	12	3	0	0

^aSum of topic drifts in each category. ^bNumber of children who had topic drifts in the category.

5.3 Overview of results

5.3.1 Summary of total pragmatic answer scores

The total pragmatic answer scores (max 41) of children increased with progressing age (Figure 13). The development progressed most actively between the ages of 3 and 4 years, after which development progressed more steadily. When comparing total answer scores of the younger AS/HFA group to all normally developing children, their total scores corresponded approximately to total scores of 6-year-olds. The performance of the older AS/HFA group was better than the performance of the younger AS/HFA group. Total scores of the older AS/HFA group corresponded approximately to total scores of 8-year-old children.

The variation within groups was remarkably large in children's total explanation scores (max 22) (Figure 14). The total explanation scores increased gradually with age. In respect of age both AS/HFA groups showed lacking ability to explain their answers.

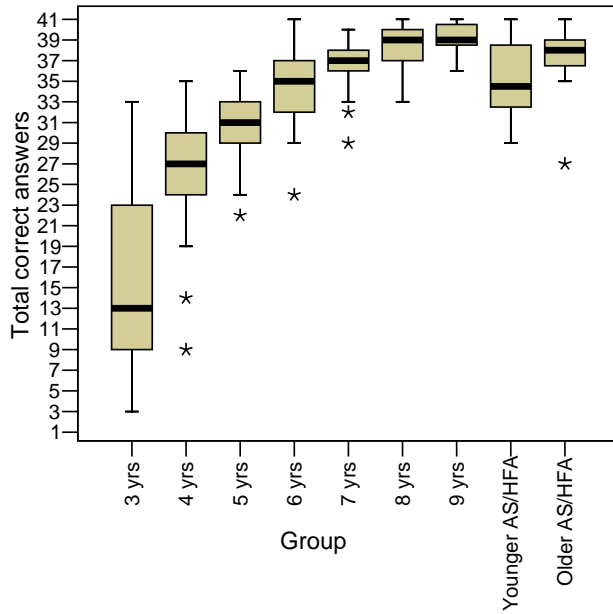


Fig. 13. Total answer scores in age groups from 3 to 9 years of normally developing children and in younger AS/HFA and older AS/HFA group (max score 41).

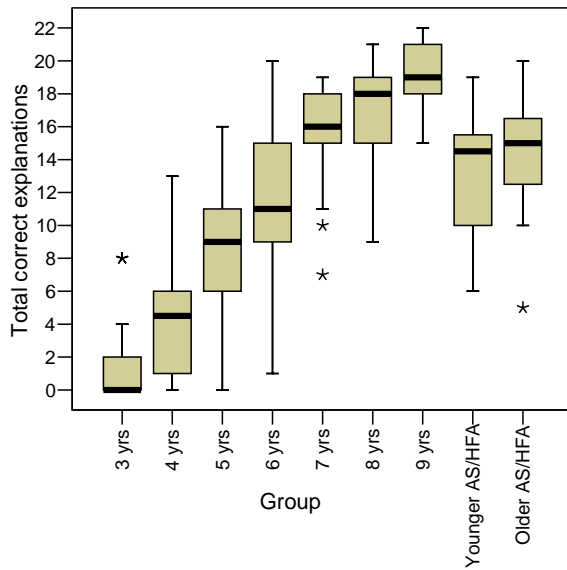


Fig. 14. Total explanation scores in normally developing children aged from 3 to 9 years and in younger AS/HFA and older AS/HFA group (max score 22).

5.3.2 The relationship between correct answers and their correct explanations

In order to explore the relationship between correct answers and their correct explanations, mean percentages of answer and explanation scores of routine, implicature and feeling questions were compared graphically. Figures 15–17 show that the difference between correct answers and correct explanations diminishes as children's age increases. Thus, there appears to be a developmental effect here for both normally developing children and children with AS/HFA.

Especially in the younger AS/HFA group, the difference between the number of correct answers and their explanations was larger than for the normally developing 7- to 9-year-old children. In routine questions the younger AS/HFA group failed to explain 27% of their correct answers and the older AS/HFA group failed to explain 17% of their correct answers (Figure 15). Correspondingly, normally developing 9-year-old children failed in 7%, 8-year-olds in 12% and 7-year-olds in 16% of the cases. The relationship of correct answers and correct explanations between children with AS/HFA and normally developing children differed the most with regard to implicature questions (Figure 16). The younger AS/HFA group failed to explain 40% and the older AS/HFA group 39% of their correct answers to implicature questions. Correspondingly, normally developing 9-year-old children failed in 11%, 8-year-olds in 24% and 7-year-olds in 27% of the cases. Explaining answers to feeling questions was easier for all the children (Figure 17). The younger AS/HFA group failed to explain 8% of their correct answers and the older AS/HFA group failed to explain 12% of their correct answers. In feeling questions, normally developing 9-year-old children failed to explain just 1% of the cases, while 8-year-olds explained all of their answers correctly and 7-year-olds failed in 9% of the cases.

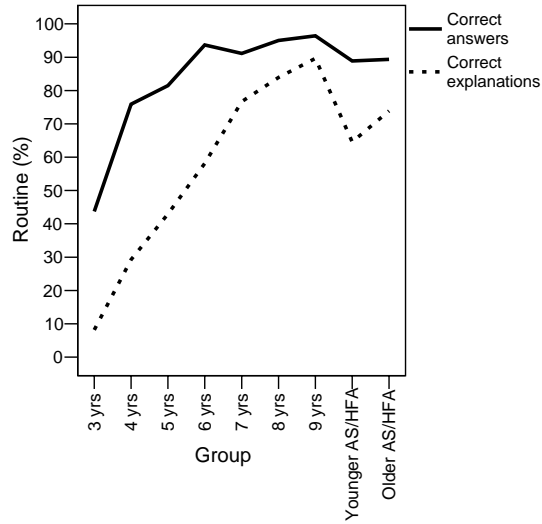


Fig. 15. Mean percentage of correct routine answers and explanations in normally developing children aged from 3 to 9 years and in younger AS/HFA and older AS/HFA group. Explanation question was asked only if a correct answer was given.

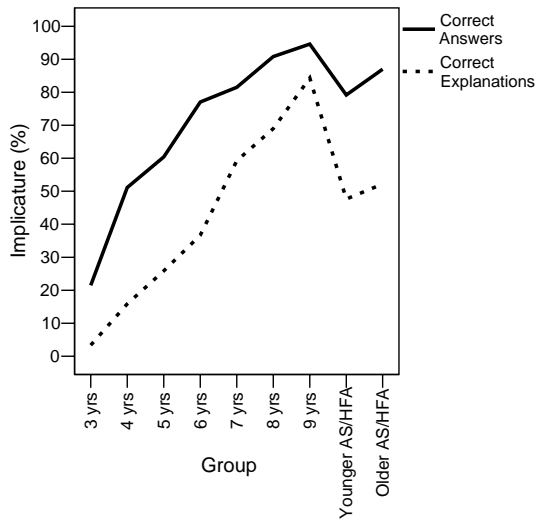


Fig. 16. Mean percentage of correct implicature answers and explanations in normally developing children aged from 3 to 9 years and in younger AS/HFA and older AS/HFA group. Explanation question was asked only if a correct answer was given. One question did not contain a follow-up question and this has been taken into account in the calculations.

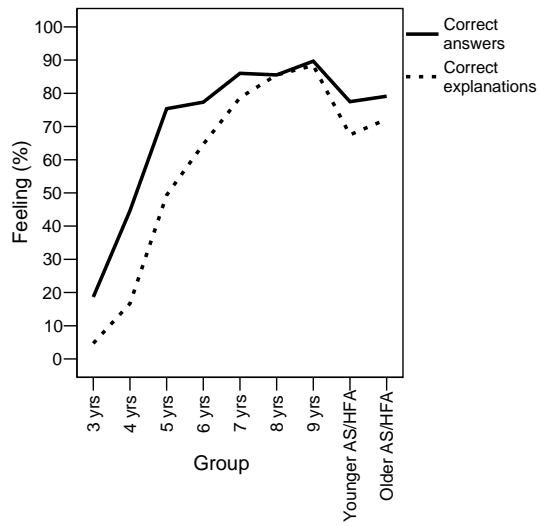


Fig. 17. Mean percentage of correct feeling answers and explanations in normally developing children aged from 3 to 9 years and in younger AS/HFA and older AS/HFA group. Explanation question was asked only if a correct answer was given.

6 Discussion

The present study investigated how normally developing children aged 3 to 9 years and children with AS/HFA aged 7 to 12 years answered pragmatically/contextually demanding questions and explained their correct answers.

6.1 Performance of normally developing children

6.1.1 *Use of context in question answering in normally developing children*

This study supported the view that pragmatic comprehension abilities of children can be meaningfully examined in relation to question types derived from relevance theory (Leinonen & Kerbel 1999, Leinonen *et al.* 2003, Ryder & Leinonen 2003). The youngest age group, 3-year-olds, were already able to engage competently in the least complex pragmatic processing, and they were starting to process adequately the more complex question types. This finding is similar to earlier studies that have shown that young children already have an ability to utilise context if it does not demand complex processing and if the context is familiar to them (e.g., O'Neill 1996, Bezuidenhout & Sroda 1998, Ryder & Leinonen 2003). However, if contextual processing is too demanding, children's processing mechanisms become overloaded, with a resulting breakdown of the comprehension process (Bezuidenhout & Sroda 1998, Foster-Cohen 2000). In this study from the age of 4 onwards, 80% of the answers were correct to reference assignment questions; from the age of 5 onwards 80% was achieved for routine questions, from the age of 6–7 onwards this level of correct answers was achieved for enrichment and feeling questions, and from age 7 onwards 80% was reached for implicature questions. This reflects the pragmatic complexity of the different question types and the children's increasing ability to bring more complex contextual information to bear on the comprehension process. Thus, even though very young children can already perform simple pragmatic processing, through development they become able to integrate and manipulate contextually relevant information in order to answer more demanding questions.

In this study it was found that children's performance was increased by visual support. The facilitating effect of visual context is not surprising, as these questions give the child strong contextual support. Additionally, pictorial

information helps children to direct their attention to the relevant part of the context.

In line with an earlier study with English children (Ryder & Leinonen 2003) a similar developmental trend was found for reference assignment, enrichment and implicature questions. However, in this study some 3-year-old children were able to answer implicature questions. This is in contrast with the results of Ryder and Leinonen, where all 3-year-old children were unable to answer implicature questions (in the present study they answered approximately 20% of these questions correctly). An explanation for this could be a different kind of memory load in the implicature questions because in this study questions were based on short scenarios, whereas in Ryder and Leinonen's study the children also had to recall information given much earlier in the story. It may also be that in the present study the context of the scenarios was more familiar to the children. Another explanation for these differences might be that language and cultural factors influence some areas of pragmatic comprehension development (see Lloyd *et al.* 1995). It is usual to use indirect utterances in both English and Finnish. However, language learning takes place in a different kind of language community and culture. It might therefore be the case that the different context may influence children's ability to acquire contextual information and utilise this information in comprehension. More future research is, however, needed to investigate this further.

In normal development it is generally accepted that various cognitive and language abilities develop in parallel (McTear & Conti-Ramsden 1992, Gillam & Bedore 2000, Buckley 2003). The positive correlation between answers to pragmatically demanding questions and language tests found in this study is consistent with this assumption. In this study the largest increase in correct answers was seen between the ages of 3 and 4, while for feeling questions this rapid development continued until the age of 5. This remarkable developmental phase in the comprehension of contextual meanings may be related to the development of other functions at that age, such as the development of working memory (Oakhill 1984, Gathercole & Baddeley 1993), the development of inferencing skills (Umstead & Leonard 1983, Bucciarelli *et al.* 2003), the ability to direct attention (Buckley 2003), and the ability to understand the mind of others (Wellman & Lagattuta 2000, Wellman *et al.* 2001). Additionally, between the ages of 3 and 4 children gain many new experiences and because of that their world knowledge increases, which directly affects their ability to derive meanings from context (Hudson & Slackman 1990, Milosky 1992, Thompson 1997, Wellman &

Lagattuta 2000). Differences in children's level of experiences may be a reason for the variation found in the age groups of 3 and 4 years. Even though all the 3- and 4-year-old children in this study were in day nurseries, they had different family backgrounds and their experiences of language use in different situations may therefore not have been similar (Becker 1990, Donaldson 1992, Milosky 1992, Robinson 1994). In this study, variation within age groups diminished as the children's age increased, and by the age of 8 variation was no longer evident, so that all children were able to utilise context in inferencing and performed near ceiling when answering all question types. However, it is probable that more sophisticated development of pragmatic comprehension continues into later childhood (Nippold & Rudzinski 1993, Vieiro & García-Madruga 1997).

In this study the content of 3- to 7-year-old children's incorrect answers was also analysed. The categorisation of incorrect answers showed that 'don't know' answers were common for all age groups from 3 to 7 years. 'Don't know' answers were especially common for 6- and 7-year-olds (> 35% of incorrect answers), which might suggest that the older children may be using these answers more commonly because they prefer this to the possibility of giving a wrong answer (see Letts & Leinonen 2001). The 'don't know' strategy may therefore be one way of minimising failure. The other common incorrect answer category for all children was 'knowledge'. This study thus suggests that over-generalisation of own knowledge is common for all 3- to 7-year-old children; in this study, 'knowledge' was an especially common category for children aged 4 and 5. Unsophisticated answer strategies 'irrelevant' and 'tautology' decreased with progressing development, and these strategies were rare in 5-year-old children and very rare in children aged 6 and 7 years. When giving an 'irrelevant' answers, the children seemed to say the first thing that came to their mind, which may suggest that young children may use a *naïve optimism* strategy where they suppose that the first thing that comes to their mind is what the hearer expects to hear (Sperber 1994). In addition to answers classified as 'irrelevant' and 'tautology', another unsophisticated strategy in which the child appeared to show no attempt at utilising the context and did not even take his/her turn was 'no answer'. Unexpectedly, the category 'no answer' decreased only at the age of 7. This finding might be explained by some cultural factors. It appears to be quite typical for Finnish children to remain silent if they do not know the answer. However, more research is needed to address this cultural characteristic as studies involving English-speaking children have not mentioned the silence strategy being by normally developing children.

The investigation of normally developing children's answers provided important information about the development of pragmatic comprehension in Finnish children. The findings are mostly in line with studies of English-speaking children (Letts & Leinonen 2001, Ryder & Leinonen 2003). This suggests that comprehension of pragmatic meaning is not a process linked to a specific language, since it was possible to replicate the developmental pattern found in English children with Finnish children, even if there were some small differences in the recovery of implicature and in the answer types children used when they did not know the answer. Compared to the study by Ryder and Leinonen (2003), in this study it was possible to obtain more developmental information because the children's age distribution was wider and the sample sizes larger.

6.1.2 Development of the ability to explain correct answers in normally developing children

The children who gave correct answers were not always able to provide adequate explanations for their correct answers. Becoming aware of the processes involved in providing an answer requires metacognitive abilities showing how cognition is connected with the development of pragmatic comprehension. According to Eisbach (2004) and Flavell *et al.* (2000), young children have a general insensitivity to their own thinking. Therefore, it might be the case that general insensitivity causes, at least partly, difficulties for children to explain how they arrived at their correct answers.

However, although young children had many difficulties with providing explanations, some of them were able to explain a few of their answers correctly. These correct explanations indicated that for some children the development of metacognitive awareness was already evident between the ages of 3 and 4, but this ability was still very limited. This finding is supported by a study of Bartch and Wellman (1995), who found that a little before the age of 3, children occasionally start to use the verb *think* when spontaneously referring to mental states. Although the development of the awareness of thinking seems to start quite early, it takes many years for the child to become properly aware of the information that he/she has utilised in the comprehension of an utterance, and to be able to verbalise this information (see Letts & Leinonen 2001). In this study, children were fairly competent (< 80%) at explaining correct routine and feeling answers by the age of 8 and implicature answers at the age of 9. This suggests that the development of

the ability to explain how one arrives at a correct answer takes place gradually over time throughout childhood.

When the relationship between correct answers and correct explanations was compared, it was noticed that the relationship between feeling answers and feeling explanations was different from that between answers and explanations for routine and implicature questions. Children aged 5 and more had as many correct explanations for feeling questions as for routine questions. Given, however, that there were many more correct routine answers than feeling answers, the proportion of correct explanations was greater for feeling questions than for routine questions. This meant that for some reason, children were more aware of the information they had used when deriving feeling answers. One explanation for this could be that in everyday life, children have more experience of explaining feelings because they are often asked to explain reasons for their own feelings (e.g. “Why are you sad?”), and parents also quite often verbalise reasons for feelings in their everyday speech.

The content of incorrect explanations showed that, as children got older, they became more conscious of the information they used in their answers, which was seen as an increase in explanations categorised as ‘incorrect focus’ and as a decrease in unsophisticated strategies (irrelevant and tautology). The ‘turn-taking’ category was common for all age groups when explaining correct answers. It may be that children used routine answers, such as *because* or *like that*, in order to fulfil their obligation to provide an explanation. In these cases, we cannot be sure whether the child really knew the explanation, or whether the child assumed that he/she had given a reasonable answer and that the researcher would be able to understand or retrieve the relevant information used in the answer. In other words, it may not be obvious for the child that the answer was not explicit enough in that situation. The ‘no answer’ explanations began to decrease only at the age of 7. This also supports the idea that it might be typical for Finnish children to remain silent if they do not know the answer.

6.2 Performance of children with AS/HFA

6.2.1 Answers to contextually demanding questions in children with AS/HFA

The results of this study support the viewpoint of relevance theory that language skills are not sufficient for understanding the meaning of an utterance, but the

interpretation of an utterance demands an ability to go beyond linguistically given meaning by using and connecting relevant contextual information (Eales 1993, Happé 1993, Sperber & Wilson 1995, Wilson 2000, Sperber & Wilson 2002, Leinonen *et al.* 2003). The findings of this study are in line with earlier studies suggesting that pragmatic comprehension difficulties can be evident in children with AS and HFA even if their linguistic abilities are at normal level (Ramberg *et al.* 1996, Norbury & Bishop 2002).

In this study the older AS/HFA group (10- to 12-year-olds) performed better than the younger AS/HFA group (7- to 9-year-olds) when answering contextually complex questions. This suggests that difficulties in utilising contextual information in comprehension decrease with progressing development. However, as the contextual comprehension abilities of children with AS/HFA develop later compared to normally developing children, important developmental stages may be missed. Therefore, it is possible that the mastery of the complexities involved in pragmatic comprehension may not be complete and that in demanding situations, performance may deteriorate. In children with AS/HFA the pattern of performance on the different question types was approximately the same as predicted by relevance theory using contextual complexity as the basis (Sperber & Wilson 1995, Leinonen *et al.* 2003), and the difference between groups increased in relation to complexity of the questions (see also Dennis *et al.* 2001). Reference assignment questions were not a problem for any of the groups. The younger AS/HFA group had some difficulties with enrichment questions, which targeted the resolution of semantically empty slots of the utterance. Both the younger and the older AS/HFA group had some difficulties with implicature questions, which were contextually the most complex question type and demanded an ability to combine the information given with world knowledge via deduction. In addition, some mild difficulties were found with routine questions, suggesting that children with AS/HFA do not always utilise learned schemas as efficiently as do normally developing children (Hudson & Slackman 1990, Dennis *et al.* 2001).

When the children provided an incorrect answer, these answers were analysed into different categories that reflected where the focus of attention was and to what degree contextual information was used. The results showed that the incorrect answers given by the control children and the children with AS/HFA were mostly similar. The majority of answers by all children tended to fall into two categories, 'incorrect focus' and 'knowledge'. This indicated that when the children's answers were incorrect, they were not totally irrelevant, but the children tried to utilise their

knowledge about the issue, albeit incorrectly, or even if they stayed on the topic, they failed to accurately address the focus of the question.

Despite the fact that children with AS/HFA showed difficulties in processing contextual information, all children were able to answer all the different pragmatic question types, even if this ability was less developed than in the normally developing children. Therefore, the performance of these children indicated deficiencies in pragmatic comprehension abilities and not an inability in the use of context in comprehension, as is also suggested by Jolliffe and Baron-Cohen (2000). It might therefore be that children with AS/HFA have some difficulties with *cognitive principle of relevance*, which means that they are not always focused towards relevant contextual information as efficiently as normally developing children. These difficulties could be caused by weak central coherence and executive dysfunction that make it more difficult to focus towards and choose between relevant contextual factors. In addition, these difficulties might be caused by a lacking mind-reading ability, since knowledge of other people's beliefs and mental states is needed in order to arrive at a relevant interpretation of a speaker's intended meaning (Papp 2006).

6.2.2 Incorrect explanations for correct answers in children with AS/HFA

It was found that children with AS/HFA had difficulties in providing explanations for their initially correct answers, so they were not as conscious of the understanding process as normally developing children. This suggests that their communication problems in real-life situations may be partly due to difficulties in understanding what kind of thought processes the communication partner has to go through to give an answer. These explanation difficulties could reflect specific problems of these children in the comprehension of mental processes (Tager-Flusberg & Sullivan 1994). Thus, it might be that even if a child with AS/HFA succeeds in understanding intentions or emotions, as in the case of feeling questions in this study, problems may arise when understanding demands more sophisticated comprehension of mental processes or understanding of subtle non-verbal emotional cues (Frith *et al.* 1994, Happé 1994, Downs & Smith 2004). This suggests lacking awareness of thought processes underlying language processing.

When the content of incorrect explanations was examined, it was found that compared to the control group, both of the AS/HFA groups had more incorrect explanations in the category 'knowledge' than the control group. This suggests

that when children try to explain their own answers, over-generalisation of their own world knowledge is more typical for the children with AS/HFA than it is for normally developing 7- to 9-year-old children. As compared to the control group, the younger AS/HFA group had more tautological explanations. Although this category was not a dominant category in the younger AS/HFA group, it showed that at least some of these children used this kind of less sophisticated strategy more often than normally developing children when having difficulty with explaining their answers. By repeating an earlier answer or question the child is trying to fulfil his/her obligation to take a turn. Therefore, tautology can be seen as a strategy to survive the communicative demands of the situation (Bogdashina 2005).

6.2.3 Topic drifts after correct answers and explanations in children with AS/HFA

This study showed that after first answering the question correctly, the number of topic drifts was greater in both of the AS/HFA groups when compared to the control group. In these topic drifts there were similarities with the inappropriacy of utterances found earlier in adults with autism (Eales 1993) and children with SPD (Bishop & Adams 1989). In the control group there was only one situation where a child started to explain his experience in an incorrect way after giving a correct answer. Children with AS/HFA had many topic drifts, and these were more common in the younger AS/HFA group as compared to the older AS/HFA group. This suggests that irrelevant answers of this kind diminish during development. The answers where a child with AS/HFA started to tell about his/her experiences were often very long, violating the “rules” of normal communicative behaviour. By the end of the answer there appeared to be no connection with the context of the initial question.

According to relevance theory, all humans have an automatic tendency to search for relevance (see Sperber & Wilson 1995). Therefore, on the basis of relevance theory we could suggest that these topic drifts run counter to the presumption of *optimal relevance*. Even if the child first succeeds in being optimally relevant when deriving an answer from the context, he/she then fails to maintain relevancy. Because people should use only relevant utterances, it can be suggested that these utterances do not follow the communicative principle of relevance. When trying to interpret an answer of this kind, the listener has to use additional cognitive effort in order to understand what the child is trying to convey.

In communicative situations answers of this kind can cause communication to fail, especially when communicating with peers who are not as capable or as willing as adults to do the additional processing necessary for understanding such non-relevant use of language.

This study has shown that some children with AS/HFA have difficulties in being optimally relevant and in stopping processing after they have given a correct answer. However, on the basis of relevance theory (Sperber & Wilson 1995) and earlier studies about ASD (e.g., Eales 1993, Happé 1993, Surian *et al.* 1996) it is possible only to suggest some potential explanations for this phenomenon. Firstly, according to the relevance-theoretic comprehension process, when interpreting utterances, people follow the path of least effort and stop when their interpretation meets their expectations (Sperber & Wilson 1995). On the basis of this study it seems that perhaps due to poor inhibition of train of thoughts, children with AS/HFA have difficulties in stopping processing after deriving a relevant answer. They appear not to recognise that the expectations of relevance has been satisfied and therefore they continue their answer unnecessarily.

Secondly, in order to formulate an optimally relevant answer, the speaker needs the ability to recognise the content of the hearer's mind, such as what the hearer knows about the subject and what the hearer can process at any given point in time (Wilson, 2000, 2005, Sperber & Wilson 2002). There is strong evidence to suggest that difficulties in mind-reading ability belong to ASD (e.g., Baron-Cohen 2000, Tager-Flusberg 2000, Rutherford *et al.* 2002) and that this ability is connected with performance in pragmatic tasks (Happé 1993, Surian *et al.* 1996, Martin & McDonald 2004, Papp 2006). In this study, when children with AS/HFA explained their experiences in an irrelevant way, the answers were often difficult to interpret because the children appeared not to consider, for example, that their everyday life was unknown to the hearer. Therefore, without trying to understand what the other person can process, it is not possible to achieve relevancy of an utterance, as is also suggested by Surian *et al.* (1996) and Papp (2006). Thirdly, it might also be the case that it is not possible to identify what causes topic drifts. According to Perkins (2002, 2005), difficulties in language use are caused by combinations of linguistic, cognitive and senso-motor factors, rather than just one underlying factor responsible for this kind of difficulty.

6.3 Critical appraisal of the study

6.3.1 Methodological considerations

In this study children's answers to contextually demanding questions were investigated in a formal test situation that made it possible to plan contextual factors of the questions in advance. This helped in the scoring and categorising of the children's answers, which was also seen in the interrater reliabilities found in this study. However, because the test set-up was structured and the test questions were based on familiar situations, the context of the questions was not as complicated as it would be in more spontaneous communicative situations, where many challenging contextual factors must be utilised at the same time in rapidly progressing communication. Therefore, it is possible that the test material was not sensitive enough to detect smaller differences between groups. Additionally, the test material contained some weaknesses, which diminishes the generalisability of the results. The material contained different numbers of questions in different question types. However, using percentages in these comparisons compensated for this lack, at least to some extent. In addition, all routine questions were accompanied by pictures, while approximately half of the other questions had pictures.

In this study, categorisation of incorrect answers and explanations was made from the total sum of incorrect answers and explanations, so it does not show whether the increasing information load of different question types affected the children's answer types, as has been suggested by Sahlén and Nettelbladt (1993) in their study of two children with SPD. However, if incorrect answers had been categorised in each contextual question type, it would have yielded sample sizes so small that it would not have been possible to make reliable conclusions about answer type differences between groups. Additionally, there were some limitations with the group comparisons in the study concerning AS/HFA data. Because the 7- to 9-year-old normal children performed near ceiling level, an older control group was not used, and therefore there was no possibility of comparing the older AS/HFA group with normal children of the same age.

6.3.2 Subjects

All typically developing children came from normal day nurseries and mainstream schools. Children's normal language level was checked by asking children's

parents to fill in a preliminary data sheet. In addition, parents of school-age children were asked to complete the ASSQ in order to verify that there were no children with ASD which could affect their performance in these tasks. Normal development and behaviour of younger children were confirmed by their nursery school teachers. In addition, children's language performance was checked using the Boston Naming Test and auditory association subtest (ITPA). It is clear that these two language measurements do not guarantee normal language level. However, the preliminary information of the children's developmental history given by parents compensated for this lack. On the basis of the preliminary information and language tests, 38 children were excluded from this study, leaving 210 children to participate in the study. This meant that about 15% were excluded from the original population (248 children). Because this study was a cross study, each age group comprised different children. With a longitudinal follow-up study it would have been possible to get more accurate developmental information. However, it would have been practically impossible to follow children's development from 3 to 9 years within the limits of this thesis.

The children with AS/HFA were part of a broader multidisciplinary study entitled A Genetic Study of Asperger's Syndrome in Northern Finland led by Professor Irma Moilanen at the University of Oulu. In this broader study, diagnoses of children with AS/HFA were carefully checked and assigned using ICD-10 criteria by a paediatrician or a psychologist, both experienced in the field of PDD, consulting other specialists in the cases where second opinion was needed. Even though the researcher of this study (a speech and language therapist) was not engaged in the diagnostic process of these children, from the numerous discussions with the paediatrician and the psychologist it was evident that a differential diagnosis between AS and HFA was not always clear, as has also been argued by many recent studies (e.g., Howlin 2003, Frith 2005, Lewis 2007). In this study, two diagnoses were combined (AS/HFA), as was also done, for example, in the study by Dennis *et al.* (2001) where inferential language skills of children with AS/HFA were studied. The current language level of these children was verified to be normal by the Boston Naming Test, by the auditory association subtest (ITPA) and by three subtests of the NEPSY that assess linguistic understanding and memory. The cognitive level (IQ) of the children was checked from their case histories. On the basis of these measurements it was clear that there were no children with AS/HFA with severe language difficulties in this study. However, there were some linguistically able children, and the children with AS/HFA were thus heterogeneous in their language level (VIQ varied from 84 to 152). It may be

that linguistically talented children were more able to use compensatory strategies in demanding tasks, which helped them in their performance (Happé 1994, Bogdashina 2005, Fisher *et al.* 2005).

6.3.3 Theoretical framework

In Finland there are no children's language tests for speech and language therapists for exploring contextual/pragmatic comprehension. Tests used by speech and language therapists mostly measure vocabulary, concepts and the understanding of grammatical structures. As a result, significant comprehension difficulties in everyday communication situations may be described by the parents of a child, but according to tests the child's comprehension abilities are at normal level. This is frustrating both for the parents and the speech and language therapist. Fortunately, nowadays, most speech and language therapists are aware of the pragmatic aspect of comprehension and if parents describe that children have comprehension difficulties, but these cannot be detected by tests, they suspect pragmatic comprehension difficulties. In addition to the lack of tests, there is also limited knowledge of the development of normal pragmatic comprehension, which causes additional difficulties when there is a need to assess whether the child's abilities are at normal level or whether development is delayed or deviant. Also, it is not clear whether studies from different countries and cultures can be generalised, so studies about different languages and cultural backgrounds are also needed (Lloyd *et al.* 1995, Adams 2002).

In this study the aim was to use a consistent analytical framework. Relevance theory was chosen, firstly, because it has earlier been utilised in studies concerning development and difficulties of pragmatic comprehension (Happé 1993, Leinonen & Kerbel 1999, Leinonen *et al.* 2003, Ryder & Leinonen 2003) and, secondly, because it is a cognitively oriented model and it has been suggested that there might be underlying cognitive functions behind the pragmatic difficulties of children with PDD (Baron-Cohen 1988, Shields *et al.* 1996).

Using the framework of relevance theory, test questions with varying contextual demands were developed. Although the questions were designed for this study, the materials of earlier studies investigating pragmatic comprehension had an influence on the materials of this study (Happé 1993, Letts & Leinonen 2001, Ryder & Leinonen 2003). It was challenging to formulate questions to examine pragmatic processing skills so that they were suitable for a wide age range of Finnish children. The verbal scenarios were as simple as possible and the

vocabulary used in questions was designed to be sufficiently easy so that even young children would know them. However, it is possible that at least in the group of 3-year-olds there were children who did not understand all the words of the test material, which then affected their performance. In order to diminish the effect of memory load, the verbal scenarios were designed to be short. However, again, it may be that in some questions, memory load was too high for some young children, causing difficulties in comprehension. When analysis of the children's answers began, it became clear that the material contained some questions that the children interpreted differently from what was expected, and these questions were therefore excluded from the final analysis.

The concept of relevance can be seen to be complicated. It can be that the child's answer is relevant to himself/herself, but not relevant to the hearer. However, in the relevance theoretic framework it is supposed that the speaker only uses utterances that are relevant to the hearer and when answering question he/she utilises relevant contextual factors only. Thus, it is not speculated here whether the answer could somehow be relevant to the speaker since, for instance, a child with AS/HFA may consider different kinds of things to be meaningful for himself/herself than the hearer could expect. In addition, young children can have a different kind of idea of what is relevant in answering and explaining. In this study, a structured test situation and test material helped when assessing whether the child's answer was relevant or not in the particular context. If the situation had been more natural, it would have been more difficult to determine the relevancy of the children's answers.

With the exception of enrichment questions, the different question types were relatively easy to classify according to their processing demands. Answering enrichment questions also demands a fair amount of contextual processing and the use of inferencing skills. Thus, it was not always clear how enrichment questions were different from implicature questions.

All in all, the relevance theory framework worked well when contextual/pragmatic comprehension of children was studied. Relevance theory helped to identify factors which affect the relevancy of an utterance. An utterance's relevancy can diminish, for example, due to utilisation of irrelevant contextual factors, failure to address the focus of the question, or lack of ability to stop processing after deriving a correct answer. However, when using relevance theory in studies concerning children's development and disordered language, it is good to bear in mind that it is a cognitively oriented theory and that it does not take into account social dimensions of language as strongly as could be desired. Answering

contextually demanding questions has been the main point of this study. However, if children's pragmatic performance had been investigated more widely in non-structural communication situations, relevance theory alone would not have been sufficient when describing pragmatic performance. Relevance theory sees that in pragmatics, grammar interacts with logic and memory. However, it does not take into cognisance the role of the whole linguistic system in this process and thus on the basis of the relevance theory, it is difficult to describe secondary pragmatic impairment caused by linguistic dysfunction, for example (see Perkins, 2002).

6.4 Clinical Implications

In clinical work it is important to know how normal development progresses because without information about normal development, it is difficult to determine when development is within normal range, delayed or deviant. Thus, the results of the normally developing children provide important data about the development of pragmatic comprehension in Finnish children. These data about normally developing children may help clinicians and others looking at delayed or deviant pragmatic language. Compared to the earlier studies about children's ability to use context in comprehension, the strength of this study is the wide age range of the children, which makes it possible to see developmental changes during childhood years. Almost all earlier studies have used English-speaking children, whereas this study provides information about children coming from a different language background and culture (see Adams 2002).

The ability to process contextual information can be seen to be important in many aspects of an individual's life. Miscommunication can result in peer discrimination and is often one of the reasons for the social problems seen in individuals with AS and HFA (Landa 2000, Fleisher 2001). In everyday classroom situations the context and continuity of discourse constitute a complex communication challenge. A child also has to learn to communicate in socially accepted ways. This means that he/she has to understand the meanings of utterances and use conventional ways when expressing his/her answer to questions (Edwards & Mercer 1986). Because of the pragmatic difficulties this may not be easy for all children with AS/HFA.

On the basis of this study it can be suggested that in communication therapy of children with AS/HFA it would be useful to focus on how to utilise and connect various types of contextual information. Even though this ability was not "automatic" for all the children all of the time, the answers of the children showed

that they were able to use contextual information appropriately in many instances. This gives useful information to build on in communication therapy. Incorrect answers given by these children demonstrated an attempt to utilise contextual information. In clinical management, it is common to provide children with AS/HFA with very structured linguistic environments, minimising variability and ambiguity. These methods have been found to be successful from the perspective of those communicating with the child. However, this study suggests that these children were able to engage in some complex contextual processing and that they had building blocks which would enable them to learn to process increasingly complex contextual data. Thus, if a child has difficulties in understanding contextual meaning, it may be helpful to explain what the intended meaning is and how it can be derived, rather than to change the language expression to one requiring less contextual processing. In addition, in communication therapy it might be helpful for children to focus on how to modify language use according to situation in order to show how different situational and cultural demands differ in communicative situations and how the world knowledge of other people differs from one's own knowledge of the world. It also seems important that children with AS/HFA receive constructive feedback about their own inadequate utterances that they can utilise when formulating utterances in future communicative situations. Finally, on the basis of information about normal development of pragmatic comprehension and information about differences between two age groups of children with AS/HFA, it can be suggested that rehabilitation of pragmatic comprehension abilities should start as soon as a child's difficulties in context use are noticed in order to give support during his/her developmentally important years. However, because development still seems to progress during the years between 7 and 12, the child can still benefit from rehabilitation if it is directed at the developmentally sensitive areas.

In future, the research material developed for this study can be utilised in the clinical work of speech and language therapists in Finland because the study of the normally developing children gives important information about 3- to 9-year-old normally developing children's performance on these questions. The lack of material that explores pragmatic comprehension is problematic. Current tests provide information about linguistic comprehension, while the pragmatic aspect of comprehension is often omitted from investigation. Observing a child's comprehension abilities in natural situations would yield information about pragmatic comprehension, but it is very time-consuming and thus often remains quite minimal.

6.5 Future research

The present study yields a basic developmental trend about Finnish-speaking children's ability to answer pragmatically/contextually demanding questions. In this study questions were classified into different question types and the context of the questions was kept simple. However, in the future it would be interesting to study answers to implicature questions in more detail. It is known that all implicatures are not as demanding, so it would be interesting to study children's answers to implicature questions with different contextual demands and processing loads. This would give information about how contextual complexity affects comprehension and how big an inferencing load children of different ages are able to process from. It would also be interesting to study in more detail children's ability to explain their answers. It is not well known when children's ability to explain their answers develops and when they start to become conscious of their understanding process, so there is still a need for basic developmental research in this area. In this study it was found that children explained their answers correctly more often when answering feeling questions as compared to implicature and routine questions. Thus, a more detailed study would enable us to explore why children are more able to explain their answers to feeling questions than other question types. In order to increase knowledge about universal and language/culture-bound features of pragmatic comprehension development, studies about different languages and cultural backgrounds are also needed. However, rather than performing separate studies in different language communities, it would be better to do simultaneous studies with similar study participants and materials in order to get more reliable information about similarities and differences in development.

Most of the studies concerning AS or HFA have used adults or adolescents, so there is still a need for studies to explore children's developmental traits. It would be beneficial to study pragmatic comprehension abilities of children with AS/HFA as early as possible. In addition, there is a need for longitudinal studies to follow up the developmental changes in the pragmatic language comprehension of individual children. Only by studying developmental phases of abnormal development it is possible to understand how different developmental pathways might cause different phenotypical outcomes (see also Karmiloff-Smith 1998). These studies should use materials that contain questions with subtle contextual cues in order to also detect smaller weaknesses in pragmatic comprehension.

In this study it was noticed that in normally developing children visual support affected their ability to answer questions, so in the future, it would be beneficial to study the effect of visual context in children with AS/HFA. Many therapy programmes for children with PDD are based on the use of strong visual support, so it would be important to study how great the effect of visual support is in the comprehension of these children and how much increased visual support can compensate for comprehension difficulties. However, it is good to bear in mind that there is not always strong visual contextual support available in everyday communication situations, and thus, it is also important to study children's performance in situations where visual contextual support is minimal.

Many studies have shown the connection between mind-reading ability and pragmatic abilities (e.g., Happé 1993, Surian *et al.* 1996). It would also be beneficial to study in more detail the connection between pragmatic comprehension abilities and other cognitive, social and language functions in children with AS/HFA. Especially, it would be interesting to study individual children's pragmatic, emotional, social, language and cognitive abilities in order to find out what developmental areas are most problematic and how the different developmental areas interact. It has been found that boys with AS start to fear negative evaluation from peers and start to avoid social situations when getting older (Kuusikko 2004); it would thus be interesting to study whether this happens at the same time when children with AS/HFA start to realise that communication situations are not always unambiguous and that they sometimes have difficulties in comprehending the meaning of an utterance by utilising contextual information. Finally, the framework used in this study could also offer a consistent background for developing rehabilitation material for pragmatic comprehension.

6.6 Conclusions

It has been useful to utilise relevance theory as a theoretical framework as it has been shown how development of pragmatic comprehension progresses between the ages of 3 and 9, how pragmatic processing load affects children's ability to comprehend language and what kind of difficulties children with AS/HFA have in pragmatic language comprehension. This is the first study to use relevance theory in non-English children when studying development of pragmatic comprehension and skills of children with AS/HFA. This study has shown that in pragmatic comprehension, similar developmental trends exist in both Finnish and English language context. However, there may be some cultural differences in the use of

different answering and explanation strategies. In future, the material developed in this study can be utilised in clinical assessment and management in the population of Finnish children with delayed or deviant pragmatic language development.

References

- Adams C (2002) Practitioner review: The assessment of language pragmatics. *Journal of Child Psychology and Psychiatry* 43: 973–987.
- Adams C, Green J, Gilchrist A & Cox A (2002) Conversational behaviour of children with Asperger syndrome and conduct disorder. *Journal of Child Psychology and Psychiatry* 43: 679–690.
- Anselmi D, Tomasello M & Acunzo M (1986) Young children's responses to neutral and specific contingent queries. *Journal of Child Language* 13: 135–144.
- Attwood T (1998) *Asperger's Syndrome: A Guide for Parents and Professionals*. Jessica Kingsley Publishers, London.
- Austin JL (1962) *How to Do Things with Words*. Oxford University Press, Oxford, UK.
- Baddeley AD (1996) The concept of working memory. In: Gathercole SE (ed) *Models of Short-Term Memory*. Psychology Press, Hove, UK, 1–27.
- Bara BG, Bosco FM & Bucciarelli M (1999) Developmental pragmatics in normal and abnormal children. *Brain and Language* 68: 507–528.
- Baron-Cohen S (1988) Social and pragmatic deficits in autism: Cognitive or affective? *Journal of Autism and Developmental Disorders* 18: 379–402.
- Baron-Cohen S (1995) *Mindblindness: An Essay on Autism and Theory of Mind*. The MIT Press, Cambridge, UK.
- Baron-Cohen S (2000) Theory of mind and autism: A fifteen year review. In: Baron-Cohen S, Tager-Flusberg H & Cohen DJ (eds) *Understanding Other Minds: Perspectives from Developmental Cognitive Neuroscience* (2nd ed). Oxford University Press, Oxford, UK, 3–20.
- Bartsch K & Wellman HM (1995) *Children Talk about the Mind*. Oxford University Press, New York.
- Beaumont R & Newcombe P (2006) Theory of mind and central coherence in adults with high-functioning autism or Asperger syndrome. *Autism* 10: 365–82.
- Becker JA (1990) Processes in the acquisition of pragmatic competence. In: Conti-Ramsden G & Snow CE (eds) *Children's Language*. Volume 7. Lawrence Erlbaum Associates, Hillsdale, NJ, 7–24.
- Bellon-Harn ML & Harn WE (2006) Profiles of social communicative competence in middle school children with Asperger syndrome: Two case studies. *Child Language Teaching and Therapy* 22: 1–26.
- Bezuidenhout A & Sroda MS (1998) Children's use of contextual cues to resolve referential ambiguity: An application of relevance theory. *Pragmatics and Cognition* 6: 265–299.

- Bíró S & Russell J (2001) The execution of arbitrary procedures by children with autism. *Development and Psychopathology* 13: 97–110.
- Bishop DVM (1997) *Uncommon Understanding*. Psychology Press, Hove, UK.
- Bishop DVM & Adams C (1989) Conversational characteristics of children with semantic-pragmatic disorder. II: What features lead to a judgement of inappropriacy? *British Journal of Disorders of Communication* 24: 241–263.
- Bishop DVM & Norbury CF (2002). Exploring the borderlands of autistic disorder and specific language impairment: A study of using standardised diagnostic instruments. *Journal of Child Psychology and Psychiatry* 43: 917–929.
- Blakemore D (1992) *Understanding Utterances: An Introduction to Pragmatics*. Blackwell, Oxford, UK.
- Bloom P & German TP (2000) Two reasons to abandon the false belief task as a test of theory of mind. *Cognition* 77: B25–B31.
- Blåfield L & Kuusinen J (1974) Suomalaisen ITPA:n psykometriset ominaisuudet. [Psychometric features of Finnish ITPA test]. *Kasvatustieteiden tutkimuslaitoksen julkaisu* 241. Jyväskylän yliopisto, Jyväskylä, Finland.
- Bogdashina O (2005) *Communication Issues in Autism and Asperger Syndrome – Do We Speak the Same Language?* Jessica Kingsley Publishers, London.
- Bucciarelli M, Colle L & Bara BG (2003) How children comprehend speech acts and communicative gestures. *Journal of Pragmatics* 35: 207–241.
- Buckley B (2003) *Children’s Communication Skills: From Birth to Five Years*. Routledge, London.
- Cain K & Oakhill JV (1999) Inference making ability and its relation to comprehension failure in young children. *Reading and Writing* 11: 489–503.
- Cain K, Oakhill JV, Barnes M & Bryant PE (2001) Comprehension skill, inference making ability, and their relation to knowledge. *Memory & Cognition* 29: 850–859.
- Catania AC (1992) *Learning* (3rd ed). Prentice-Hall, Englewood Cliffs, NJ.
- Christensen AL (1975) *Luria’s Neuropsychological Investigation*. Munksgaard, Copenhagen, Denmark.
- Cohen G (1989) *Memory in the Real World*. Lawrence Erlbaum Associates, Hove, UK.
- Damico JS & Nelson RL (2005) Interpreting problematic behaviour: Systematic compensatory adaptations as emergent behaviour in autism. *Clinical Linguistics & Phonetics* 19: 405–417.
- Dennis M, Lazenby AL & Lockyer L (2001) Inferential language in high-function children with autism. *Journal of Autism and Developmental Disorders* 31: 47–54.

- Diehl JJ, Bennetto L & Young EC (2006) Story recall and narrative coherence of high-functioning children with autism spectrum disorders. *Journal of Abnormal Child Psychology* 34: 83–98.
- Donaldson M (1978) *Children's Minds*. Fontana, London.
- Donaldson M (1992) *Human Minds: An Exploration*. Allen Lane, London.
- Donaldson ML (1986) *Children's Explanations: A Psycholinguistic Study*. Cambridge University Press, Cambridge, UK.
- Downs A & Smith T (2004) Emotional understanding, cooperation, and social behavior in high-functioning children with autism. *Journal of Autism and Developmental Disorders* 34: 625–635.
- Eales MJ (1993) Pragmatic impairments in adults with childhood diagnoses of autism or developmental receptive language disorder. *Journal of Autism and Developmental Disorders* 23: 593–617.
- Edwards D & Mercer N (1986) Context and continuity: Classroom discourse and the development of shared knowledge. In Durkin K (ed) *Language Development in School Years*. Croom Helm, London, 172–203.
- Ehlers S & Gillberg C (1993) The epidemiology of Asperger syndrome. A total population study. *Journal of Child Psychology and Psychiatry* 34: 1327–1350.
- Ehlers S, Gillberg C & Wing L (1999) A screening questionnaire for Asperger syndrome and other high-functioning autism spectrum disorders in school age children. *Journal of Autism and Developmental Disorders* 29: 129–141.
- Eisbach AO (2004) Children's developing awareness of diversity in people's trains of thought. *Child Development* 75: 1694–1707.
- Eisenmajer R, Prior M, Leekam S, Wing L, Gould J, Welham M & Ong B (1996) Comparison of clinical symptoms in autism and Asperger's disorder. *Journal of the American Academy of Child and Adolescent Psychiatry* 35: 1523–1531.
- Eisenmajer R, Prior M, Leekam S, Wing L, Ong B, Gould J & Welham M (1998) Delayed language onset as a predictor of clinical symptoms in pervasive developmental disorders. *Journal of Autism and Developmental Disorders* 28: 527–533.
- Elrod MM (1987) Children's understanding of indirect request. *Journal of Genetic Psychology* 148: 63–70.
- Emerich DM, Creaghead NA, Grether SM, Murray D & Grasha C (2003) The comprehension of humorous materials by adolescents with high-functioning autism and Asperger's syndrome. *Journal of Autism and Developmental Disorders* 33: 253–257.
- Ervin-Tripp SM (1996) Context in language. In: Slobin DI, Gerhardt J, Kyratzis A & Guo J (eds) *Social Interaction, Social Context, and Language*. Lawrence Erlbaum Associates, Mahwah, NJ, 21–36.

- Eson ME & Shapiro AS (1982) When 'don't' means 'do': pragmatic and cognitive development in understanding an indirect imperative. *First Language* 3: 83–91.
- Fine J, Bartolucci G, Szatmari P & Ginsberg G (1994) Cohesive discourse in pervasive developmental disorders. *Journal of Autism and Developmental Disorders* 24: 315–329.
- Fisher N, Happé F & Dunn J (2005) The relationship between vocabulary, grammar, and the false belief task performance in children with autistic spectrum disorders and children with moderate learning difficulties. *Journal of Child Psychology and Psychiatry* 46: 409–419.
- Flavell JH, Green FL & Flavell ER (2000) Development of children's awareness of their own thoughts. *Journal of Cognition and Development* 1: 97–112.
- Fleisher M (2001) Autism: an inside view. In: Richer J & Coates S (eds) *Autism: The Search for Coherence*. Jessica Kingsley Publishers, London, 322–328.
- Foster-Cohen S (2000) Relevance theory and language acquisition: a productive paradigm shift? *Child Language Bulletin* 20: 5–8.
- Foster-Cohen S (2004) Relevance Theory, Action Theory and second language communication strategies. *Second Language Research* 20: 289–302.
- Frith U (2004) Emanuel Miller lecture: Confusions and controversies about Asperger syndrome. *Journal of Child Psychology and Psychiatry* 45: 672–686.
- Frith U, Happé F & Siddons F (1994) Autism and theory of mind in everyday life. *Social Development* 3: 108–124.
- Gathercole SE & Baddeley AD (1993) *Working Memory and Language*. Lawrence Erlbaum Associates, Hove, UK.
- Gersten RM (1980) In search of the cognitive deficit in autism: beyond the stimulus overselectivity model. *The Journal of Special Education* 14: 47–65.
- Geurts HM, Verte S, Oosterlaan J, Roeyers H, Hartman CA, Mulder EJ, van Berckelaer-Onnes IA & Sergeant JA (2004) Can the Children's Communication Checklist differentiate between children with autism, children with ADHD, and normal controls? *Journal of Child Psychology and Psychiatry* 45: 1437–1453.
- Gibbs Jr RW & Moise JF (1997) Pragmatics in understanding what is said. *Cognition* 62: 51–74.
- Gilchrist A, Green J, Cox A, Burton D, Rutter M & Le Couter A (2001) Development and current functioning in adolescents with Asperger syndrome: A comparative study. *Journal of Child Psychology and Psychiatry* 42: 227–240.
- Gillam RB & Bedore LM (2000) Language science. In: Gillam RB, Marquardt TP & Martin FN (eds) *Communication Sciences and Disorders: From Science to Clinical Practice*. Singular Publishing Club, Thomson Learning, San Diego, CA, 385–408.
- Grice HP (1969) Utterer's meaning and intentions. *Philosophical Review* 78: 147–177.

- Grice HP (1975) Logic and conversation. In: Cole P & Morgan JL (eds) *Syntax and Semantics*. Volume 3: *Speech Acts*. Academic Press, San Diego, CA, 41–58.
- Happé FGE (1993) Communicative competence and theory of mind in autism. A test of relevance theory. *Cognition* 48: 101–109.
- Happé FGE (1994) *Autism: An Introduction to Psychological Theory*. UCL Press, London.
- Happé FGE (1995) Understanding minds and metaphors: Insight from the study of figurative language in autism. *Metaphor and Symbolic Activity* 10: 275–295.
- Hassibi M & Breuer Jr H (1980) *Disordered Thinking and Communication in Children*. Plenum Press, New York.
- Hewitt LE (1998) Influence of question type on response adequacy in young adults with autism. *Journal of Communication Disorders* 31: 135–152.
- Hill EL (2004) Executive dysfunction in autism. *Trends in Cognitive Sciences* 8: 26–32.
- Hippler K & Klicpera C (2003) A retrospective analysis of the clinical case records of 'autistic psychopaths' diagnosed by Hans Asperger and his team at the University Children's hospital, Vienna. *Philosophical Transactions of the Royal Society of London B* 358: 291–301.
- Howlin P (2003) Outcome in high-functioning adults with autism with and without early language delays: Implication for the differentiation between autism and Asperger Syndrome. *Journal of Autism and Developmental Disorders* 33: 3–13.
- Hudson J & Nelson K (1983) Effects of script structure on children's story recall. *Developmental Psychology* 19: 625–635.
- Hudson JA & Slackman EA (1990) Children's use of scripts in inferential text processing. *Discourse Processes* 13: 375–386.
- Jaswal VK & Markman EM (2001) Learning proper and common names in inferential versus ostensive contexts. *Child Development* 72: 768–786.
- Jolliffe T & Baron-Cohen S (1999a) The Strange Story Test: A replication with high-functioning adults with autism or Asperger syndrome. *Journal of Autism and Developmental Disorders* 29: 395–406.
- Jolliffe T & Baron-Cohen S (1999b) A test of central coherence theory: linguistic processing in high-functioning adults with autism or Asperger syndrome: Is local coherence impaired? *Cognition* 71: 149–185.
- Jolliffe T & Baron-Cohen S (2000) Linguistic processing in high-functioning adults with autism or Asperger's syndrome: Is global coherence impaired? *Psychological Medicine* 30: 1169–1187.
- Kaland N, Møller-Nielsen A, Callesen K, Mortensen EL, Gottlieb D & Smith L (2002) A new 'advanced' test of theory of mind: evidence from children and adolescents with Asperger syndrome. *Journal of Child Psychology and Psychiatry* 43: 517–528.

- Kaplan EF, Goodglass H & Weintraub S (1983) *The Boston Naming Test* (2nd ed). Lea & Febiger, Philadelphia.
- Karmiloff-Smith A (1986) Some fundamental aspects of language development after age 5. In: Fletcher P & Garman M (eds) *Language Acquisition: Studies in First Language Development* (2nd ed). Cambridge University Press, Cambridge, UK, 455–474.
- Karmiloff-Smith A (1998) Development itself is the key to understanding developmental disorders. *Review. Trends in Cognitive Sciences* 2: 389–398.
- Kerbel D & Grunwell P (1998) A study of idiom comprehension in children with semantic-pragmatic difficulties. Part II: Between-groups results and discussion. *International Journal of Language and Communication Disorders* 33: 23–44.
- Kirk SA, McCarthy JD & Kirk WS (1968) *Illinois Test of Psycholinguistic Abilities (ITPA)*. University of Illinois Press, Urbana, IL.
- Klin A, Sparrow SS, Marans WD, Carter A & Volkmar FR (2000) Assessment issues in children and adolescents with Asperger syndrome. In: Klin A, Volkmar FR & Sparrow SS (eds) *Asperger Syndrome*. The Guilford Press, New York, 309–339.
- Klippi A (1995) Konteksti logopedisessa tutkimuksessa. Afasiavuorovaikutuksen kielioppia etsimässä [Context in logopedic research. Searching for the grammar of aphasic interaction]. *Suomen logopedis-foniatrinen aikakauslehti* 15: 97–109.
- Koegel RL, Rincover A & Egel AL (1982) *Educating and Understanding Autistic Children*. College-Hill, San Diego, CA.
- Korkman M (2000) NEPSY: Lasten neuropsykologinen tutkimus, käsikirja II. Testin tausta ja soveltaminen. [The NEPSY: Children's Neuropsychological Investigation, manual II. Background of the test and application]. Psykologien kustannus Oy, Helsinki, Finland.
- Korkman M, Kirk U & Kemp SL (1997) NEPSY: Lasten neuropsykologinen tutkimus. [The NEPSY: Children's neuropsychological investigation]. Psykologien kustannus Oy, Helsinki, Finland.
- Kuusikko S (2004) Experienced social anxiety in Finnish children with Asperger syndrome. Master's thesis. Department of Psychology, University of Jyväskylä, Finland.
- Laine M, Goodglass H, Niemi J, Koivuselkä-Sallinen P, Tuomainen J & Marttila R (1993) Adaptation of the Boston Diagnostic Aphasia Examination and the Boston Naming Test into Finnish. *Scandinavian Journal of Logopedics and Phoniatics* 18: 83–92.
- Laine M, Koivuselkä-Sallinen P, Hänninen R & Niemi J (1997) Bostonin nimentätesti [The Boston Naming Test]. Psykologien Kustannus Oy, Helsinki, Finland.
- Landa R (2000) Social language use in Asperger syndrome and high-functioning autism. In: Klin A, Volkmar FR & Sparrow SS (eds) *Asperger Syndrome*. The Guilford Press, New York, 125–155.

- Leinonen E & Kerbel D (1999) Relevance theory and pragmatic impairment. *International Journal of Language and Communication Disorders* 34: 367–390.
- Leinonen E, Letts C & Smith BR (2000) *Children's Pragmatic Communication Difficulties*. Whurr Publishers, London.
- Leinonen E, Ryder N, Ellis M & Hammond C (2003) The use of context in pragmatic comprehension by specifically language-impaired and control children. *Linguistics* 41–2: 407–423.
- Letts C & Leinonen E (2001) Comprehension of inferential meaning in language-impaired and language normal children. *International Journal of Language and Communication Disorder* 36: 307–328.
- Lewis FM, Murdoch BE & Woodyatt GC (2007) Linguistic abilities in children with autism spectrum disorders. *Research in Autism Spectrum Disorders* 1: 85–100.
- Lloyd P, Camaioni L & Ecolani P (1995) Assessing referential communication skills in the primary school years: A comparative study. *British Journal of Developmental Psychology* 13: 13–29.
- Losh M & Capps L (2003) Narrative ability in high-functioning children with autism or Asperger syndrome. *Journal of Autism and Developmental Disorders* 33: 239–251.
- Lord C, Rutter M, DiLavore PC & Risi S (2000) *Autism Diagnostic Observation Schedule (ADOS)*. Western Psychological Services, Los Angeles.
- Lord C, Rutter M & LeCouter A (1995). *Autism Diagnostic Interview-Revised* (3rd ed). Western Psychological Services, Los Angeles.
- Lovaas OI & Schreibman L (1971) Stimulus overselectivity of autistic children in a two stimulus situation. *Behaviour Research and Therapy* 9: 305–310.
- Maratsos MP 1973 Nonegocentric communication abilities in preschool children. *Child Development* 44: 697–700.
- Marinac JV & Ozanne AE (1999) Comprehension strategies: The bridge between literal and discourse understanding. *Child Language Teaching and Therapy* 15: 233–246.
- Marmaridou SSA (2000) *Pragmatic Meaning and Cognition*. John Benjamins Publishing Co, Amsterdam.
- Martin I & McDonald S (2004) An exploration of causes of non non-literal language problems in individuals with Asperger syndrome. *Journal of Autism and Developmental Disorders* 34: 311–328.
- Matthews B, Shute R & Rees R (2001) An analysis of stimulus overselectivity in adults with autism. *Journal of Intellectual & Developmental Disability* 26: 161–176.

- Mattila ML, Kielinen M, Jussila K, Linna SL, Bloigu R, Ebeling H & Moilanen I (2007) An epidemiological and diagnostic study of Asperger syndrome according to four sets of diagnostic criteria. *Journal of the American Academy of Child & Adolescent Psychiatry* 46: 636–646.
- Mattila ML, Kielinen M, Linna SL, Ebeling H & Moilanen I (2001) Asperger syndrome project in Northern Ostrobothnia Hospital District: Preliminary results from the screening by ASSQ. *International Journal of Circumpolar Health* 60, Suppl 1: 66.
- Mayes SD & Calhoun SL (2001) Non-significance of early speech delay in children with autism and normal intelligence and implications for DSM-IV Asperger's disorder. *Autism* 5: 81–94.
- McTear MF & Conti-Ramsden G (1992) *Pragmatic Disability in Children*. Whurr Publishers, London.
- Mercer N (2000) *Words and Minds: How We Use Language to Think Together*. Routledge, London.
- Milosky LM (1992) Children listening: The role of world knowledge in language comprehension. In: Chapman RS (ed) *Processes in Language Acquisition and Disorders*. Mosby-Year Book, St Louis, MO, 20–44.
- Minshew NJ, Goldstein G & Siegel DJ (1995) Speech and language in high-functioning autistic individuals. *Neuropsychology* 9: 255–261.
- Muris P, Steerneman P, Meesters C, Merckelbach H, Horselenberg R, van den Hogen T & van Tongen L (1999) The TOM test: A new instrument for assessing theory of mind in normal children and children with pervasive developmental disorders. *Journal of Autism and Developmental Disorders* 29: 67–80.
- Nelson K (1978) How children represent knowledge of their world in and out of language: A preliminary report. In: Siegler RS (ed) *Children's Thinking*. Lawrence Erlbaum Associates, Hillsdale, NJ, 255–273.
- Nelson K (1996) *Language in cognitive development. The emergence of the mediated mind*. Cambridge University Press, Cambridge, UK.
- Nippold MA & Rudzinski M (1993) Familiarity and transparency in idiom explanation: A developmental study of children and adolescents. *Journal of Speech and Hearing Research* 36: 728–737.
- Noens ILJ & van Berckelaer-Onnes IA (2005) Captured by details: sense-making, language and communication in autism. *Journal of Communication Disorders* 38: 123–141.
- Norbury CF & Bishop DVM (2002) Inferential processing and story recall in children with communication problems: a comparison of specific language impairment, pragmatic language impairment and high-functioning autism. *International Journal of Language and Communication Disorders* 37: 227–251.

- Oakhill J (1984) Inferential and memory skills in children's comprehension of stories. *British Journal of Educational Psychology* 54: 31–39.
- Oakhill J & Yuill N (1986) Pronoun resolution in skilled and less-skilled comprehenders: Effects of memory load and inferential complexity. *Language and Speech* 29: 25–37.
- O'Neill DK (1996) Two-year-old children's sensitivity to a parent's knowledge state when making request. *Child Development* 67: 659–677.
- Ozonoff S & Griffith EM (2000) Neuropsychological function and the external validity of Asperger syndrome. In: Klin A, Volkmar FR & Sparrow SS (eds) *Asperger Syndrome*. The Guilford Press, New York, 72–96.
- Ozonoff S & Miller JN (1996) An exploration of right-hemisphere contributions to the pragmatic impairments of autism. *Brain and Language* 52: 411–434.
- Papp S (2006) A relevance-theoretic account of the development and deficits of theory of mind in normally developing children and individuals with autism. *Theory & Psychology* 16: 141–161.
- Paul R, Augustyn A, Klin A & Volkmar FR (2005) Perception and production of prosody by speakers with autism spectrum disorders. *Journal of Autism and Developmental Disorders* 35: 205–220.
- Perkins MR (2002) An emergentist approach to clinical pragmatics. In: Windsor FM, Louise K & Hewlett N (eds) *Investigations in Clinical Phonetics and Linguistics*. Lawrence Erlbaum Associates, New York, 1–14.
- Perkins MR (2005) Pragmatic ability and disability as emergent phenomena. *Clinical Linguistics & Phonetics* 19: 367–377.
- Pillow BH (1999) Children's understanding of inferential knowledge. *Journal of Genetic Psychology* 160: 419–428.
- Prutting CA (1982). Pragmatics as social competence. *Journal of Speech and Hearing Disorders* 47: 123–134.
- Quinn B & Malone A (2000) *Pervasive Developmental Disorder: An Altered Perspective*. Jessica Kingsley Publishers, London.
- Ramberg C, Ehlers S, Nydén A, Johansson M & Gillberg C (1996) Language and pragmatic functions in school-age children on the autism spectrum. *European Journal of Disorders of Communication* 31: 387–414.
- Rapin I & Dunn M (2003) Update on the language disorders of individuals on the autistic spectrum. Review article. *Brain & Development* 25: 166–172.
- Robinson EJ (1994) What people say, what they think, and what is really the case: Children's understanding of utterances as sources of knowledge. In: Lewis C & Mitchell P (eds) *Children's Early Understanding of Mind: Origins and Development*. Lawrence Erlbaum Associates, Hove, UK, 355–381.

- Robinson EJ & Whittaker SJ (1987). Children's conceptions of relations between messages, meanings and reality. *British Journal of Developmental Psychology* 5: 81–90.
- Rutherford MD, Baron-Cohen S & Wheelwright S (2002) Reading the mind in the voice: A study with normal adults with Asperger syndrome and high functioning autism. *Journal of Autism and Developmental Disorders* 32: 189–194.
- Ryder N & Leinonen E (2003) Use of context in question answering by 3-, 4- and 5-year-old children. *Journal of Psycholinguistic Research* 32: 397–415.
- Ryder N, Leinonen E & Schulz JA (in press) Cognitive approach to assessing pragmatic language comprehension in children with specific language impairment. *International Journal of Language & Communication Disorders*.
- Sahlén B & Nettelbladt U (1993) Context and comprehension: A neurolinguistic and interactional approach to the understanding of semantic-pragmatic disorder. *European Journal of Disorders of Communication* 28: 117–140.
- Schank RC (1986) *Explanation Patterns: Understanding Mechanically and Creatively*. Lawrence Erlbaum Associates, Hillsdale, NJ.
- Searle JR (1975) Indirect speech acts. In: Cole P & Morgan JL (eds) *Syntax and Semantics*. Volume 3: *Speech Acts*. Academic Press, San Diego, CA, 59–82.
- Shatz M (1977) Children's comprehension of their mothers' question-directives. *Journal of Child Language* 5: 39–46.
- Shatz M & McCloskey L (1984). Answering appropriately: A developmental perspective on conversational knowledge. In: Kuczaj S (ed) *Discourse Development*. Springer, New York, 19–36.
- Shields J, Varley R, Broks P & Simpson A (1996) Social cognition in developmental language disorders and high-level autism. *Developmental Medicine and Child Neurology* 38: 487–495.
- Shriberg LD, Paul R, McSweeney JL, Klin A, Cohen DJ & Volkmar FR (2001) Speech and prosody characteristics of adolescents and adults with high-functioning autism and Asperger syndrome. *Journal of Speech, Language, and Hearing Research* 44: 1097–1115.
- Siegal M & Beattie K (1991) Where to look first for children's knowledge of false beliefs. *Cognition* 38: 1–12.
- Spencer KD (2001) Broadening the units of analysis in communication: speech and nonverbal behaviours in pragmatic comprehension. *Journal of Child Language*: 28, 325–349.
- Sperber D (1994) Understanding verbal understanding. In: Khalifa J (ed) *What Is Intelligence?* Cambridge University Press, Cambridge, UK, 179–198.

- Sperber D & Wilson D (1982) Mutual knowledge and relevance in theories of comprehension. In: Smith NV (ed) *Mutual Knowledge*. London, Academic Press, 61–85.
- Sperber D & Wilson D (1995) *Relevance: Communication and Cognition* (2nd ed). Blackwell, Oxford, UK.
- Sperber D & Wilson D (1997) Remarks on relevance theory and the social sciences. *Multilingua* 16: 145–151.
- Sperber D & Wilson D (2002) Pragmatics, modularity and mind-reading. *Mind & Language* 17: 3–23.
- Strohner H & Nelson KE (1974) The young child's development of sentence comprehension: Influence of event probability, nonverbal context, syntactic form, and strategies. *Child Development* 45: 567–576.
- Surian L, Baron-Cohen S & Van der Lely H (1996) Are children with autism deaf to Gricean Maxims? *Cognitive Neuropsychiatry* 1: 55–71.
- Tager-Flusberg H (2000) Language and understanding minds: Connections in autism. In: Baron-Cohen S & Cohen DJ (eds) *Understanding Other Minds*. Oxford University Press, Oxford, UK, 124–149.
- Tager-Flusberg H & Sullivan K (1994) Predicting and explaining behaviour: A comparison of autistic, mentally retarded and normal children. *Journal of Child Psychology and Psychiatry* 35: 1059–1075.
- Thompson L (1997) The development of pragmatic competence: Past findings and future directions for research. In: Thompson L (ed) *Children Talking: The Development of Pragmatic Competence*. Multilingual Matters, Clevedon, UK, 3–21.
- Umstead RS & Leonard LB (1983) Children's resolution of pronominal reference in text. *First Language* 4: 73–84.
- Van der Henst JB & Sperber D (2004) Testing cognitive and communicative principle of relevance. In Noveck IA & Sperber D (eds) *Experimental Pragmatics*. Palgrave Macmillan, Basingstoke, UK, 141–171.
- Van der Henst JB, Sperber D & Politzer G (2002) When is a conclusion worth deriving? A relevance-based analysis of indeterminate relational problems. *Thinking and Reasoning* 8: 1–20.
- Verschueren J (1999) *Understanding Pragmatics*. Arnold, London.
- Vieiro P & García-Madruga JA (1997) An analysis of story comprehension through spoken and written summaries in school-age children. *Reading and Writing: An Interdisciplinary Journal* 9: 41–53.
- Volden J (2004) Conversational repair in speakers with autism spectrum disorder. *International Journal of Language and Communication Disorders* 39: 171–189.

- Wellman HM, Cross D & Watson J (2001) Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development* 72: 655–684.
- Wellman HM & Lagattuta KH (2000) Developing understanding of mind. In: Baron-Cohen S, Tager-Flusberg H & Cohen DJ (eds) *Understanding Other Minds: Perspectives from Developmental Cognitive Neuroscience* (2nd ed). Oxford University Press, Oxford, UK, 21–49.
- Wilson D (2000) Metarepresentation in linguistic communication. In: Sperber D (ed) *Metarepresentations: A Multidisciplinary Perspective*. Oxford University Press, Oxford, UK, 411–448.
- Wilson D (2005) New directions for research on pragmatics and modularity. *Lingua* 115: 1129–1146.
- Wilson D & Sperber D (1988) Representation and relevance. In: Kempson RM (ed) *Mental Representations: The Interface between Language and Reality*. Cambridge University Press, Cambridge, UK, 133–153.
- Wilson D & Sperber D (1993) Linguistic form and relevance *Lingua* 90: 1–25.
- Wilson D & Sperber D (2002) Truthfulness and relevance. *Mind* 111: 583–632.
- Wilson D & Sperber D (2004) Relevance theory. In: Horn L & Ward G (eds) *Handbook of Pragmatics*. Blackwell, Oxford, UK, 607–632.
- Wolf AJE (1999) Context and relevance theory in language teaching. *IRAL* 37: 95–109.
- World Health Organisation (1993) *The ICD-10 Classification on Mental and Behavioural Disorders. Diagnostic Criteria for Research*. Author, Geneva.
- Zegarac V (2004) Relevance theory and *the* in second language acquisition. *Second Language Research* 20: 193–211.
- Ziatas K, Durkin K & Pratt C (2003) Differences in assertive speech acts produced by children with autism, Asperger syndrome, specific language impairment, and normal development. *Development and Psychopathology* 15: 73–94.

Appendices

Appendix 1(1)

International Classification of Diseases (ICD-10) Diagnostic criteria for childhood autism

A. Developmental abnormalities must have been present in the first three years in at least one of the following areas:

1. Receptive or expressive language as used in social communication.
2. The development of selective social attachments or reciprocal social interaction.
3. Functional or symbolic play.

B. A total of at least six symptoms from below three categories must be present, with at least two from 1) and at least one from each of 2) and 3):

1. Qualitative impairments in **reciprocal social interaction**:
 - a) Failure adequately to use eye-to-eye gaze, facial expression, body posture and gesture to regulate social interaction.
 - b) Failure to develop peer relationships.
 - c) Lack of socio-emotional reciprocity.
 - d) Lack of spontaneous seeking to share enjoyment, interests, or achievements with other people.
2. Qualitative abnormalities in **communication**:
 - a) A delay in, or total lack of, development of spoken language that is not accompanied by an attempt to compensate through the use of gesture or mime as an alternative mode of communication.
 - b) Relative failure to initiate or sustain conversational interchange.
 - c) Stereotyped and repetitive use of language or idiosyncratic use of words or phrases.
 - d) Lack of varied spontaneous make-believe or social imitative play.

Appendix 1(2)

3. Restricted, repetitive and stereotyped patterns of behaviour, interests and activities:

- a) Stereotyped and restricted patterns of interest or interest that is abnormal in intensity.
- b) Compulsive adherence to specific, non-functional routines or rituals.
- c) Stereotyped and repetitive motor mannerisms.
- d) Preoccupations with part-objects or non-functional elements of play material.

C. The disorder is not attributable to the specific developmental disorder of receptive language with secondary socio-emotional problems, reactive attachment disorder or disinhibited attachment disorder, mental retardation with some associated emotional or behavioural disorder, schizophrenia of unusually early onset, or Rett's syndrome.

Appendix 1(3)

International Classification of Diseases (ICD-10)

Diagnostic criteria for Asperger syndrome

A. A lack of any clinically significant delay in language or cognitive development.

Diagnosis requires that single words should have developed by two years of age or earlier and that communicative phrases be used by three years of age or earlier. Self-help skills, adaptive behaviour and curiosity about the environment during the first three years should be at a level consistent with normal intellectual development. However, motor milestones may be somewhat delayed and motor clumsiness is usual (although not a necessary diagnostic feature). Isolated special skills, often related to abnormal preoccupations, are common, but are not required for diagnosis.

B. Qualitative impairments in **reciprocal social interaction** (criteria as for autism).

C. **Restricted, repetitive and stereotyped patterns of behaviour, interests and activities.** (Criteria as for autism; however it would be less usual for these to include either motor mannerisms or preoccupations with part-objects or non-functional elements of play materials).

D. The disorder is not attributable to the other varieties of pervasive developmental disorder, schizotypal disorder, simple schizophrenia, reactive and disinhibited attachment disorder of childhood, obsessional personality disorder, or obsessive compulsive disorder.

Appendix 2(1)

Esitietokaavake

[Preliminary data sheet]

Lapsen nimi [Name of the child]

Syntymäaika [Date of birth]

Sisarusten lukumäärä [Number of siblings]

Sujuiko raskaus ja synnytys lapsenne kohdalla normaalisti vai ilmenikö niissä jotain poikkeavaa?

[Did pregnancy and birth of your child go normally or was there something abnormal?]

Onko lapsenne varhaiskehitys sujunut normaalisti?

[Has your child's early development progressed normally?]

Onko lapsellanne todettu jokin sairaus tai vamma? Jos on, niin mikä?

[Does your child have any disease or disability? If yes, what is it?]

Minkä ikäisenä lapsenne sanoi ensisanat?

[How old was your child when he/she said his/her first words?]

Minkä ikäisenä lapsenne alkoi liittää yhteen yksittäisiä sanoja pitemmiksi ilmauksiksi eli alkoi puhua lauseita?

[How old was your child when he/she started combining individual words, i.e. when he/she started speaking sentences?]

Onko lapsenne saanut puheterapiaa?

[Has your child been in speech therapy?]

Appendix 2(2)

Oletteko olleet jossakin vaiheessa huolissanne lapsenne puheen ymmärtämisen tai tuottamisen taidoista?

[At any point, have you been worried about your child's speech comprehension or production?]

Onko lapsenne puheen ja kielen kehitys kulkenut tasaisesti normaalivauhtia vai onko kehityksen kulku ollut mielestänne poikkeava?

[In your opinion, has the development of your child's speech and language progressed normally or have there been deviant features in the development?]

Mitä ajattelette tällä hetkellä lapsenne

[What do you currently think about your child's]

- puheen tuottamisesta?
[speech production?]
- puheen ymmärtämisestä?
[speech understanding?]
- keskustelutaidoista ja kyvystä ilmaista omia ajatuksiaan?
[discourse skills and his/her ability to express his/her own thoughts?]

Original publications

- I Loukusa S, Leinonen E & Ryder N (2007) Development of pragmatic language comprehension in Finnish-speaking children. *First Language* 27(3): 281–298.
- II Loukusa S, Ryder N & Leinonen E (accepted for publication) Answering questions and explaining answers: A study of Finnish-speaking children. *Journal of Psycholinguistic Research*.
- III Loukusa S, Leinonen E, Kuusikko S, Jussila K, Mattila ML, Ryder N, Ebeling H & Moilanen I (2007) Use of context in pragmatic language comprehension by children with Asperger syndrome or high-functioning autism. *Journal of Autism and Developmental Disorders* 37(6): 1049–1059.
- IV Loukusa S, Leinonen E, Jussila K, Mattila ML, Ryder N, Ebeling H & Moilanen I (2007) Answering contextually demanding questions: Pragmatic errors produced by children with Asperger syndrome or high-functioning autism. *Journal of Communication Disorders* 40(5): 357–381.

65. Tuovila, Seija (2005) Kun on tunteet. Suomen kielen tunnesanojen semantiikkaa
66. Olga Haurinen ja Helena Sulkala (toim.) (2005) Tutkielmia vähemmistökielistä Jäämereltä Liivirantaan. Vähemmistökielten tutkimus- ja koulutusverkoston raportti IV
67. Väyrynen, Pertti (2005) Perspectives on the utility of linguistic knowledge in English word prediction
68. Xaviera, Torres Joerges (2005) Importancia de la viruela, gastroenteritis aguda y paludismo en Finlandia entre 1749 y 1850
69. Olga Haurinen ja Helena Sulkala (toim.) (2006) Tutkielmia vähemmistökielistä Jäämereltä Liivirantaan. Vähemmistökielten tutkimus- ja koulutusverkoston raportti V
70. Säaskilahti, Minna (2006) Vapise, kuningas Alkoholi. Alkoholivalistuksen tekstilaji ja sen muuttuminen vuosien 1755 ja 2001 välisenä aikana
71. Keisanen, Tiina (2006) Patterns of stance taking. Negative yes/no interrogatives and tag questions in American English conversation
72. Schmitt, Gerhard (2006) Sieben Aufsätze um Nietzsche
73. Paavola, Leila (2006) Maternal sensitive responsiveness, characteristics and relations to child early communicative and linguistic development
74. Niemelä, Raimo (2006) Ikääntyneiden informaatiokäyttäytyminen. Laadullinen tutkimus arkielämän informaatiokäytännöistä ja toimintaan aktivoitumisesta
75. vom Schemm, Axel (2006) Dichter am Ball. Untersuchungen zur Poetik des Sports am Beispiel deutschsprachiger „Fußball-Literatur“
76. Taramaa, Raija (2007) Stubborn and Silent Finns With 'Sisu' in Finnish-American Literature. An Imagological Study of Finnishness in the Literary Production of Finnish-American Authors
77. Paso, Eija (2007) Työkyky merkitsee. Työkyvyn merkityksen ja maailman rakentuminen lehtiteksteissä
78. Kunnas, Niina (2007) Miten muuttuu runokyllien kieli. Reaaliaikatu tutkimus jälkitaavujen A-loppuusten vokaalijonojen variaatiosta vienalaismurteissa
79. Harri Mantila, Merja Karjalainen ja Jari Sivonen (toim.) (2007) Merkityksen ongelmasta vähemmistökielten oikeuksiin. Juhlakirja professori Helena Sulkalan 60-vuotispäivänä

Book orders:
OULU UNIVERSITY PRESS
P.O. Box 8200, FI-90014
University of Oulu, Finland

Distributed by
OULU UNIVERSITY LIBRARY
P.O. Box 7500, FI-90014
University of Oulu, Finland

S E R I E S E D I T O R S

A
SCIENTIAE RERUM NATURALIUM
Professor Mikko Siponen

B
HUMANIORA
Professor Harri Mantila

C
TECHNICA
Professor Juha Kostamovaara

D
MEDICA
Professor Olli Vuolteenaho

E
SCIENTIAE RERUM SOCIALIUM
Senior Assistant Timo Latomaa

E
SCRIPTA ACADEMICA
Communications Officer Elna Stjerna

G
OECONOMICA
Senior Lecturer Seppo Eriksson

EDITOR IN CHIEF
Professor Olli Vuolteenaho

EDITORIAL SECRETARY
Publications Editor Kirsti Nurkkala

ISBN 978-951-42-8577-6 (Paperback)

ISBN 978-951-42-8578-3 (PDF)

ISSN 0355-3205 (Print)

ISSN 1796-2218 (Online)

