Development and Psychopathology, **15** (2003), 73–94
Copyright © 2003 Cambridge University Press
Printed in the United States of America
DOI: 10.1017.S0954579403000051

Differences in assertive speech acts produced by children with autism, Asperger syndrome, specific language impairment, and normal development

KATHRYN ZIATAS,[a] KEVIN DURKIN,[a] AND CHRIS PRATT[b]
[a]*The University of Western Australia; and* [b]*La Trobe University*

Abstract
The assertive speech acts of children with autism (n = 12) and Asperger syndrome (n = 12), individually matched to children with specific language impairment (SLI; n = 24) and children with normal development (n = 24) were studied in the context of gently structured conversation. These children also completed the false belief test of theory of mind. The children with autism used significantly lower proportions of assertions involving explanations and descriptions than the children with SLI or normal development and significantly lower proportions of assertions involving internal state and explanations than the children with Asperger syndrome. The children with autism used a higher proportion of assertions involving identifications than any other group. The assertions of the children with Asperger syndrome were generally not different than those of the children with SLI or normal development except for a higher proportion of assertions involving own internal state. Further analysis of the mental assertions revealed that the children with autism and Asperger syndrome predominantly referred to desire and made few references to thought and belief, whereas the children with SLI and those with normal development used a higher proportion of references to thought and belief.

Autism and Asperger syndrome are pervasive developmental disorders characterized by a triad of social, communicative, and imaginative impairments (Wing, 1988), yet differentiated by the relatively intact development of language skills in children with Asperger syndrome (DSM-IV, American Psychiatric Association, 1994). Although autism and Asperger syndrome have been differentiated by clinical criteria as distinct entities, there has been substantial debate regarding whether they represent clear-cut diagnostic categories or conditions within the autistic spectrum (Schopler, Mesibov, & Kunce, 1998).

Address correspondence and reprint requests to: Kathryn Ziatas, Department of Psychology, University of Western Australia, Mounts Bay Road, Crawley, Western Australia 6907; E-mail: kathy@psy.uwa.edu.au.

The research reported in this paper involved the investigation of the communicative features of children with autism and children with Asperger syndrome, specifically, comparing the speech act profiles of the two groups and also comparing the performance of the children with autism and Asperger syndrome to that of individually matched children with specific language impairment (SLI) and with normal development. A major purpose of this research was to examine the relationship of theory of mind to communicative competence. This was achieved through contrasting the speech act profiles of the children with autism (previously shown to fail theory of mind tests) with the speech act profiles of children with Asperger syndrome, SLI, and normal development (all previously shown to pass theory of mind tests).

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Communicative Profiles of Children with Autism and Asperger Syndrome

Since Kanner's (1943) first description of children with autism, there has been a substantial amount of research identifying the particular features that characterize the disordered prelinguistic, verbal, and nonverbal communications of these individuals. In the past 3 decades of research examining the communicative competence of children with autism, there have been two important shifts. First, the emphasis of this research has become oriented toward examining the function, or pragmatics, of the children's speech rather than the structural aspects, such as grammatical and morphological development. Second, an emphasis has developed on examining both assets and deficits within the communicative profiles of children with autism in order to develop and test explanatory models.

In part, the emphasis toward examining the pragmatic disorder of children with autism has resulted from evidence of relatively intact grammatical development. Several studies have indicated that the grammatical development of children with autism, although frequently delayed, progresses at a rate and order commensurate with developmental level (Jarrold, Boucher, & Russell, 1997) and similarly to that of children with Down syndrome (Tager–Flusberg, Calkins, Nolin, Baumberger, Anderson, & Chadwick–Dias, 1990).

Early research by Wetherby and Prutting (1984) provided evidence of the pragmatic impairment of children with autism. The child-initiated communicative acts of four young children with autism were analyzed from 60 min of videotaped experimenter–child interactions. In comparison to the language matched normal children, the children with autism showed higher frequencies of requesting objects and actions, protesting, and nonfocused utterances. The normal children displayed a broader range of communicative functions and were more likely than the children with autism to use communication to acknowledge others, show off, comment, regulate their own behavior, label referents, and accompany familiar actions with sound effects or ritualized vocalizations. The children with autism were never observed to request information, acknowledge others, show off, comment, or label.

Subsequent to Wetherby and Prutting's (1984) study, a number of researchers investigated the impaired pragmatics and conversational disorder of children with autism. Specific features identified have included stereotypic, repetitive language (Eales, 1993; Volden & Lord, 1991); pronoun reversal (Landry & Loveland, 1988); and inappropriate use of questions (Hurtig, Ensrud, & Tomblin, 1982). A number of deficits in conversational function were identified, including a restricted range of communicative functions, less initiation, less affirming, and less turn taking (Loveland, Landry, Hughes, Hall, & McEvoy, 1988); an absence of questions intended to gain new information (Tager–Flusberg & Sullivan, 1995); and poor conversational coherence and cohesion (Fine, Bartolucci, Szatmari, & Ginsberg, 1994). In addition, Surian, Baron–Cohen, and Van der Lely (1996) examined the ability of children with autism, SLI, and normal development to identify violations of Gricean maxims. The children with autism were unable to identify such violations and performed poorly in contrast to the children with SLI or normal development. Surian et al.'s findings provide a further indication of conversational impairment in the form of impaired understanding of the pragmatic conventions underlying conversation.

Children and adults with autism also demonstrate literal interpretation and use of indirect language, with evidence of difficulty with irony, jokes, sarcasm, and metaphorical expression (Frith, 1989a; Happe, 1991; Szatmari, Bartoloucci, & Brenner, 1989). Within narrative tasks, children with autism have shown relative strengths in reference to the mechanical and behavioral content of the text (Baron–Cohen, Leslie, & Frith, 1986) and attention to the story characters' desires, emotions, and perceptions (Tager–Flusberg, 1992), yet shown specific impairment in reference to characters' cognitive mental state (Baron–Cohen et al., 1986; Tager–Flusberg, 1992) and the causal relationships within the text (Tager–Flusberg & Sullivan, 1995).

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Hence, the particular strengths, or communicative assets, of children with autism have tended to relate to the structural or code aspects of language: the grammatical, morphological, and phonological components. The particular communicative deficits of children with autism relate to the pragmatic elements. Children with autism fail to integrate relative strengths involving the code aspects of language with the context and purpose of communication.

Asperger syndrome, a relatively new diagnostic category within the DSM-IV, describes children who, with an absence of clinically significant delays in language or intellectual function, share the social and communicative impairments and restricted and repetitive patterns of interest characteristic of autism. A small number of studies have focused on the communicative profiles of children with Asperger syndrome, as distinct from the profiles of children with autism. Szatmari, Bartoloucci, and Brenner (1989) and Gillberg (1989), in early epidemiological studies, identified a number of characteristics of disordered communication, including formal pedantic language, odd prosody, peculiar voice characteristics, literal interpretation of meaning, too much or too little talk, lack of cohesion, idiosyncratic use of words, and repetitive patterns of speech. Dahlgren and Trillingsgaard (1996) and Ehlers, Nyden, Gillberg, and Dahlgren Sandberg (1997) found that children with Asperger syndrome exhibited higher verbal than performance ability whereas children with autism exhibited peaks in subtests related to performance ability.

Two recent studies have examined whether children with Asperger syndrome manifest the same pragmatic impairment as children with autism. Ghaziuddin and Gerstein (1996) found more evidence of pedantic speaking style in children with Asperger syndrome than children with autism. Ramberg, Ehlers, Nyden, and Johansson (1996) found that, although children with Asperger syndrome could be differentiated from children with autism by higher full-scale and verbal intelligence, they exhibited comparable evidence of pragmatic difficulties. In summary, children with Asperger syndrome exhibit less evidence of language delay or impairment than children with autism, yet have in common that they exhibit significant difficulties with pragmatic competence.

The Theory of Mind Hypothesis

An important development related to communicative competence in children with autism has been research motivated by the theory of mind hypothesis, which proposes that the communicative and social impairments observed in children with autism are a result of an inability to form representations of another's mental state (Baron–Cohen, 1995; Baron–Cohen, Leslie, & Frith, 1985; Frith, Happe, & Siddons, 1994; Happe, 1995). Proposing a relationship between theory of mind and communicative competence is consistent with existing theories related to language use. Golinkoff (1993) described communication as a "meeting of the minds" with many of the underlying features of competent communication requiring an understanding of mental state, such as understanding speaker intention and presupposition. The traditions of intersubjectivity (Trevarthen, 1979) and common ground (Clark, 1992) emphasize the importance of shared understanding of mental state. Current theories of pragmatics, particularly cognitive (Sperber & Wilson, 1986) and mentalist (Grice, 1975; Tirassa, 1999) accounts, have argued for the importance of mentalizing for intentional communication.

A number of studies have indicated evidence of the pragmatic impairments of children with autism being related to theory of mind impairment. Eisenmajer and Prior (1991) found a relationship between linguistic function and theory of mind performance in children with autism. Children completed the Test of Pragmatic Skills (Shulman, 1986), a measure of communicative intentions including requesting, greeting, and informing within a game setting. Scores on this test differentiated the children with autism who passed the theory of mind task from those who failed, whereas there were no differences on a vocabulary measure.

In the study of children's awareness of conversational conventions, Surian et al.

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

(1996) showed that those children with autism able to pass the theory of mind task also did well in identifying violations of Gricean maxims. Awareness of another's independent mental state was associated with the ability to monitor the appropriate use of language. Surian et al.'s findings provide further support for the theory of mind hypothesis by demonstrating better pragmatic competence in the small number of children with autism able to pass the first order theory of mind task.

Happé (1993) examined the role of theory of mind in the understanding of similes, metaphors, and irony. Happé proposed that similes could be understood at a literal level without attention to the underlying intention or thoughts of the speaker, whereas metaphor and irony would require first and second order theory of mind understanding, respectively, in order to decode the underlying intention of the utterance form. In keeping with these predictions, Happé found that those children with autism who were unable to pass even the first order theory of mind task were able to pass the simile task but not the metaphor or irony tasks. Those able to pass first order but not second order theory of mind task were able to complete both the simile and metaphor tasks, and those able to pass both first and second order theory of mind tasks were able to comprehend similes, metaphors, and irony. The children with autism presented profiles of asset and deficit on nonliteral language tasks that were directly related to their theory of mind understanding.

Additional support for the theory of mind hypothesis comes from studies examining the use of mental state language by children with autism. Tager–Flusberg (1995) demonstrated a relationship between theory of mind understanding and use of cognitive mental state terms to answer questions regarding characters' behavior within a narrative text. Kazak, Collis, and Lewis (1998) demonstrated that children with autism were unable to use *know* and *think* to report having seen or not seen the location of an object. Ziatas, Durkin, and Pratt (1998) demonstrated impaired ability in children with autism in understanding and using the contrastive distinctions of *think, know,* and *guess.* Ziatas et al. examined the children's profiles of first order theory of mind and belief term comprehension and expression, demonstrating patterns consistent with the theory of mind hypothesis. In general, those children who failed the theory of mind task also performed poorly on the belief term tasks. Studies examining the typical development of theory of mind and language have provided additional evidence in support of the relationship between theory of mind and communicative competence. For example, Moore, Furrow, Chiasson, and Patriquin (1994) showed a relationship between the contrastive use of belief state terms and the development of theory of mind. In addition, studies examining the social and communicative correlates of theory of mind in preschool children have shown abilities such as stating goals, ending conversations appropriately (Lalonde & Chandler, 1995), making role assignments and joint proposals in play (Astington & Jenkins, 1995), and participating in conversations about the past (Welch–Ross, 1997) to be associated with measures of theory of mind.

Older children and adolescents with Asperger syndrome (Dahlgren & Trillingsgaard, 1996) and adults with Asperger syndrome (Bowler, 1992; Ozonoff, Pennington, & Rogers, 1991) pass tests of theory of mind. The research undertaken in this paper will examine whether the theory of mind understanding demonstrated by individuals with Asperger syndrome relates to the better communicative competence characterizing this group in contrast to the severe impairments in both theory of mind and communicative competence observed in individuals with autism.

Speech Act Analysis

Communicative competence incorporates a range of features, including utterance purpose and intent, topic, paralinguistic features, cohesion, and coherence. Because this study was specifically interested in examining the communicative correlates of theory of mind, the emphasis was on the intentional aspects of language use within conversational contexts. The specific focus of the conversational analysis was at the level of the speech acts independently asserted by the children (as distinct

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Table 1. *Codes for assertive speech acts from Dore's (1986) conversational acts*

Code	Definition	Examples From Children's Samples
ASIR	Internal reports express emotions, intents, and other mental events.	"I remember seeing one of these at school."
ASAT	Attributions express beliefs about another's state.	"You don't know what I am making."
ASEX	Explanations express causal relationship, give reasons, or make predictions.	"He's crying because he is hurt."
ASID	Identifications label objects and events.	"Eggs."
ASDC	Descriptions predicate events, properties, locations, and so forth, of objects.	"The red one is fixed."
ASEV	Evaluatives express personal judgments or attitudes.	"This is yucky things."
ASPR	Procedurals invoke norms or rules, set procedures, or define conditions.	"Goes like that."
ASCL	Claims attempt to preempt rights for the speaker.	"My turn."

from responses). The children's utterances were coded using Dore's (1986) speech act taxonomy. This framework was selected because it was designed for the analysis of children's conversations and because the classification of assertive speech acts differentiates between utterances that presuppose awareness of mind and those that concern more concrete phenomena.

In previous research, particularly that related to narrative discourse, the communicative context has been characterized as having both *consciousness* and *action* landscapes (Astington, 1990; Bruner, 1986; Tager–Flusberg & Sullivan, 1995). The *landscape of consciousness* attends to the internal states of the participants, whereas the *landscape of action* attends to the more concrete features of the communicative context. As shown in Table 1, Dore's (1986) speech acts contain eight assertives, three of which relate closely to theory of mind and attend to the landscape of consciousness, which is referred to here as the *mental landscape* of the conversational interaction. These are assertions regarding the speaker's own internal mental state (ASIR), explanations (ASEX), and assertions regarding another's mental state (ASAT). The characterization of these assertions as *mental* is justified by internal reports (ASIR) and attributions of another's mental state (ASAT) actively referring to internal mental state in the self and others. ASEX, although not necessarily directly referring to mental state, contain implicit reference to reason and causality, and hence to mental state. The remaining assertions relate to the landscape of action, referred to here as the *event landscape* within the conversational interaction: identifications (ASID), descriptions (ASDC), evaluations (ASEV), speaker claims (ASCL), and assertions regarding procedures (ASPR).

In this study it was predicted that the impaired theory of mind understanding of the children with autism would result in a restriction in content to the physical and event aspects rather than attention to the interpersonal, mental aspects of the conversational context. Hence, children with autism would demonstrate relatively more utterances involving the *event landscape* and relatively few utterances involving the *mental landscape*. In contrast, the children with Asperger syndrome, on the basis of having awareness of mental state (i.e., theory of mind), were expected to demonstrate relatively greater use of those assertions concerning the *mental landscape* of the interaction.

Encoding of the Mental Assertions

A further interest was the particular nature of the *mental* assertions produced by the children. Among normally developing children there is substantial evidence of mental state reference occurring prior to evidence of a rep-

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

resentational theory of mind, in the 4th year. Reference to mental state has been recorded in children at as early as 2 years of age (Bartsch & Wellman, 1995; Bretherton & Beeghly, 1982). These references include attention to desire, perception, and emotion. However, it is only at approximately 4 years of age that children begin to demonstrate the ability to use cognitive mental states contrastively (Moore, Pure, & Furrow, 1990). Previous research has attributed a developmental sequence to young children's growing awareness of internal state with pretence, imagination, and perception (at 2 years), followed by desire and intention (at 3 years), and knowledge and belief (at 4 years; Gopnik & Slaughter, 1991).

In this study we planned to profile the specific nature of references within the mental assertions. It was predicted that there would be evidence of subtle differences within groups, involving greater complexity of mental state reference by those children able to understand independent mental state. The children's assertions of internal state for self (ASIR) and other (ASAT) were reclassified following Tager–Flusberg's (1992) taxonomy, distinguishing among references to desire, thought and belief, intention, perception, physiology, and affect and emotion. The children's explanations (ASEX) were reclassified to reflect slightly different content. Based on Dunn and Brown's (1993) coding of children's causal conversations, the explanations were coded as reference to behavior and action, affect and emotion, desire, thought and belief, social practices, abilities, and physical reality. It was predicted that the children with autism would be differentiated from the children with Asperger syndrome on the basis that the formers' assertions related to mental state would predominantly concern desire states, consistent with the finding that young children with normal development are able to represent these states prior to the development of a metarepresentational theory of mind. In contrast, the children with Asperger syndrome would demonstrate a wider range of mental state terms, including terms involving thought and belief, consistent with demonstrating an understanding of theory of mind.

Speech Acts in Children with SLI and Normal Development

Unlike the more structural areas of linguistic development, such as syntax or phonology, there are few "benchmarks" regarding the normal development of conversational competence, such as speech acts. In the present study it was important to examine how normally developing children of equal language resources (matched by language age to children with autism and Asperger syndrome) would function in the conversational setting.

We also examined the speech act profiles of children with SLI. The pragmatic function of children with SLI has been an area of considerable research interest in the past decade, with many studies demonstrating significant social and conversational difficulty in such children (Bishop, Chan, Adams, Hartley, & Weir, 2000; Craig & Evans, 1993; Craig & Washington, 1993; Fujiki, Brinton, & Todd, 1996). Other studies, however, have indicated that the difficulties experienced by these children relate more to limitations in the grammatical system than in wider social understanding (Lapadat, 1991; Leonard, 1986; Rollins, Pan, Conti–Ramsden, & Snow, 1994; Rom & Bliss, 1981). Consistent with this conclusion are Perner, Frith, Leslie, and Leekam's (1989) and Surian et al.'s (1996) findings that children with SLI were able to pass first order theory of mind tasks. Hence, although children with SLI do experience social and communicative difficulties, these appear to be a reflection of syntactic impairment rather than of broader social cognitive deficits such as theory of mind. In this study, it was predicted that the children with SLI would *not* exhibit limitations in their speech act profiles. Rather, the speech act profiles of these children were expected to be consistent with linguistic capacity, and hence similar to those of language matched children with normal development.

In summary, previous research has demonstrated that children with autism experience a specific disorder related to communicative competence. The majority of children with autism demonstrate difficulty with theory of mind understanding. In contrast, two other groups of children shown to experience diffi-

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

culties with communicative competence, children with Asperger syndrome and children with SLI, do not show difficulties with theory of mind understanding. Studies examining normal children have shown close relationships between developments of theory of mind and communicative competence. These four groups of children provide a valuable opportunity to examine the relationship of theory of mind to the development of communicative competence.

To date, no research has been reported examining children's speech acts from the perspective of developing theory of mind understanding. Moreover, no research has examined the relationship of theory of mind and communicative competence from the perspective of differences in conversation function demonstrated by groups of children with autism, Asperger syndrome, and SLI as compared to normally developing children. Hence, the purposes of this study were twofold: first, to determine whether differences are manifest in the conversational assertions of children with autism and children with Asperger syndrome, SLI, and normal development and, second, to examine these differences in relation to the children's theory of mind development.

The specific predictions addressed by the research were the following:

1. Speech act analysis of conversational interaction would reveal differences in the assertive speech act profiles of children with autism and children with Asperger syndrome. Children with autism were expected to show relatively less use of the mental assertions related to own internal state (ASIR), another's internal state (ASAT), and ASEX than the children with Asperger syndrome.

2. It was expected that differences in the assertive speech acts of the children with autism and children with Asperger syndrome would be explained by differences in theory of mind understanding, with theory of mind accounting for the variability in mental assertion use across the two groups of children.

3. The children with autism were expected to show less use of mental assertions (internal state reports/ASIR, assertions regarding another's internal state/ASAT, and explanations/ASEX) than the language matched children with SLI or language age–matched children with normal development. No differences were expected between the children with Asperger syndrome and the matched children with SLI or normal development.

4. Within the mental assertions (ASIR, ASAT, and ASEX), less emphasis regarding cognitive mental state was expected for children with autism as compared to the children with Asperger syndrome, SLI, or normal development.

Method

Participants

In total, 72 children were involved in the study. Twelve children with autism were individually matched by sex, chronological age, and verbal mental age to 12 children with SLI and by sex and verbal mental age to 12 children with normal development. On the same basis, 12 children with Asperger syndrome were individually matched to 12 children with SLI and 12 children with normal development. There were six groups of children involved in the study; the children with autism (group 1) and the matched children with SLI (group 2) and normal development (group 3), plus the children with Asperger syndrome (group 4) and the matched children with SLI (group 5) and normal development (group 6).

These children were predominantly from Perth, Western Australia, with a small number included from Brisbane in Queensland. All the children with autism and Asperger syndrome had been diagnosed (independently of the present investigation) by a team comprising a pediatrician, clinical psychologist, and speech pathologist using the DSM-IV criteria.

Children with SLI were selected from Language Development Centre schools servicing the special needs of this population. Children attending these schools are referred on the basis of having a significant gap (>25 points) between performance and verbal intelligence quotients. In this study, the children with SLI,

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

who were matched to the children with autism, represented children with severe mixed receptive–expressive language impairment. The children with SLI matched to the children with Asperger syndrome represented children of low average to average comprehension with significant evidence of expressive language disorder. The difference between the children with SLI matched to the children with autism and the children with SLI matched to the children with Asperger syndrome reflected the greater severity of language disorder present in the children with autism (Peabody Picture Vocabulary Test—Revised, PPVT-R, Dunn & Dunn, 1981; standard scores ranged from 47 to 97, $M = 71$), as compared to the children with Asperger syndrome (PPVT-R standard scores ranged from 66 to 125, $M = 94$).

The normal match children were selected from local preschools and primary schools. These children were selected on the basis that they were judged by their teachers to be at least at the average level of achievement for their age and having no identified disorders or impairments. Details of the resulting groups are shown in Table 2.

Assessment

All children were assessed for verbal mental age using the PPVT-R to enable language age matching to the children with SLI and normal development. The Test of Reception of Grammar (TROG; Bishop, 1989) was used to ensure that the children's grammatical comprehension was at least at a 4-year age equivalent.

Baron–Cohen et al.'s (1985) "Sally Anne" false belief task was used as a measure the child's ability to understand another's independent mental state (first order theory of mind). The procedure involved two trials: On the first trial, one puppet, Sally, hid a marble in a basket and left the scene. While she was gone, the other puppet, Anne, shifted the marble to a box. Sally then returned and the child was asked, "Where will Sally first look for her marble?" This was followed by two control questions, the reality control question, "Where is the marble now?" and the memory control question, "Where did Sally put the marble in the beginning?" The second trial involved new materials with the equivalent questions. All children were required to pass the control questions in order for their responses to the false belief questions to be included in the study. A preliminary check confirmed that all participants passed the control questions. As with previous research (e.g., Baron–Cohen et al., 1985), the children were required to correctly identify the initial hiding place as the location in which Sally would look for the marble on both trials to be credited with possessing an understanding of false belief. The probability of achieving this combined success criterion by guessing is 25%.

Scripted interaction task

To provide a supportive yet stimulating context to sample conversation skills from all children, a scripted conversational interaction task was developed. The purpose of this task was to provide a context capable of eliciting a wide range of speech acts within a conversational setting. Based on research related to sampling procedures involving children with SLI, a home-based, gently structured play interaction was chosen as the most valid method of sampling the full range of these behaviors (Brinton & Fujiki, 1993; Craig & Evans, 1993; Fujiki et al., 1996). This involved the researcher taking a standard set of toys to each child's house and "playing" with the child in a quiet room for approximately 45 min. This task was termed the scripted interaction task, as each child was presented with the same materials, in essentially the same order. The researcher presented the toys to each child, achieving at least a minimum set of consistent verbal behaviors, while also following the child's lead in the conversation in as natural a manner as possible (see Appendix A for details of the content of the scripted interaction).

All sessions were video recorded. The interactions were then transcribed for both the researcher's and the child's utterances and analyzed according to Dore's (1986) speech act framework. The final data derived from the conversation samples were sum totals for each

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Table 2. *Participant variables*: *Means and standard deviations of chronological* (*CA*), *verbal mental* (*PPVT*) *and comprehension* (*TROG*) *ages*

	Autism	SLI[a]	Normal[b]	Asperger	SLI[c]	Normal[d]
Male/female	10/2	10/2	10/2	8/4	8/4	8/4
CA						
M	8:3	8:2	5:8	6:11	6:11	6:5
SD	2:7	2:7	1:9	2:1	2:2	2:0
PPVT AE						
M	5:9	6:1	6:3	6:4	6:5	7:0
SD	1:11	1:10	1:10	2:0	1:10	2:5
TROG AE						
M	6:3	6:7	6:3	7:3	6:7	7:4
SD	2:0	2:3	2:3	2:5	2:0	2:0

Note: PPVT, Peabody Picture Vocabulary Test; TROG, Test of Reception of Grammar; AE, age equivalent.
[a]Matched by PPVT age equivalent and chronological age to children with autism.
[b]Matched by PPVT age equivalent to children with autism.
[c]Matched by PPVT age equivalent and chronological age to children with Asperger syndrome.
[d]Matched by PPVT age equivalent to children with Asperger syndrome.

speech act and total speech acts for both the researcher and the child. A random 10% of the transcripts was subsequently reanalyzed by another researcher, with 83% reliability achieved. Cohen's kappa value was .78, indicating strong agreement above chance (Fleiss, 1981).

Procedure

Children were assessed in a quiet room in their home. In an initial session, the scripted interaction task was completed, followed by the PPVT-R and the TROG. A subsequent session involved the false belief tasks. For the scripted interaction task, a video recorder with microphone attached (National NV-180) was placed on a tripod in the corner of the room and started prior to the session.

Results

Matching

The age equivalents for the PPVT and TROG scores (see Table 2) were compared for the children with autism and Asperger syndrome and the matched children with SLI and normal development, using one-way between groups analysis of variance (ANOVA). There were no significant between groups differences for the PPVT-R, F (5, 71) = .241, *ns*, or TROG age equivalents, F (5, 71) = .53, *ns*.

False belief test performance

As was expected, the majority (83%) of children diagnosed with autism failed the false belief task, despite all children having a comprehension age above 4 years as measured by the TROG. However, few of the children with Asperger syndrome (25%), SLI (17%), or normal development (8%) failed the task.

Total speech act output by the researcher and children

It was important to determine whether the scripted interaction task elicited comparable levels of speech act use by the researcher across all groups of children, avoiding the possibility that some groups of children might be given greater opportunity to demonstrate communicative competence than other groups. In addition, it was important for subsequent comparisons to determine whether the scripted interaction elicited comparable levels of speech act output by the children.

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Table 3. *Total speech acts used by the child and the researcher in the scripted interaction*

Total Speech Acts	Autism	SLI	Normal	Asperger	SLI	Normal
Researcher						
M	504.25	546.50	555.17	526.58	636.50	502.17
SD	140.11	110.15	110.38	99.27	129.61	79.85
Children						
M	333.83	368.75	361.67	422.33	409.17	321.58
SD	124.19	82.61	73.57	107.38	87.46	98.20

Total speech acts used by the researcher and the children are displayed in Table 3. The total speech acts used by researcher and child were compared using a one-way between groups ANOVA. No significant differences were revealed for either the researcher's total speech acts, F (5, 71) = 2.30, *ns*, or the children's total speech acts, F (5, 71) = 2.04, *ns*.

Comparisons of the assertions produced by the children

Statistical method. Although the differences in raw frequencies of total speech act output were nonsignificant for the groups of children, there was some variability. Hence, we chose the conservative approach of comparing the assertions as proportions of total speech acts across the groups rather than as raw frequencies. This enabled between-groups comparisons of the children's use of assertive speech acts, relative to total speech act output. Each of the eight assertions is displayed as both raw frequency and as proportion of total speech act output in Table 4.

Although the use of proportions minimized difficulties related to variability in the children's total output, it also introduced complications that relate to their comparison. The major concern was that the proportions were obtained from different numbers of total speech acts for different subjects. Proportions based on a large number of speech acts are likely to be more accurate than those based on a small number.

In order to control for these difficulties, statistical methods used by Bishop et al. (2000) in a study of conversational responsiveness were applied. These methods involved the calculation of paired comparisons (z scores) using differences in weighted empirical log odds scores and their associated variances. The benefit of this procedure was in the use of weighted log transformations, which took account of both the number of specific speech acts (e.g., ASIR) and the overall total speech acts produced by each child. The log odds score and associated variance were calculated as ratios of frequencies of the particular assertive speech act being computed and of total speech acts. The variance associated with each log odds score produced a weighting term, which was subsequently used within the z score formulae as the weight associated with each of the two log odds scores being compared. The formulae for calculating the weighted scores and variances and specific details of the z score comparisons are detailed in Bishop et al. (2000, appendix 2).

Assertive speech act comparisons. Across the groups, the following paired comparisons of the log odds scores for each of the assertions were completed:

1. autism to Asperger syndrome
2. autism to SLI match
3. autism to normal match
4. Asperger syndrome to SLI match
5. Asperger syndrome to normal match

Holm's test was used to adjust significance levels to account for the use of multiple comparisons (Howell, 1995). Table 5 provides detail of the z scores resulting from these comparisons.

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Table 4. *Assertions produced by the children, reported as frequency of occurrence in the transcript and as percentage of total speech acts*

Speech Act	Autism	SLI	Normal	Asperger	SLI	Normal
ASIR Frequency						
M	16.33	23.67	24.50	36.42	25.83	25.17
SD	14.22	10.29	10.41	10.69	9.39	3.31
Range	1–55	13–48	4–47	16–49	9–37	9–55
% of total						
M	4.77	6.68	6.56	8.82	6.41	7.51
SD	3.32	2.80	2.20	2.53	2.38	2.92
Range	0.65–10.15	3.12–11.46	2.03–9.75	5.01–12.58	2.99–11.08	4.17–11.75
ASAT Frequency						
M	7.8	11.0	9.83	8.42	12.5	10.9
SD	5.95	5.31	3.24	4.34	5.37	4.8
Range	0–16	3–22	6–17	1–18	2–20	2–17
% of total						
M	2.31	3.20	2.80	2.07	3.11	3.46
SD	1.76	1.64	1.00	1.11	1.44	1.51
Range	0–4.73	0.68–5.58	1.58–4.99	2.5–4.3	0.76–5.11	0.96–6.28
ASEX Frequency						
M	5.42	11.75	18.08	14.25	14.67	13.33
SD	7.43	10.01	9.46	10.69	13.80	7.22
Range	0–21	0–34	4–38	1–42	1–44	1–24
% of total						
M	1.44	3.33	4.81	3.20	3.55	4.19
SD	1.66	2.63	1.95	1.89	3.41	2.31
Range	0–4.48	0–8.85	2.03–8.87	0.27–7.94	0.27–12.05	0.61–8.17
ASID Frequency						
M	22.50	15.92	19.83	18.08	16.92	20.42
SD	14.56	9.47	10.97	9.61	6.83	10.85
Range	8–49	8–44	5–39	4–34	7–30	8–46
% of total						
M	7.38	4.34	5.40	4.47	4.39	6.40
SD	5.32	2.13	2.67	2.70	2.09	2.83
Range	1.99–20.26	1.92–10.05	1.32–10.00	1.32–11.50	1.52–8.98	2.91–12.99
ASDC Frequency						
M	69.92	95.92	108.67	97.83	109.92	78.50
SD	42.89	25.05	42.34	40.62	35.32	34.28
Range	15–152	60–133	45–202	36–170	53–170	19–141
% of total						
M	19.64	26.23	29.53	22.57	26.56	23.64
SD	6.68	4.97	7.78	5.90	5.81	5.69
Range	9.68–31.08	18.9–33.59	21.08–44.89	11.92–32.08	16.89–36.44	11.59–33.42
ASEV Frequency						
M	4.67	7.00	6.08	8.67	12.33	8.50
SD	5.84	4.11	3.90	8.05	20.85	7.27
Range	0–18	1–13	0–14	0–25	0–77	0–25
% of total						
M	1.16	1.99	1.65	2.12	3.17	2.39
SD	1.20	1.20	0.92	2.30	5.73	1.72
Range	0–3.73	0.23–3.79	0–3.28	0–8.28	0–21.10	0–6.10
ASPR Frequency						
M	2.75	6.08	3.33	5.33	4.17	3.75
SD	2.99	5.48	2.64	4.98	4.28	4.43
Range	0–11	0–17	1–10	0–17	0–13	0–16
% of total						
M	0.84	1.68	0.88	1.17	0.90	1.06
SD	0.82	1.50	0.58	0.94	0.90	1.12
Range	0–2.74	0–4.55	0.26–2.07	0–2.86	0–2.82	0–4.17

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Table 4. (*cont.*)

Speech Act	Autism	SLI	Normal	Asperger	SLI	Normal
ASCL Frequency						
M	2.0	2.83	2.25	2.83	5.42	2.25
SD	1.54	4.11	2.05	2.69	6.13	1.71
Range	0–5	0–15	0–6	0–9	1–23	0–5
% of total						
M	.64	.69	.61	.70	1.32	.68
SD	.52	.92	.47	.72	1.64	.45
Range	0–1.54	0–3.42	0–1.35	0–2.41	0.27–6.27	0–1.28

Note: ASIR, internal reports; ASAT, another's mental state; ASEX, explanations; ASID, identifications; ASDC, descriptions; ASEV, evaluations; ASPR, procedurals; ASCL, speaker claims.

Table 5. *z-Score comparisons of the empirical logit transformations of children's assertions as a proportion of total utterances*

	Autism–Asperger	Autism–SLI	Autism–Normal	Asperger–SLI	Asperger–Normal
ASIR	–4.81*	–1.70	–1.82	4.06*	1.277
ASAT	1.93	–1.24	0.05	–1.11	1.78
ASEX	–3.13*	–3.86*	–5.69*	–2.27	–1.75
ASID	5.42*	5.51*	3.05*	–0.75	–3.82*
ASDC	–2.14	–4.88*	–8.92*	–3.86*	–1.29
ASEV	2.81	–1.31	–0.04	–5.72*	–0.70
ASPR	–1.67	–3.59*	0.14	.95	0.00
ASCL	0.71	–1.51	0.02	–5.43*	0.23

Note: ASIR, internal reports; ASAT, another's mental state; ASEX, explanations; ASID, identifications; ASDC, descriptions; ASEV, evaluations; ASPR, procedurals; ASCL, speaker claims.
*Results significant at $p < .05$ using Holm's test to correct for multiple comparisons.

With respect to comparison 1, autism to Asperger syndrome, the children with autism used significantly lower proportions of ASIR and ASEX and significantly higher proportions of ASID than the children with Asperger syndrome.

With respect to comparisons 2 (autism to SLI match) and 3 (autism to normal match), the children with autism used significantly lower proportions of ASDC and ASEX than the children with SLI and normal development and significantly higher proportions of ASID than both groups.

With respect to comparisons 4 (Asperger to SLI match) and 5 (Asperger to normal match) the children with Asperger syndrome used a higher proportion of ASIR and lower proportions of ASDC, ASEV, and claims regarding speaker rights (ASCL) than the children with SLI. Moreover, in comparison to the children with normal development, there was a lower proportion of ASID.

Could theory of mind differences account for the differences in assertions observed in the children with autism and Asperger syndrome? Additional analyses were completed in order to assess the relationship of theory of mind to the differences in assertive profiles of the children with autism and with Asperger syndrome. Regression analysis was used to examine the relative contributions of diagnostic group (autism, Asperger syndrome) and theory of mind (false belief pass/fail) to the variability observed in the children's use of the three mental speech acts (internal state reports, reports of another's internal state, and explanations). Diagnostic group and theory of mind collectively accounted for 35.9% of the variance in the internal state reports, $F(2, 21) = 5.587$, $p < .01$. However, only diagnostic group made a significant unique contribution, accounting for 30.7% of the variance in ASIR when added after theory of mind, $t(21) = 3.17$, $p < .01$. The unique contribution of the-

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

ory of mind did not approach significance. Theory of mind and diagnostic group collectively accounted for 22.8% of the variance in the proportion of ASEX, F (2, 21) = 3.10, p = .06, with diagnostic group again making the only significant unique contribution, accounting for 20.1% of the variance when added after theory of mind, t (21) = 2.34, $p <$ .05. For the proportion of assertions regarding another's internal state (ASAT), diagnostic group and theory of mind collectively accounted for only 1% of the variance, F (2, 21) = .093, *ns.*

Comparisons of the content of the mental assertions. As described in the Introduction, the children's mental assertions were reclassified to distinguish the specific content. Assertions of internal state for self (ASIR) and other (ASAT) were reclassified to distinguish among references to desire, thought and belief, intention, perception, physiology, and affect and emotion. The children's explanations (ASEX) were reclassified to reflect reference to behavior and action, affect and emotion, desire, thought and belief, social practices, abilities, and physical reality. Twenty percent of the utterances were subsequently reclassified by an independent coder. Interjudge reliability was high, with 96% agreement across the two coders, Cohen's kappa of .95.

The children's references to thought and belief and references to desire were of central interest. References to thought and belief and references to desire were summed across the three speech acts (results displayed in Table 6). Paired empirical log odds z scores (Table 7) were calculated for each of the five comparisons (autism–Asperger, autism–SLI, autism–normal, Asperger–SLI, and Asperger–normal).

The children with autism showed a significantly lower proportion of reference to *thought and belief* in the mental assertions than the children with Asperger syndrome, SLI, or normal development. The children with Asperger syndrome also showed a significantly lower proportion of reference to thought and belief in their mental assertions than the matched children with SLI and normal development. The children with autism and the children with Asperger syndrome demonstrated higher proportions of reference to desire than the matched children with SLI and normal development.

Discussion

There were two main purposes of this study. The first was to determine differences in the communicative profiles of children with autism and with Asperger syndrome, between the children with autism and the matched children with SLI and with normal development, and between the children with Asperger syndrome and the matched children with SLI and with normal development. The second was to examine whether theory of mind ability was associated with communicative competence.

The scripted interaction task was developed to enable a comparison of the assertive speech acts used by the children with autism, Asperger syndrome, SLI, and normal development. This play-based interaction was successful in eliciting a substantial conversational sample from each child (approximately 300–400 speech acts per child). These samples were comparable across groups, in terms of both the speech acts produced by the children and the speech acts addressed to the children by the researcher.

The children with autism demonstrated assertive speech act profiles that were significantly different than the children with Asperger syndrome and also than the matched children with SLI and normal development. The children with autism produced more identifications (ASID, e.g., "That's a car") and fewer explanations (ASEX, e.g., "He got a new one because it was broken") than the comparison groups. They produced fewer descriptions (ASDC, e.g., "That's going down now") than the matched children with SLI or normal development and fewer internal state reports (ASIR, e.g., "I know how to do this") than the children with Asperger syndrome.

Further analysis of the children's mental assertions (ASIR, ASAT, and ASEX), revealed that the children with autism rarely referred to their own or another's thoughts and beliefs (~5%) and the majority of their utterances concerned desire (~49%). This profile

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Table 6. *Frequency and proportion of reference to desire and thought/belief within the "mental" assertions*

	Autism	SLI	Normal	Asperger	SLI	Normal
Desire freq.						
M	7.42	4.91	6.83	14.17	8.33	6.66
SD	6.55	4.77	5.18	9.06	3.42	4.64
% of total						
M	36.53	12.08	12.52	23.77	18.21	12.31
SD	30.19	12.89	7.69	16.59	8.86	7.11
Thought/belief freq.						
M	2.41	11.42	13.08	9.83	13.42	11.75
SD	3.45	7.41	5.68	7.38	9.11	5.70
% of total						
M	5.05	24.19	25.60	17.31	24.05	25.67
SD	6.14	16.31	7.88	12.86	12.78	8.81

Table 7. *z-Score comparisons of empirical logit transformations for proportion of reference to desire and thought/belief within the "mental" assertions*

	Autism–Asperger	Autism–SLI	Autism–Normal	Asperger–SLI	Asperger–Normal
Desire	–0.52	3.94*	4.16*	2.97*	4.36*
Thought/ belief	–3.92*	–5.63*	–5.19*	–3.12*	–2.21*

*Results significant at $p < .05$ using Holm's correction for multiple comparisons.

was different than those of the matched children with SLI and with normal development. A larger proportion of these children's mental assertions concerned their own and another's thoughts and beliefs (~25%).

Hence, in comparison to the children with Asperger syndrome, SLI, and normal development, the conversations of the children with autism involved the here and now of the immediate context rather than the broader (interpersonal) context of the conversation. These conversations concerned the event landscape, rarely referring to the mental landscape, or landscape of consciousness. The assertive speech act profiles of the children with autism are consistent with previous research indicating impaired use and comprehension of cognitive mental state terms in narrative (Tager–Flusberg & Sullivan, 1995) and experimental tasks (Kazak et al., 1998; Ziatas et al., 1998).

The children with Asperger syndrome presented communicative profiles that were different than the children with autism and also different than the matched children with SLI and with normal development. These children used more internal state assertions (ASIR) than any other group (autism, matched SLI, or matched normal). Previous research has indicated that children with Asperger syndrome may use internal state terms artificially, or in an inappropriate manner (Happé, 1994). Although there were few examples of stereotyped or inappropriate internal state assertions, the children with Asperger syndrome did make greater reference to desire and fewer references to thought and belief than the matched children with SLI or with normal development.

Arguably, the high proportion of internal state assertions (ASIR) could be interpreted as reflecting greater communicative competence in the children with Asperger syndrome as compared to the children with autism or the children with SLI or with normal development. However, the finding appeared to represent an overfocus on one's own desires as internal states, to the detriment of communi-

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

cating about one's own thoughts and beliefs or about another's internal state. Although the differences did not reach significance, the proportion of assertions related to another's mental state (ASAT) was lowest of all for children with Asperger syndrome. The low proportion of assertions related to another's mental state (ASAT) within all groups limit the comparisons that can be made, but the pattern tentatively discerned here is consistent with the clinical description of individuals with Asperger syndrome as egocentric (Frith, 1991).

Speech acts cannot provide conclusive "proof" of poorer or better communicative competence. However, the results of the comparisons discussed here support the characterization of children with Asperger syndrome as having greater communicative competence than children with autism (Dahlgren & Trillingsgaard, 1996; Ehlers et al., 1997; Ramberg, et al., 1996) yet impaired communicative competence relative to SLI or normal peers (Gillberg, 1989; Ramberg et al., 1996; Schopler et al., 1998). The children with SLI demonstrated speech act profiles consistent with the language age–matched peers with normal development. As noted in the Introduction, children with SLI experience significant difficulty with communication in conversational contexts, but many studies have indicated that these difficulties are more a result of syntactic impairment than of wider social factors associated with conversational competence (Lapadat, 1991; Leonard, 1986; Rollins et al., 1994; Rom & Bliss, 1981). Hence, the communicative competence observed for these children was consistent with the linguistic resources available to them. This study matched the children with SLI and normal development by language age. It is possible that there would be differences in the speech act profiles of children with SLI matched by chronological age to children with normal development.

Examining the communicative profiles of the children with autism for evidence in support of the theory of mind hypothesis

As predicted, the majority of the children with autism failed the theory of mind task, whereas the majority of the children with Asperger syndrome, SLI, and normal development passed. The theory of mind hypothesis (Baron–Cohen, 1995; Frith, 1989a) broadly proposes that the communicative disorder observed in individuals with autism is a result of failure to mentalize, resulting in an understanding of the code, but not of the intentional aspects, of language use.

Based on the theory of mind hypothesis, it was predicted that the children with autism would rarely refer to the mental landscape of the shared communicative context, with a paucity of assertions related to internal state (ASIR), another's internal state (ASAT), and ASEX. As discussed, the children with autism did use a lower proportion of explanations than any other group. This result emphasizes an important relationship between theory of mind development and children's reference to causality.

The notion of causal assertions being linked to the development of theory of mind is consistent with Bruner and Feldman's (1993) argument that it is difficulty in understanding and using narrative formats to create meaning for life events that result in the impaired theory of mind of children with autism. The limited evidence of explanations for the children with autism within the conversational sample may indicate that these children do not make the necessary causal links within narrative plots to create meaning for life events. Consistent with the findings of the present study, Tager–Flusberg (1995) demonstrated a paucity of causal references within the narrative productions of children with autism.

Wellman (1990) considered theory of mind to involve two components, the ability to distinguish between the real and the mental world and the ability to understand mutual causal relationships between mental states and the physical, behavioral world. If, as indicated by the low proportion of reference to explanations, the children with autism do not attend to causal relationships within the environment, then the impairment to theory of mind understanding is not only at the level of understanding mental states, but also at the level of attributing a causal relationship between mental state and behavior. The evidence of a

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

lower proportion of explanations identifies a significant impairment in the children with autism, as even 3-year-old children show a preference for explaining events in terms of people's mental states (Lillard & Flavell, 1990).

A further possibility regarding the differences in explanations for the children with autism is that these participants did not appreciate the need to communicate internal realizations regarding causal relationships. Hence, rather than representing impaired causal understanding in general, the children may have made causal connections but failed to communicate them due to a failure to understand causal inferences as opaque, internal, and independent mental representations. Tager–Flusberg (1995) presented a parallel argument when discussing the absence of causal references in the narratives of the children with autism in her study, in contrast to the behavioral explanations produced by the children with autism for Baron–Cohen et al.'s (1986) picture-sequencing task. The picture sequencing task may have elicited behavioral explanations by isolating the task demands such that the children understood the need to make the explanations, whereas within the wider context of Tager-Flusberg's wordless picture text narrative, the demands to communicate causality would not have been as apparent.

Although frequency data revealed fewer references to internal state for self (ASIR) and other (ASAT) by the children with autism, once we had converted the data to proportions, it became clear that these children referred to own and another's internal state in roughly the same proportion of speech acts as the matched children with SLI and with normal development. Hence, predictions based on the theory of mind hypothesis that children with impaired ability to understand independent mental state would make less reference to internal state for self or other were not supported. The children's emphasis on desire within the mental assertions and limited reference to thought and belief did provide evidence consistent with the theory of mind hypothesis. Previous research has indicated that, prior to understanding first order theory of mind, young children demonstrate understanding of desire (Baron–Cohen, 1991; Gopnik & Slaughter, 1991; Wellman & Woolley, 1990). The higher proportion of reference to desire in the children with autism suggests that these children may be at this pre-representational theory of mind stage, despite the mean verbal mental age of the group being above 6 years.

It is possible that the low proportions of use of internal state reports for self and others across all of the children, relative to the full sample, may have masked differences among the groups in terms of proportion of use of the *mental* speech acts. In order to make the task accessible and replicable across all children the scripted interaction task deliberately involved the concrete context of presenting toys to the participants. This context may have elicited a greater emphasis on the here and now, or event landscape, than the more abstract mental landscape, even for the children with normal development. Future research could usefully draw on evidence from studies of peer interaction indicating that contexts capable of eliciting higher frequencies of mental assertions are those of pretend play (Hughes & Dunn, 1997) and of conflict and negotiation (Howe, Petrakos, & Rinaldi, 1998).

The children with autism produced a higher proportion of identifications (ASID) compared to the matched children with SLI or with normal development. Identifications involve reference to the discrete objects and events within the communicative context and require little understanding of the conversational partner's theory of mind. It is possible that the children with autism overused identifications, making more references to discrete elements of the communicative context than the more able language users, who implicitly understood this content as common ground. That the children with autism should exhibit a relative "asset" within their assertions related to identifications provides further support for the theory of mind hypothesis.

An unexpected finding was that the children with autism used lower proportions of descriptions (ASDC) than the matched children with SLI or with normal development. The high proportion of use of identifications by the children with autism would indicate

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

that whereas children with SLI and normal development described the broader context of an item, including content that they may have considered was not part of shared knowledge, the children with autism named or labeled the item. In the process of describing, the speaker would need to attend to the broader features of the communicative context, and in doing so perhaps might employ theory of mind to differentiate shared from unshared knowledge.

Examining differences in the assertions of the children with autism and Asperger syndrome

The children with autism demonstrated significantly different assertive speech act profiles than the children with Asperger syndrome. Regression analysis revealed that diagnosis, and not theory of mind, made a significant unique contribution to explaining the variance observed between groups for the internal state assertions and explanations. Hence, the indications of this analysis were that the differences identified between the groups of children with autism and with Asperger syndrome could not be attributed to the differences in false-belief pass–fail status across the groups. These results do require cautious interpretation, however, particularly related to the use of the false-belief pass–fail measure for theory of mind, the comparisons of small proportions of assertions, and the small number of children ($N = 24$) involved in the analysis.

An alternative interpretation of these results is in line with Frith's (1991) and Bowler's (1992) arguments that children with Asperger syndrome are able to pass simple tasks of theory of mind through computational or logicoaffective mechanisms, with theory of mind difficulties only reflected in complex tasks requiring the integration of theory of mind understanding with real life social and communicative demands. In the false belief task, the pass–fail process may have misrepresented the theory of mind understanding of the children with Asperger syndrome, with the subsequent emphasis on own internal state and lack of reference to another's mental state being representative of impaired theory of mind understanding, as proposed by Frith and Bowler.

Support for the logicoaffective explanation is available from Happé, Ehlers, Fletcher, and Frith's (1996) functional imaging study involving young adults with Asperger syndrome. In this study Happé et al. showed a failure of the individuals with Asperger syndrome to activate areas of the left mesial prefrontal cortex, an area identified in a previous study involving college students as associated with theory of mind understanding (Fletcher et al., 1995). Hence, it may be that the false-belief theory of mind measure within this study was not sufficiently sensitive to differentiate the speech act performance of the children with autism and with Asperger syndrome. Recent research has demonstrated moderate levels of internal consistency for composite theory of mind measures used with children with developmental delay (Charman & Campbell, 1997) and good levels for children with normal development (Hughes et al., 2000). A composite measure of theory of mind would provide a more reliable basis to examine the relative contribution of theory of mind.

In addition, studies examining theory of mind correlates to communicative competence will benefit from examining performance within groups involving children with autism differentiated by theory of mind performance and children with Asperger syndrome differentiated by theory of mind performance. This will be an important extension of the current study as the indications of the regression analysis were that diagnosis was an important predictor of the variance observed in the assertions of the children with autism and with Asperger syndrome. These results provide support for the argument that there are important differences between groups of children with autism and with Asperger syndrome and that combining groups and studying communication in autistic spectrum disorders may potentially negate important differences in the communicative profiles of these children.

The theory of mind performance of a small number of children within the autism and Asperger groups differed from that expected

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

on the basis of their group membership. Two children with autism passed and three children with Asperger syndrome failed the false-belief task. Individual details of these children's mental assertions are provided in Appendix B. As a precaution, analyses were rerun without these children. No changes were observed to the pattern of results. In addition, these children's individual patterns of performance were examined for consistency with predictions based on the theory of mind hypothesis. According to the theory of mind hypothesis, those children with autism who passed false-belief would exhibit a higher proportion of mental assertions. Conversely, those children with Asperger syndrome who failed the false-belief task would be expected to exhibit a lower proportion of the mental assertions.

The evidence was mixed. Of the two children with autism shown to pass the theory of mind task, one child did have, as expected, higher proportions of attributions of another's mental state (ASAT) and ASEX plus a higher proportion of use of thought and belief. This child also showed a proportion of reference to desire lower than the remaining group of children with autism and similar to the matched children with SLI and with normal development. This child, not unexpectedly, was the oldest, most language-able child with autism, (chronological age 12;0, PPVT-R age equivalent AE 8;2, TROG AE 9;0). The performance of this particular child, who passed the false-belief task and subsequently demonstrated greater evidence of use of mental assertions and reference to thought and belief, is consistent with Happé's (1994) finding that all children with autism demonstrating a verbal mental age greater than 11;7 years were able to pass the first order false belief task.

The other child with autism did not follow the expected patterns of performance. This boy was not an older, or more able, language user, chronological age 5;6 years, PRVT-R AE 3;9 years, TROG AE 4;3 years, and among the children with autism he represented one of the lowest users of mental state assertions, with no evidence of reference to thought and belief. The probability of passing the false-belief task by chance is 25%, and it could be unwise to place too much weight on a single anomalous case.

The performance of the three children with Asperger syndrome who failed the false-belief task also presented mixed evidence in relation to the theory of mind hypothesis. Two of these children presented profiles consistent with impaired theory of mind understanding. Both presented with a high proportion of internal state reference and low proportions of assertions of another's internal state and explanations. Both referred more frequently to desire rather than thought and belief within their mental assertions. The third child with Asperger syndrome did not present the same pattern; instead he had lower frequencies, a low proportion of internal state reference, attributions of another's internal state, and explanations at a level similar to the matched children with SLI and with normal development. This child's conversational assertions demonstrated greater communicative competence than expected in a child who did not indicate understanding of independent mental state in the false-belief task. Hence, of the five children with autism or Asperger syndrome who did not perform as expected on the false-belief task, the speech act profiles of three of these children were consistent with predictions based on the theory of mind hypothesis.

Conclusions

This research has indicated several important findings. First, there are differences between the communicative assertions of children with autism and children with Asperger syndrome and also between the children with autism and the matched children with SLI or normal development. Further, many of these differences are consistent with the theory of mind hypothesis. Finally, there is evidence that although children with Asperger syndrome at first appear similar in conversational function to language age matched children with SLI or normal development, finer analysis reveals differences that may reflect subtle impairment in both communicative function and theory of mind understanding.

Interpretation of the findings of this study

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

requires caution. This study was cross-sectional; hence, although the results provide support to the theory of mind hypothesis in that impaired understanding of independent mental state results in impaired communicative competence, causal direction cannot be confirmed by the current results. It could be argued that the impaired communicative competence of the children with autism (and subtle impairments of the children with Asperger syndrome) result in subsequent impairments to theory of mind understanding. Alternatively, an underlying cognitive or neuropsychological factor common to both theory of mind and communicative competence could result in the profile of results observed within this study. Only longitudinal research can confirm the direction of the associations between the impaired theory of mind and communicative competence that we found. The present results lead to the expectation that the development of theory of mind and of communicative competence will prove to be closely interwoven.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders.* (4th ed.). Washington, DC: Author.

Astington, J. (1990). Narrative and the child's theory of mind. In B. Britton & A. Pellegrini (Eds.), *Narrative thought and narrative language* (pp. 151–171). Hillsdale, NJ: Erlbaum.

Astington, J. W., & Jenkins, J. J. (1995). Theory of mind development and social understanding. *Cognition and Emotion, 9,* 151–165.

Baron–Cohen, S. (1991). The theory of mind deficit in autism: How specific is it? *British Journal of Developmental Psychology, 9,* 301–314.

Baron–Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind.* Cambridge, MA: MIT Press.

Baron–Cohen, S., Leslie, A., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition, 21,* 37–46.

Baron–Cohen, S., Leslie, A., & Frith, U. (1986). Mechanical, behavioural and intentional understanding of picture stories in autistic children. *British Journal of Developmental Psychology, 4,* 113–125.

Bartsch, K., & Wellman, H. (1995). *Children's talk about the mind*. New York: Oxford University Press.

Bishop, D. (1989). *Test of Reception of Grammar* (2nd ed., University of Manchester, Age and Cognitive Performance Research Centre), Manchester: Author.

Bishop, D. V. M., Chan, J., Adams, C., Hartley, J., & Weir, F. (2000). Evidence of disproportionate pragmatic difficulties in a subset of children with specific language impairment. *Development and Psychopathology, 12,* 177–199.

Bowler, D. M. (1992). "Theory of mind" in Asperger's syndrome. *Journal of Child Psychology and Psychiatry, 33,* 877–893.

Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. *Developmental Psychology, 6,* 906–921.

Brinton, B., & Fujiki, M. (1993). Language, social skills and socio-emotional behavior. *Language, Speech and Hearing Services in Schools, 24,* 194–198.

Bruner, J. (1986). *Actual minds, possible worlds.* Cambridge, MA: Harvard University Press.

Bruner, J., & Feldman, C. (1993). Theories of mind and the problem of autism. In S. Baron–Cohen, H. Tager–Flusberg, & J. Cohen (Eds.), *Understanding other minds: Perspectives from autism.* Oxford: Oxford University Press.

Charman, T., & Campbell, A. (1997). Reliability of theory of mind task performance by individuals with a learning disability: A research note. *Journal of Child Psychology and Psychiatry, 38,* 725–730.

Clark, H. H. (1992). *Arenas of language use.* Chicago: University of Chicago Press.

Craig, H., & Evans, J. (1993). Pragmatics and SLI: Within group variations in discourse behavior. *Journal of Speech and Hearing Research, 36,* 779–789.

Craig, H., & Washington, J.A. (1993). The access behaviors of children with specific language impairment. *Journal of Speech and Hearing Research, 36,* 322–337.

Dahlgren, S. O., & Trillingsgaard, A. (1996). Theory of mind in non-retarded children with autism and Asperger's syndrome. A research note. *Journal of Child Psychology and Psychiatry, 37,* 759–763.

Dore, J. (1986). The development of conversational competence. In R. Scheifelbusch (Ed.), *Language competence: Assessment and intervention*. (pp. 3–60). San Diego, CA: College–Hill Press.

Dunn, J., & Brown, J. R. (1993). Early conversations about causality: Content, pragmatics and developmental change. *British Journal of Developmental Psychology, 11,* 107–123.

Dunn, L., & Dunn, P. (1981). *Peabody Picture Vocabulary Test—Revised.* Circle Pines, MN: American Guidance Services.

Eales, M. (1993). Pragmatic impairments in adults with childhood diagnoses of autism or developmental receptive language disorder. *Journal of Autism and Developmental Disorders, 23,* 593–617.

Ehlers, S., Nyden, A., Gillberg, C., & Daahlgren Sandberg, A. (1997). Asperger syndrome, autism and attention disorders: A comparative study of the cognitive profiles of 120 children. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 38,* 207–217.

Eisenmajer, R., & Prior, M. (1991). Cognitive linguistic correlates of "theory of mind" ability in autistic children. *British Journal of Developmental Psychology, 9,* 351–364.

Fine, J., Bartolucci, G., Szatmari, P., & Ginsberg, G. (1994). Cohesive discourse in pervasive develop-

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

mental disorders. *Journal of Autism and Developmental Disorders, 24,* 315–329.
Fleiss, J. L. (1981). *Statistical methods for rates and proportions.* New York: Wiley.
Fletcher, P. C., Happe, F., Frith, U., Baker, S. C., Dolan, R. J., Frackowiak, R. S. J., & Frith, C. D. (1995). Other minds in the brain: a functional imaging study of "theory of mind" in story comprehension. *Cognition, 57,* 109–128.
Frith, U. (1989a). *Autism: Explaining the enigma.* Oxford: Blackwall.
Frith, U. (1989b). A new look to language and communication in autism. *British Journal of Disorders of Communication, 24,* 123–150.
Frith, U. (1991). Asperger and his syndrome. In U. Frith (Ed.), *Autism and Asperger syndrome* (pp. 1–36). Cambridge: Cambridge University Press.
Frith, U., Happe, F., & Siddons, F. (1994). Autism and theory of mind in everyday life. *Social Development, 3,* 108–124.
Fujiki, M., Brinton, B., & Todd, C. (1996). Social skills of children with specific language impairment. *Language, Speech and Hearing Services in Schools, 27,* 195–202.
Ghaziuddin, M., & Gerstein, L. (1996). Pedantic speaking style differentiates Asperger syndrome from high functioning autism. *Journal of Autism & Developmental Disorders, 26,* 585–595.
Gillberg, C. (1989). Asperger syndrome in 23 Swedish children. *Developmental Medicine and Child Neurology, 31,* 520–531.
Golinkoff, R. (1993). When is communication a "meeting of minds"? *Journal of Child Language, 20,* 199–207.
Gopnik, A., & Slaughter, V. (1991). Young children's understanding of changes in their mental states. *Child Development, 62,* 98–110.
Grice, H. P. (1975). Logic and conversation. In P. Cole & J.L. Morgan (Eds.), *Syntax and semantics: Vol. 3. Speech acts* (pp. 41–58). New York: Academic Press.
Happe, F. (1991). The autobiographical writings of three Asperger syndrome adults: Problems of interpretation and implications for theory. In U. Frith (Ed.), *Autism and Asperger syndrome* (pp. 207–242). Cambridge: Cambridge University Press.
Happé, F. (1993). Communicative competence and theory of mind: A test of relevance theory. *Cognition, 48,* 101–119.
Happé, F. (1994). An advanced test of theory of mind: Understanding of story character's thoughts and feelings by able autistic, mentally handicapped, and normal children and adults. *Journal of Autism and Developmental Disorders, 24,* 129–154.
Happé, F., Ehlers, S., Fletcher, P., & Frith, U. (1996). "Theory of mind" in the brain: Evidence from a PET scan study of Asperger syndrome. *Neuroreport: An International Journal for the Rapid Communication of Research in Neuroscience, 8,* 197–201.
Happe, F. G. E. (1995). The role of age and verbal ability in the theory of mind task performance of subjects with autism. *Child Development, 66,* 843–855.
Howe, N., Petrakos, H., & Rinaldi, C. M. (1998). "All the sheeps are dead: He murdered them." Sibling pretense, negotiation, internal state language, and relationship quality. *Child Development, 69,* 182–191.
Howell, D. C. (1995). *Fundamental statistics for the behavioral sciences.* (3rd ed.). Belmont, CA: Duxbury Press.
Hughes, C., Adlam, A., Happe, F., Jackson, J., Taylor, A., & Avshalom, C. (2000). Good test–retest reliability for standard and advanced false belief tasks across a wide range of abilities. *Journal of Child Psychology and Psychiatry, 41,* 483–490.
Hughes, C., & Dunn, J. (1997). "Pretend you didn't know": Preschoolers' talk about mental states in pretend play. *Cognitive Development, 12,* 381–403.
Hurtig, R. P., Ensrud, S., & Tomblin, J. (1982). The communicative function of question production. *Journal of Autism and Developmental Disorders, 12,* 57–69.
Jarrold, C., Boucher, J., & Russell, J. (1997). Language profiles in children with autism. *Autism, 1,* 57–76.
Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2,* 217–250.
Kazak, S., Collis, G. M., & Lewis, V. (1998). Can young children with autism refer to knowledge states? *Journal of Child Psychology and Psychiatry, 38,* 21–34.
Lalonde, C. E., & Chandler, M. J. (1995). False belief understanding goes to school: On the socio-emotional consequences of coming early or late to a first theory of mind. *Cognition and Emotion, 9,* 1167–1185.
Landry, S. H., & Loveland, K. A. (1988). Communication behaviors in autism and developmental language delay. *Journal of Child Psychology and Psychiatry, 29,* 621–634.
Lapadat, J. C. (1991). Pragmatic language skills of students with language and/or learning disabilities: A quantitative synthesis. *Journal of Learning Disabilities, 24,* 147–158.
Leonard, L. (1986). Conversational replies of children with specific language impairment. *Journal of Speech and Hearing Research, 29,* 114–119.
Lillard, A.S., & Flavell, J.H. (1990). Young children's preferences for mental state versus behavioral descriptions of human action. *Child Development, 61,* 1–18.
Loveland, K. A., Landry, S. H., Hughes, S. O., Hall, S. K., & McEvoy, R. E. (1988). Speech acts and the pragmatic deficits of autism. *Journal of Speech and Hearing Research, 31,* 593–604.
Moore, C., Furrow, D., Chiasson, L., & Patriquin, M. (1994). Developmental relationships between production and comprehension of mental terms. *First Language, 14,* 1–17.
Moore, C., Pure, K., & Furrow, D. (1990). Children's understanding of the modal expressions of speaker certainty and uncertainty and its relation to the development of a representational theory of mind. *Child Development, 61,* 722–730.
Ozonoff, S., Pennington, B. F., & Rogers, S. J. (1991). Executive functioning deficits in high functioning autistic individuals: Relationship to theory of mind. *Journal of Child Psychology and Psychiatry, 32,* 1081–1105.
Perner, J., Frith, U., Leslie, A. M., & Leekam, S. R. (1989). Exploration of the autistic child's theory of mind: Knowledge, belief and communication. *Child Development, 60,* 689–700.
Ramberg, C., Ehlers, S., Nyden, A., & Johansson, M. (1996). Language and pragmatic functions in school-age children on the autistic spectrum. *European Journal of Disorders of Communication, 31,* 387–413.
Rollins, P., Pan, B., Conti–Ramsden, G., & Snow, C.

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

(1994). Communicative skills in children with specific language impairments: A comparison with their language matched siblings. *Journal of Communication Disorders, 27,* 189–206.

Rom, A., & Bliss, L. (1981). A comparison of verbal communicative skill of language impaired and normal speaking children. *Journal of Speech and Hearing Disorders, 14,* 133–140.

Schopler, E., Mesibov, G. B., & Kunce, L. (Eds.). (1998). *Asperger syndrome or high-functioning autism?* Chapel Hill, NC: Plenum Press.

Shulman, B. B. (1986). *Test of Pragmatic Skills—Revised*. Tucson, AZ: Communication Skills Builders.

Sperber, D., & Wilson, D. (1986). *Relevance: Communication and cognition.* Oxford: Blackwell.

Surian., L., Baron–Cohen, S., & Van der Lely, H. (1996). Are children with autism deaf to Gricean maxims? *Cognitive Neuropsychiatry, 1,* 55–71.

Szatmari, P., Bartoloucci, G., & Brenner, R. (1989). Asperger's syndrome and autism: Comparisons on early history and outcome. *Developmental Medicine and Child Neurology, 31,* 709–720.

Tager–Flusberg, H. (1992). Autistic children's talk about psychological states: Deficits in the early acquisition of a theory of mind. *Child Development, 63,* 161–172.

Tager–Flusberg, H. (1995). "Once upon a ribbit": Stories narrated by autistic children. *British Journal of Developmental Psychology, 13,* 45–59.

Tager–Flusberg, H., Calkins, S., Nolin, T., Baumberger, T., Anderson, M. & Chadwick–Dias, A. (1990). A longitudinal study of language acquisition in autistic and Down syndrome children. *Journal of Autism and Developmental Disorders, 20,* 1–21.

Tager–Flusberg, H., & Sullivan, K. (1995). Attributing mental states to story characters: A comparison of narratives produced by autistic and mentally retarded individuals. *Applied Psycholinguistics, 16,* 241–256.

Tirassa, M. (1999). Communicative competence and the architecture of the mind/brain. *Brain and Language, 68,* 419–441.

Trevarthen, C. (1979). Communication and co-operation in early infancy: A description of primary intersubjectivity. In M. Bullowa (Ed.). *Before speech: The beginnings of interpersonal communication.* Cambridge: Cambridge University Press.

Volden, J., & Lord, C. (1991). Neologisms and idiosyncratic language in autistic speakers. *Journal of Autism and Developmental Disorders, 21,* 109–130.

Welch–Ross, M. K. (1997). Mother–child participation in conversation about the past: Relationship to preschoolers' theory of mind. *Developmental Psychology, 33,* 618–629.

Wellman, H. (1990). *The child's theory of mind.* Cambridge, MA: MIT Press.

Wellman, H.M., & Woolley, J.D. (1990). From simple desires to ordinary beliefs: The early development of everyday psychology. *Cognition, 35,* 245–275.

Wetherby, A., & Prutting, C. (1984). Profiles of communicative and cognitive social abilities in autistic children. *Journal of Speech and Hearing Research, 27,* 364–377.

Wing, L. (1988). The continuum of autistic characteristics. In E. Schopler & G.B. Mesibov (Eds.), *Diagnosis and assessment in autism* (pp. 91–110). New York: Plenum Press.

Ziatas, K., Durkin, K., & Pratt, C. (1998). Belief term development in children with autism, Asperger syndrome, specific language impairment and normal development: Links to theory of mind development. *Journal of Child Psychology and Psychiatry, 39,* 755–763.

Appendix A

Details of the Scripted Interaction

Greet child, Hello [name].

Take out the toy bag. "I have some toys for us to see. I'm going to show them to you."

Present toys one by one. Follow the child's interest in the toy, extending the interaction by following the child's lead.

Take out the bubbles and blow until the child is engaged, then stop blowing.

Pull out the soft ball, hand to child. Next, hand the child the spike ball and follow with the gel ball and world ball.

Take out the talking doll; make the doll talk by pulling the string. Do this several times, ensuring that the doll is kept out of reach of the child.

Build a tower with blocks, building it up very high.

Take out the "Transformer"; ask, "Do you want me to make a truck or a man?"

Pull out a cup and then a shoe.

Pull out the unusual object (wood carving).

Take out the jar of lollies (candies) and eat some but don't offer any to the child. If necessary ask the child if he or she wants either one or another of the lollies.

Take out a display box of lollies. Say, "Look at these."

Blow up a balloon and let it go; when the child returns with the balloon, attend elsewhere.

Take your keys out of the bag and hand them to the child, saying, "Can you put these in my bag?" with the bag out of sight.

Wind up a spinner toy, retaining the key; let it go, allowing it to run down (or the child to catch it).

Show the child the wind-up hopping rabbit; send it hopping to the edge of the table where the child cannot reach it.

Blow the kazoo and hand it to the child saying, "You do it."

Hand the child the magnetic building materials. Follow the child's lead, make a point of asking one "Why?" question during the building sequence.

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press

Hand the child the dolls. Follow the child's lead.
Take out the "Ninja Turtles" one by one, asking, "Who is this?"
Hold up one of the turtles (not Leonardo), asking, "So, is this Leonardo?"
Identify the correct Leonardo with the child's help and then put him away in the bag.
Search about in the bag for a fifth Turtle, saying, "Where's Amadeus?"
Search about for Leonardo, asking, "Where's Leonardo?"
Put out the board game ("Tummy Ache"), saying, "Lets play this."
Explain how to play, leaving pauses for the child to acknowledge understanding, but sneeze at a critical part of the instruction.
Halfway through the game take several turns, as if that is how the game is played.
Place one card in the wrong place.
Say, "Pardon?" to one of the child's utterances.
Attend elsewhere at some point in the game when it is your turn.
Take out the puppets; explain, "How about I show you a puppet show?" Show the puppets fighting over a ball and hitting each other.
Present the child with the *Feelings* book (a book of simple pictures of bears with varying affects in related situations); if necessary, say, "You can tell me about this [book]."
Pack the toys away and make as if to leave the room, saying, "Thank you for looking through the toys with me."

Appendix B

Patterns of performance for the two children with autism found to pass the false-belief task and the three children with Asperger syndrome found to fail the false-belief task

	Autism Pass	Autism Pass	Asperger Fail	Asperger Fail	Asperger Fail
ASIR					
Frequency	14	10	46	40	31
% of total	4.31	2.04	12.33	9.76	5.86
ASAT					
Frequency	13	1	7	4	18
% of total	3.69	0.2	1.88	0.98	3.41
ASEX					
Frequency	12	0	1	19	42
% of total	4.00	0	0.3	4.63	7.94
Desire (%)	29	78	80	35	31
Thought/belief (%)	14	0	0	8	34

Note: Summarized from Table 4. Group means and standard deviations for autism, ASIR (*M* freq. = 16.33, *M* (%) total = 4.77), ASAT (*M* freq. = 5.42, *M* (%) total = 1.44), ASEX (*M* freq. = 7.8, *M* (%) total = 2.33). Group means and standard deviations for Asperger syndrome, ASIR (*M* freq. = 36.42, *M* (%) total = 8.82), ASAT (*M* freq. = 8.42, *M* (%) total = 2.07), ASEX (*M* freq. = 14.25, *M* (%) total = 3.20). See Table 4 for full details of speech act performance.

https://doi.org/10.1017/S0954579403000051 Published online by Cambridge University Press