Running head: COLLABORATIVE COMPETENCE IN DIALOGUE

Collaborative competence in dialogue: Pragmatic language impairment as a window onto the psychopathology of autism

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Abstract

Background: Pragmatic language, including conversational ability, can be difficult for people with autism. Difficulties with dialogue may reflect impairment in interpersonal engagement more than general language ability. Method: We investigated conversational abilities among children and adolescents with and without autism (n=18 per group) matched for language proficiency and productivity. Videotaped conversations from the Autism Diagnostic Observational Schedule (ADOS, Lord, Rutter, DiLavore & Risi, 2001) were rated according to the Collaborative Competence in Dialogue (CCD) scale featuring six verbal and non-verbal 'cues' that conversational partners use to sustain dialogue. Results: Participants with autism produced significantly fewer 'typical' communicative cues and more cues rated as intermittent or rote/stereotyped, even when non-verbal items (gaze) were removed from consideration. Within the autism group, competence in dialogue was *not* correlated with 'general' language ability, but was correlated with a measure of pragmatic ability. Conclusions: Difficulties with collaboration in dialogue may mirror the intermittent or incomplete interpersonal engagement of children with autism. Implications: Assessment of language ability in autism should include observation in unstructured social settings.

Keywords: Autism, Pragmatic Language, Conversation, Identification, ADOS.

Highlights

We investigated conversational abilities among children and adolescents with and without autism (n=18 per group).

Participants with autism produced significantly fewer ‘typical’ communicative cues and more cues rated as atypical.

Within the autism group, competence in dialogue was *not* correlated with ‘general’ language ability, but was correlated with a measure of pragmatic ability and with ADOS scores.

Results suggest pragmatic language ability mirrors the intermittent interpersonal engagement of children and adolescents with autism, which may reflect difficulties identifying with others’ perspectives.

Introduction

Language development is highly variable in autism (Tager-Flusberg, Paul & Lord, 2005). However, even individuals with autism whose syntax (structure of language) and semantics (word meaning) may be relatively spared tend to have difficulties with aspects of pragmatic language (Baltaxe, 1977; Schoen-Simmons, Paul & Volkmar, 2014). The present study of the pragmatics of conversation is concerned with the ways in which verbal children with autism collaborate with an interlocutor to sustain a dialogue, and investigates the relationship between the children's collaborative competence and their social impairments.

A variety of atypicalities in pragmatic language have been documented among people with autism. For example, it is common for affected individuals to encounter difficulty in initiating interaction and making conversational overtures (Loveland & Tunali, 2005); they tend to employ stereotyped or scripted language as well as idiosyncratic phrases or words, and may be atypical in the use of 'I' and 'you' (e.g., Lee, Hobson & Chiat, 1994; Loveland & Tunali, 2005; Tager-Flusberg et al., 2005); and show some difficulties in relating narratives to others (Canfield, Eigsti, de Marchena, & Fein, 2016; Capps, Losh & Thurber, 2000; Tager-Flusberg, 2005). So, too, their comprehension of others' speech can be limited, not least in understanding figurative or ambiguous language as in humour or irony (Happé, 1993). It is evident that such atypicalities will influence the quality of conversations between individuals with autism and other people (Fine, Bartolucci, Szatmari & Ginsberg, 1994; Loveland & Tunali, 2005). In an early ground-breaking study, Baltaxe (1977) reported that a group of verbally-able adolescents with autism were inconsistent in maintaining appropriate speaker/hearer roles, they tended to produce unintentionally offensive utterances, and they failed to differentiate old and new information, thereby tending to repeat irrelevant facts. More recent research documents related problems with maintaining and adjusting topics to be relevant or interesting for interlocutors (De Marchena, & Eigsti, 2016; Tager-Flusberg & Anderson, 1991; Volden, Magill-Evans, Goulden, & Clark, 2007; Nadig, Vivanti, & Ozonoff, 2009). Individuals with autism may fail to take into account an interlocutor's informational state, for instance, saying 'he' rather than naming a character when describing a film the other person has not seen (Arnold, Bennetto, & Diehl, 2009; Loveland & Tunali, 2005). Sometimes they omit to repair communicative breakdown by clarifying or repeating something the listener did not understand or hear (Volden, 2004), or require

explicit cues from a conversational partner in order to maintain dialogue (Schoen-Simmons, Paul & Volkmar, 2014).

However, many pragmatic abilities are relatively spared: children with autism can and do show the ability to adjust their communication in appropriate ways to interlocutors, albeit inconsistently or imperfectly (e.g. Nadig et al., 2009; Volden et al., 2007). This inconsistency poses a challenge for researchers to account for, and raises theoretical questions about the root cause of pragmatic language impairment in ASD. The present study concerns conversations between an adult investigator and children and adolescents with and without autism. Our first aim was to analyse strengths and limitations of participants' use of communicative cues in the course of conversations, what we call 'collaborative competence'. Our second aim was to investigate the relations between 'collaborative competence' and individuals' language ability and social interaction.

Conversation as Joint Engagement

The study of pragmatic aspects of conversation offers a window onto wider aspects of interpersonal understanding and relatedness. The reason is that in essence, conversation is an interpersonal interaction, albeit one that is verbally-mediated (Bates, 1976). Whether as speaker or listener, producing and comprehending language appropriate to context requires attunement to the mental states of the conversational partner (Levinson, 1983), as well as sensitivity to features of context and content that are relevant for the pair (Grice, 1975, 1978; Sperber & Wilson, 1986, 2002). Conversation also requires speakers to adjust their reactions and contributions on a moment-to-moment basis as the dialogue unfolds. Impairments in this domain tend to reflect problems with "responding to and expressing communicative intents" (Bishop et al. 2000:177) as well as achieving interpersonal co-ordination of mental attitudes and orientations.

[NOTE: section cut on inferential pragmatics, section on Conversation Analysis moved lower down.]

One perspective on the development of pragmatic abilities is based on the notion that very young children's social interactions, especially when supported by competent communicative partners, enable them to acquire social understanding and pragmatic ability through activity, conceptualised variously as 'naïve participation' (Fernyhough, 2008) or 'use before meaning' (Nelson,

1996). Writers in this tradition view the child's access to the social, interpersonal context as primary in development, providing the attuned, collaborative exchanges from which cognition and language are moulded (Trevarthen & Aitken, 2001; Vygotsky, 1978). Correspondingly, pragmatic impairments in autism are considered to reflect atypicality in engagement with the bodily-expressed attitudes and actions of other people. One approach has been to highlight how children who develop autism have a limited ability to identify with others (Hobson, 2002; 2007; 2012). For instance confusions in the understanding and use of personal pronouns, or atypicalities in expressing greetings and farewells, may reflect failures in this basic kind of interpersonal role-taking (Lee, Hobson & Chiat, 1994; Hobson & Lee, 1998; Hobson, Lee & Hobson, 2010). Given that identifying-with is a process with cognitive, motivational and affective aspects, this account reconfigures distinctions among these partly separable categories of mental functioning, and posits affective/motivational as well as cognitive aspects to pragmatic impairments in autism.

Provisional evidence in support of this account comes from recent research on conversations involving individuals with autism. In a study of nonverbal aspects of conversation with an adult, children with autism were reported to have subtle deficits in features of nonverbal communication, and in particular head-nodding, which are integral to collaboration in dialogue (García-Pérez, Lee & Hobson, 2007). Compared with matched children without autism, those with autism were found to have marked limited affective engagement with the conversational partner, and a poorer flow of conversational exchange. In a further study of the same videotaped conversations, Hobson, Hobson, García-Pérez & DuBois (2012) reported that among participants with autism, measures of affective engagement were correlated with the degree to which the children responded to the adult's intended meaning in dialogue, rather than the surface meaning of their utterances. A second finding from this sample (Du Bois, Hobson, & Hobson, 2014) was that although participants with autism showed 'dialogic resonance' in picking up features of the adult's prior speech (e.g. adult: 'What are you good at?' to which the participant responded: 'I am good at science.'), they were more likely than matched participants without autism to build upon the other's speech forms in atypical or deficient ways (e.g., adult: 'What do you like most about yourself?' to which a participant responded: 'Most about myself is the teach', demonstrating how the participant not only picked up and modified an expression to 'Most about myself…', but then failed to use this as a basis for what followed). While the children with

autism often adapted the form of their responses in keeping with that of the adult, they were not consistent in assimilating this in such a way as to sustain coherent, relevant dialogue.

To further develop this approach, we can look to the field of conversation analysis, which offers a rich examination of the mental capacities needed for these aspects of successful conversation (Clark & Brennan, 1991; Clark & Krych, 2004). Conversation analysis allows the researcher to examine the moment-to-moment subtleties of verbal exchanges, providing data on the nuanced ways in which speakers evidence their sensitivity to each other's mental states, and their capacity to collaborate in sustaining a dialogue. It enables examination of the ways in which speakers provide and elicit feedback from each other over the course of a conversation (Clark, 2004). For instance, interlocutors monitor indications of potential derailment of dialogue in order to maintain topics of interest to each (Clark & Brennan, 1991), and provide mutual feedback that is integral to the unfolding conversation (Schegloff, 1982). Nodding one's head, or saying 'mm-hmm', 'um' or 'uh', are subtle ways in which conversational partners signal their understanding, their hesitation, or their intention to carry on speaking (Clark & Fox Tree, 2002). In constantly *grounding* communication through back-channel support, therefore, speakers coordinate their actions and collaborate in creating mutually meaningful dialogue (Duncan & Fiske, 1977). If we are to understand impairments in pragmatic language and conversation among individual with autism, we must determine whether – and if so, why - these collaborative processes are derailed. While the field of pragmatics in ASD has begun to draw on concepts from conversation analysis in recent years (e.g. *common ground* in DeMarchena & Eigsti, 2016), the field is yet to fully exploit the insights from this approach, which offers a means to examine the ways in which subtle conversational features can index broader deficits in joint action, attunement and collaboration.

Methodological approach and predictions.

The current study was intended as a preliminary attempt to apply concepts from the field of conversation analysis to a group of adolescents with ASD, and to examine whether these concepts were related to general difficulties with social engagement in ASD. We devised a new measure of 'collaborative competence', focussing on verbal, non-verbal and paralinguistic features of two-person connectedness in dialogue that are described in the literature of conversational analysis (Clark, 2006). We selected the following aspects of conversation: Continuers and Assessments (Levinson, 1983;

Schegloff, 1982); Appropriate Next Response (Clark & Krych, 2004; Prutting & Kirchner, 1987); Repairs (Volden, 2004); Try Markers (Clark & Krych, 2004); Gaze to Regulate and Gaze to Co-regulate (Goodwin, 1981; Kendon, 1967). Expression and responsiveness to these cues (which are described in detail below) appears critical for speakers to regulate and maintain dialogue.

Divergent findings within the literature exist around whether pragmatic difficulties relate more strongly to linguistic ability (e.g. Nadig et al., 2009), or autism symptom severity (e.g. De Marchena & Eigsti, 2016). One potential reason for this divergence is the methodology used to assess pragmatic language impairment: highly structured assessments (e.g. referential communication paradigms) have high internal validity, but place fewer demands on the participant and may assess latent skills that are not typically employed in more challenging unstructured settings. We would argue, with other researchers (e.g. Arnold et al., 2009; De Marchena, & Eigsti, 2016) that a more ecologically valid assessment of pragmatic language ability may be found via assessment of language in naturalistic contexts, with the full range of cognitive and social demands this places on the participants. Canfield and colleagues (2016) reported that coding schemes failed to detect systematic differences in narrative quality between children with and without autism, but naïve raters could still detect subtle difficulties in the narratives of children with autism nonetheless. It is therefore necessary for linguistic analysis to focus on detailed aspects of conversation, in order to identify the subtle ways in which individuals with autism have difficulty in conversing (Arnold et al., 2009): modifying the approach of conversation analysis may offer us a means to do this.

The present study therefore assessed conversation using naturalistic conversation during the ADOS assessment (Lord, Rutter, DiLavore & Risi, 2001). Previous research has also based assessment of pragmatic ability (i.e. narrative ability) on segments from the ADOS (Canfield et al., 2016). While the ADOS includes codes for pragmatic language ability (e.g. Conversation, Reporting of Events), in the present study we wished to take a more fine-grained approach to both verbal and nonverbal indicators of collaboration in dialogue, which would complement the information that the ADOS codes provide. Typically, conversational analysis involves intensive coding of small numbers of transcribed conversations or frame-by-frame videotape recordings. However, we wanted to judge the quality of collaboration in conversations over a relatively long time, and therefore sought to make broad qualitative judgements on the presence, absence and typicality of verbal, non-verbal and

paralinguistic cues. This process of coding is more familiar in psychological research and clinical settings, and is similar to ADOS coding, which requires coders to assign qualitative ratings, typically from 0-2, on specific social behaviours across a 30-45 minute interaction (Lord et al., 2001).

In summary, this study attempted to evaluate the quality of collaborative cues derived from conversation analysis in the dialogue of adolescents with autism, using a methodology that is well established in autism research and clinical fields. We examined the relation between collaborative competence in dialogue and children's language ability and symptom severity to evaluate the thesis that collaboration in conversation indexes children's degree of intersubjective or social engagement. We chose to include a comparison group of children with learning disabilities (LD) rather than typically-developing children. Like children with ASD, children with LD may struggle with language ability and executive function within conversation. If children with LD show superior performance to children with ASD on collaboration in dialogue, this would be a clearer indication of the importance of the tendency or motivation to 'identify with' the others' perspective.

Method

Participants

This study formed part of a larger body of research that was approved by two university ethics boards. Informed consent for children to participate was obtained from parents. Eighteen children and adolescents with autism, and 18 children and adolescents with moderate learning difficulties (LD) between 7 and 15 years of age were recruited as the two primary, atypically developing groups for the study. The groups were matched on measures of 'general' cognitive and linguistic ability, so that any group differences in communicative competence could not be attributed to discrepancies in these respects. There were 16 males and 2 females in each group.

A further 8 participants were identified as sub-threshold for autism. These children did not have previous clinical diagnoses of autism, but showed a range of clinical features of autism on both the diagnostic measures and classroom observation. We shall report these participants' characteristics and results separately.

Diagnostic Criteria

Children with autism were selected according to three sets of diagnostic criteria. Firstly, they had an established DSM-IV diagnosis of autism or Asperger's syndrome, and this was confirmed to be in keeping with classroom observations of the children's behaviour.

Secondly, all participants in the study were administered the Autism Diagnostic Observation Schedule (ADOS: Lord et al., 2001), a semi-structured interview lasting 30-45 minutes. In this assessment, a participant interacts with a tester on a range of activities, such as reading a story from a book, engaging in conversation, and joining in make-believe play. The tester provides a variety of social presses in order to assess the participant's communication, social interaction, imagination and behaviour. Module 3, which is designed for school-age children and adolescents who are verbally fluent (a criterion necessary for the present study), was the version administered. All children assigned to the autism group scored above social-communication diagnostic threshold (> 7) on the ADOS (see Table 1).

Thirdly, parent or teacher reports on the Social Communication Questionnaire – Current (SCQ: Berument et al., 1999) were used to confirm diagnosis for both groups (Table 1). This 40-item checklist screens for existing social communication impairment and behavior typical of autism.

In most cases, the three approaches to diagnosis were in keeping with each other, indicating that a given individual either did or did not qualify for the diagnosis of autism. In exceptional instances where the diagnostic measures conflicted, clinical judgement was used to interpret the tests and assign participants to each group. Of special note is that six of the LD children scored over 7 (max 13) on the ADOS. Although such scores are usually taken to reflect autism-style communication impairment, few research studies have used the ADOS on an LD group, among whom difficulties may arise for different reasons. The six LD participants with social-communication difficulties failed to meet criteria for autism according to both classroom observation, and teacher/parent report on the SCQ. One child with learning difficulties scored above the SCQ threshold at 16, but when this was considered in the light of his ADOS score and classroom observation, he was not deemed to meet criteria for autism. Six children with previous autism diagnoses met all other criteria but scored below the SCQ threshold. Although we are confident the allocation to groups was appropriate (based on developmental history and current presentation), it may be noted that this strategy for determining

group composition is conservative, in that any diagnostic error would tend to decrease the chance of finding group differences in conversational abilities.

TABLE 1 ABOUT HERE

Matching

Participants were required to have sufficient language ability to engage in conversation and allow assessment of communicative competence. In order to ensure that group differences in this respect were not attributable to 'general' aspects of language ability the two groups were matched on a measure of expressive language ability and verbal mental age, the Oral and Written Language Scales: Oral Expression (OWLS: Carrow-Woolfolk, 1995: see Table 1). The OWLS is composed of 96 items, for which the child is shown a stimulus picture and asked to complete a sentence or create their own sentence to explain what is happening in the picture. The items cover Lexical, Syntactic, Supralinguistic and Pragmatic areas of language. As can be seen from Table 1, both groups had similar age equivalents for the Oral Expression scale, with the autism group showing a slight but non-significant advantage over the LD group, $t(34) = -0.96$, *ns*. Separate percentage scores were also calculated for the number of Syntactic and Lexical items that were administered. The number of lexical/syntactic items each participant answered correctly was recorded, and a percentage score was calculated by dividing the number passed by the number administered and multiplying by 100.

In addition, we tested groups for language productivity by assessing mean length of utterance in words (MLUw). Participants were administered a task in which they described what was happening in a series of cartoons. This was audio-taped, transcribed, and the MLU calculated based on criteria given in the Expression, Reception and Recall of Narrative Instrument Manual (ERRNI: Bishop, 2004). False starts, repetitions and non-words are excluded and abbreviated words are counted as two words. To calculate MLU, the total number of words in the participant's speech is divided by the number of utterances. A higher MLU is taken to indicate a higher level of language proficiency, whereas a lower MLU score suggests that the participant uses single clauses with simple structure. Two raters independently calculated MLU for 9 (20%) of the transcripts and were found to agree strongly (ICC=0.99), so the second rater calculated MLU for the remaining transcripts. The results appear in Table 1: the groups were not significantly different in MLU scores, $t(33) = -1.17$, *ns*. One

MLU rating from the Autism group could not be obtained, as the participant was not available for testing.

Measures of Pragmatic Linguistic Functioning

Established measures.

We employed two established measures of pragmatic language functioning. The first was the Children's Communication Checklist – 2nd edition (CCC-2: Bishop, 2003), a 70-item checklist, which can be used to identify pragmatic language impairment. This measure was completed and returned by either parents, teachers or the Speech and Language therapist of the participants. It provides scaled scores and percentile ranks for speech, syntax, coherence and semantics, which are general language abilities, as well as pragmatic language abilities of Inappropriate Initiation ("Talks to people too readily: e.g., without any encouragement, starts up a conversation with a stranger"), Stereotyped Language ("Pronounces words in an over-precise manner: accent may sound affected..."), Use of Context ("Gets confused when a word is used with a different meaning from usual...") and Nonverbal Communication ("Makes good use of gesture to get his/her meaning across"). Two scales for Social Relations and Interests are also included. For each item, raters make a judgement about the frequency of occurrence: 0 = less than once a week,or never; 1 = at least once a week, but not every day; 2 = once or twice a day; 3 = several times ie more than twice a day or always. Two summary variables are calculated from the completed CCC-2. The General Communication Composite (GCC) gives a scaled score and percentile rank for overall language and communication ability; the Social Interaction Deviance Composite (SIDC) is a ratio score which signals the presence of either a structural or pragmatic language impairment. The SIDC represents discrepancy between general language ability and social communication quality. A substantial negative discrepancy suggests a social communication profile characteristic of autism. One CCC-2 from the Autism group was not returned.

As a further measure of pragmatic ability, we calculated the proportion of correct answers given to the pragmatic items of the OWLS Oral Expression subtest. The pragmatic scale includes items which require responses appropriate to context. Example items include "Sarah gave Mary a present. What should Mary say to Sarah? (courtesy response)". For the pragmatic scale, the number of pragmatic items the participant had been administered was calculated. This was not uniform

across participants since each participant had a unique basal and ceiling on the administered items. The number of pragmatic items each participant answered correctly was recorded, and a percentage score was calculated by dividing the number passed by the number administered and multiplying by 100.

Novel measure: Collaborative Competence in Dialogue (CCD).

The third, novel measure of pragmatic language impairment, specially designed for the present study, was the Collaborative Competence in Dialogue Rating Scale (CCD). Ratings are made of videotaped conversations. The scale specifies a conversational partner's verbal, non-verbal and paralinguistic 'cues' identified in the literature on conversational analysis. The cues reflect an interlocuter's participation with a conversational partner, in jointly creating and managing a dialogue.

- Continuers: Cues given by the listener that allow and encourage the speaker to continue (Levinson,1983; Schegloff, 1982). They comprise utterances or nods which signal the listener's interest in and understanding of what the speaker is saying. The listener passes up opportunities to take a full turn at speaking, whilst using a partial turn to encourage the speaker to 'go on'. Examples are utterances such as 'Mm-hmm', 'Yes/Yeah', 'Uh-Huh' or 'Ok', or nodding.
- Assessments: Cues given by the listener in which the speaker's contributions are *evaluated* with short utterances or reactions which allow or encourage the speaker to continue or elaborate (Levinson,1983; Schegloff, 1982). The listener passes up opportunities to take a full turn at speaking, using a partial turn to encourage the speaker to 'go on'. Examples are utterances such as 'Wow'. 'I know', 'Alright', 'Cool', 'Awesome', or 'Great', or laughter.
- Appropriate Next Responses: These provide a measure of how relevant the child's replies are to the tester's speech, and how conducive to a to-and-fro conversation (Clark & Krych, 2004; Prutting & Kirchner, 1987). Judgments may take into account the manner and length of response, and how well the comment maintains the dialogue. The issue is whether a participant makes relevant replies to the tester's turn, for instance by answering a question or commenting on the other person's statement.
- Repairs: Cues in which the child either initiates a repair in what s/he has just said, or requests clarification from the speaker, *in order to overcome communicative breakdown.* It is important

that repairs are not directly prompted, for instance by a question. Self-repair can include repeating something, revising something to say it a bit differently, re-phrasing to clarify, or making a meta-comment about what has just been said (Volden, 2004).

- Try Markers: These involve "A rising intonation followed by a slight pause, to request confirmation mid-utterance" (Clark & Krych, 2004:64). This form of cue is given by a speaker who changes the intonation of his/her voice, usually upward in a questioning manner, seeking a verdict from the listener on something the participant has said. The aim is to elicit an evaluation or a marker of understanding from the tester, which guides subsequent conversation (Clark & Wilkes-Gibbs, 1986; Clark & Krych, 2004). An example from the study was: Tester: 'Let's think of what could happen to him first'. Participant: '...there could be an accident (↑) or something (?).'
- Gaze to Regulate: Successful *gaze to regulate* is taken as a marker of competence in maintaining a collaborative conversation, signalling turn maintenance as well as transition between turns (Goodwin, 1981; Kendon, 1967). Gaze to regulate occurs both in the role of listener and in the role of speaker. Listeners *tend* to *actively look* during the speaker's contribution and then to *look away more* when in the role of speaker. In addition, gaze is used to signal the beginning and ending of a turn to speak. When a person has finished speaking, s/he tends to look to the tester to signal closure; when beginning to speak, a person may look away to signal s/he has taken the floor.
- Gaze to Co-Regulate: This takes place when in (or taking up) the role of speaker (Goodwin, 1981; Kendon, 1967). A conversational partner pauses or hesitates during speech and *actively looks* to the listener in order to seek input. Gaze is used to invite a contribution or response from the listener to what the speaker is saying (or is about to or trying to say), a contribution which often takes the form of a continuer or assessment. An example is of a child who cannot remember the word 'tube' and looks at interlocutor a number of times mid-sentence for her to supply the word, before asking her what the word is.

Before commencing the study, we checked that these communicative features were present among typically developing school-age children, using our measure and rating scheme. ADOS videotapes involving 10 typically-developing (TD) children, five boys and five girls between their ninth and tenth birthdays (mean age 9 years, 7 months), were evaluated. The results were that the seven

collaborative cues were well represented in these conversations, and most were rated as *present and typical*. The only form of atypicality was that of *intermittent* usage of Try Markers.

Testing Procedure

To minimise disruption to school lessons, the measures were administered on three separate school visits. At one school visit, the ADOS was administered to participants and CCC-2 and SCQ forms were sent home. Where parent forms were not returned, teachers or speech and language therapists completed these measures instead. At another visit, the OWLS was administered, and at another visit, the verbal testing for MLU was recorded and the child was observed in the classroom. The order in which these measures were collected was flexible depending on the amount of time available to the child at each visit.

Coding Procedure and Reliability

Conversations which took place throughout the video-taped ADOS were rated using the CCD rating scale, by careful observation of the entire 30-45 minute administration. The full coding scheme is available from the first author on request. Each item was scored as being:

i) *present and typical, or*

ii) *present and atypical, or*

iii) *absent.*

A 'present and atypical' rating was given for a cue being *a) intermittent, b) excessive,* or *c) rote / stereotyped*, and more than one kind of atypicality could be rated. The criteria were as follows:

a) *Intermittent* referred to either low frequency of the cue throughout the dialogue, or the cue having been difficult for an interlocutor to detect by virtue of being very quiet or rushed. An example of this atypical form of Appropriate Next Response was from a child who conversed fairly well with the tester, answering questions and building on responses, but at times ignored the tester's questions and gave vague answers that were not comprehensible to the tester.

b) *Excessive* - A cue was rated excessive when it was used very frequently. An example of this atypical form of Continuer was from a child who said 'uh-huh' and 'mm' continuously

over a two-minute period while the tester spoke, in a way that was not responsive to the content of the tester's talk.

c) *Rote/stereotyped* was rated where the cue was used in an inflexible way that seemed to be learned or rehearsed. An example of this atypical form of Assessment was when the tester told the child something interesting about her weekend, and after a 6 second pause the child said, 'Oh really' with exaggerated intonation, as though applying a learned phrase.

Inter-rater reliability.

The first author, Rater 1, pretrained a University placement student, Rater 2, who was blind to diagnosis and predictions of the study. Coding of the full set of 54 cases (18 LD, 18 Autism, 8 ASD and 10 TD) proceeded independently with regular reliability meetings to prevent rater drift. Original ratings were used to calculate reliability, and then consensus scores from the reliability meetings were used in the analysis of results.

Three measures of agreement were calculated. The first concerned ratings of the presence versus absence of a conversational cue (and here it should be recalled that relatively long periods of conversation were being rated). See Table 2. For six of the seven communicative cues, reliability estimated by Cohen's κ ranged from .41 to .68 (where agreement from .41 to .60 is considered moderate, and .61-.80 is considered substantial, Landis & Koch, 1977); the only estimate of agreement lower than this was in relation to Appropriate Next Response, where Cohen's κ=.37. This cue was therefore dropped from further analyses. The second measure of agreement concerned the typicality versus atypicality of a cue. This was applied only in instances when both raters had judged a cue to be present (~~where the number of instances for each cue ranged from 17 in the case of Gaze to Co-regulate to 50 for Appropriate Next Response)~~. Here agreement ranged from Cohen's κ=.67 to .97. The third estimate concerned agreement over the kind of atypicality present (intermittent, excessive, or rote), and was applied only when both raters had judged a cue to be atypical. Agreement was calculated across all cues due to small numbers, and was almost perfect (Cohen's κ=0.88, Landis & Koch, 1977).

TABLE 2 AROUND HERE

Analyses and Predictions

We adopted two approaches to analysing performance on the CCD. Firstly, a Total Collaboration Index (TCI) was calculated based on the number of *present and typical* ratings a subject scored, out of a maximum of 6. This global rating of each participant's communicative competence was considered to reflect how well a participant collaborated in creating a dialogue, and was used for the principal analyses in relation to predictions made at the outset of the study.

Our predictions were that:

a) between groups: TCI scores would be lower among participants with autism than among the language-matched participants without autism, and

b) within the group of participants with autism: TCI scores would

i) correlate with two measures of pragmatic language ability (CCC-2 and OWLS) but would *not* be related to general language ability.

ii) correlate with participants' ADOS scores (i.e., degree of social communication and interaction impairment). Here it needs to be acknowledged that the ADOS was the source of the conversations rated by the TCI, and that the conversational interactions would have contributed to the broader ADOS measure of social-communication. Therefore, in evaluating consistency across two very different measures applied to overlapping social-communicative phenomena, this amounts to a tentative exploration of the hypothesized relation between pragmatic language ability and other aspects of interpersonal engagement among individuals with autism.

Our second approach was to focus not upon *present and typical* modes of communicative interaction, but instead to evaluate the conversations in relation to the numbers of participants in each group who manifested either *present and atypical* or *absence* of communicative cues in their conversations.

Results

LD *versus* Autism on Total Collaboration Index (TCI)

There was a significant difference between the LD and Autism groups in participants' scores on the TCI (LD *M* = 1.94, SD 1.59, Autism *M* = .44, SD 1.04, *t*(34)=3.35, *p* =.002). This result indicates that participants with autism, although matched with the LD group on measures of language ability and productivity, were significantly restricted in producing 'typical' forms of communicative cue, of the kinds that have been identified as sustaining coherent, fluid dialogue.

The individual cues were also compared between the two groups (Table 3). It was less common for the children with autism to use each of the six cues in a typical way, with significant group differences between the two groups on Try Markers and Gaze to Regulate, and non-significant trends for Continuers and Gaze to Co-regulate.

TABLE 3 AROUND HERE

Here it is important to appreciate that the six 'cues' had been identified by investigators who study conversations among interlocutors drawn from typical populations. In this framework, it made sense to consider gaze as integrative to communicative competence. However, the possibility arises that there is some relative domain-specific abnormality in the deployment of gaze among individuals with autism, and so it may be contended that gaze should not be viewed as an indicator of pragmatic difficulty (although of course, there might be various versions of a contrary view, for instance that gaze abnormalities contribute to pragmatic limitations, or that the gaze abnormalities are in part a reflection of specific interpersonal-communicative deficits). Therefore as an additional analysis, we removed the two gaze-related communicative cues in the TCI, and compared groups on the remaining 4 cues: there was still a significant group difference (LD *M* = 1.06, SD 1.06, Autism *M* = .33, SD 0.84, *t*(34)=2.27, *p* =.030)

Within-group Analyses

Here ratings from the Autism group were analysed to examine how the TCI related firstly, to other measures of pragmatic ability that are not so specifically focused on conversation, and also 'general' language ability, and secondly, to the domain of social interaction. We did not run these analyses across the whole sample as our hypotheses about the relations between collaborative competence and social interaction are specific to children with autism. Table 4 provides an overview of the results.

TABLE 4 AROUND HERE

Measures of pragmatic and 'general' language ability.

As we had anticipated, there was *not* a significant within-group correlation between the TCI and measures of general language ability, namely the OWLS Oral Expression Age Equivalent, $r(18) = 0.97$, $p=.351$, and the GCC from the CCC-2, $r(17) = -0.32$, $p=.108$. This suggests that general language ability may not be tightly connected with collaborative competence. To further support this contention, we specifically tested whether the TCI would correlate with the Lexical and Syntactic items from the OWLS. We found no significant correlations between the TCI and the percentage of correct scores for Lexical items on the Listening Comprehension $r(18)=.07$, $p=.39$ or Oral Expression subscales $r(18)=-.12$, $p=.32$. Similarly there were no significant correlations between the TCI and percentage of correct scores for Syntactic items on the Listening Comprehension $r(18)=.00$, $p=..50$ or Oral Expression subscales $r(18)=-.26$, $p=.15$.

By contrast, within the group of participants with autism, the TCI correlated significantly with the individuals' pragmatic percentage score on the OWLS Oral Expression Scale, $r(18)=0.59$, $p = .005$. The correlation between the TCI and the Social Interaction Deviance Composite from the CCC-2 was positive in value, but was not significant in degree, $r(18)=0.14$, $p=.303$.

In addition, a Fisher's z-test was run to assess whether the strength of the correlation between TCI and OWLS pragmatic percentage score was significantly greater than that between the the TCI and GCC, as this latter correlation, at $r=0.317$, was approaching moderate strength. The results of the Z-test indicated that the correlation between TCI and OWLS pragmatic percentage ($r=0.59$) was significantly larger than that between the TCI and GCC ($r=0.32$), $Z=2.29$, $p=.011$.

In balance, therefore, comparisons among these different measures provide tentative evidence for an area of overlap between the CCD rating scale and very different measures of pragmatics, but also reflect the diverse facets to 'pragmatic language ability'.

Social interaction.

If 'general' language ability is not highly correlated with communicative competence within a group of individuals with autism, then what about other aspects of participants' social interaction and

communication? As predicted (see Table 3), there was a significant negative correlation, $r(18) = -0.48$, $p=.022$, between the Total Collaboration Index (TCI) and the ADOS Communication and Social Interaction Composite Score (where a higher ADOS score indicates greater impairment in social interaction). The significant negative correlation remained, even when Gaze to Regulate and Gaze to Co-regulate were removed from consideration, $r(18) = -.57$, $p < .001$. These results need to be treated with some caution, given that the TCI and ADOS ratings were applied to material from the same ADOS videotapes. However, it may be noted from Table 4 that a totally separate measure of pragmatics, namely that provided by the OWLS, was also negatively correlated with the ADOS social-communication scores. Within the autism group, lesser degrees of social impairment were associated with higher collaborative competence as well as pragmatic ability.

Group Comparisons for Atypical Cues

Now we shift the focus to the presence of atypicalities in collaborative cues employed by participants. Thus far in the results, we have tested for a relative lack of what might be expected to occur in conversations, but at this point we turn to examine positive signs of atypicality in the conversations involving participants with autism. Our analyses complement what has been reported so far in another respect: we consider not participants' scores for atypicalities, but rather, the numbers of individual participants who showed any abnormality in relevant respects. Here our only prediction was there would be fewer LD than Autism participants manifesting *atypical* conversational cues.

The first point to make about the results is that with the exception of the two items involving gaze to regulate and co-regulate, communicative cues were not striking for their *absence* among participants with autism (See Table 5). Therefore, the questions arise: when collaborative cues were judged to be present but atypical, how marked was any group difference, and how was atypicality manifest? Results are presented in Table 5. [NOTE: text describing differences removed]

TABLE 5 AROUND HERE

The upshot of these results is that, rather than manifesting a complete absence of collaborative cues, participants with autism ~~were more likely to~~ also showed evidence of atypicality in the nature and/or deployment of such communicative acts. This suggests that children with autism show evidence of attempting to collaborate with their interlocutor, but somewhat imperfectly.

What, then, of the qualities of atypicality recorded in the case of participants with autism? A common rating for conversations involving participants with autism was that the cue was employed in an *intermittent* fashion, that is, either low in frequency throughout the dialogue, or difficult for an interlocutor to detect by virtue of being very quiet or rushed. Among participants with autism with atypical ratings, this rating applied to 72% of the atypical Continuers, and 78% of the atypical Try Markers, as well as 100% of the Repairs, Gaze to regulate, and Gaze to co-regulate.

A cue was rated *excessive* when it was used very frequently. The only occasions on which this rating was made, were for two children with autism who used Continuers excessively, and one LD participant whose use of Try Markers and Repairs was judged to be excessive. Therefore this form of atypicality was not highly prevalent in the conversations recorded.

Finally, *rote/stereotyped* was rated where the cue was used in an inflexible way that seemed to be learned or rehearsed. It was in this respect that the most marked group differences were apparent. Indeed, not one of the conversations of LD participants received a rating of *rote*. By contrast, *rote* atypicalities among the participants with autism were recorded for Continuers (7 participants), Assessments (9 participants), Try markers (3 participants), and Gaze to regulate dialogue (2 participants).

Participants with Subclinical Autism

We conducted subsidiary analyses on the data from conversations involving 8 participants who did not meet full criteria for Autism. As described earlier, these participants manifested some features of autism, but to an insufficient degree to warrant inclusion in the group of children with autism. They were all male, aged between 10 years 7 months and 15 years 4 months, with scores between 4 and 12 on the ADOS, scores between 6 and 20 on the SCQ, and MLU estimates between 3.1 and 7.2. The small sample size precludes any meaningful statistical comparison against the main clinical groups, but a descriptive summary helps to reinforce the position that CCD performance reflects social ability more strongly than linguistic ability. In summary, the TCI results from this group fell between those recorded for the LD and Autism groups. In particular, the mean TCI score was 1.75 (SD=0.45). As with the Autism group, the conversations of this group of children were better characterised by the atypical use of collaborative cues rather than their absence, except for Gaze to Co-regulate, which was only judged to be present for one of the participants (and used in a typical

way). For the remaining cues, 5 out of the 8 participants used Continuers (4 atypical), 6 used Assessments (4 atypical), 5 used Try Markers (1 atypical), 6 used Gaze to Regulate (2 atypical) and 4 used Repairs (2 atypical, 1 participant did not have the opportunity). As can be seen by reference to Table 5, the proportions of atypical usage of cues are not as high as for the Autism group. However, as with the Autism group, a *rote/stereotyped* quality was seen in the use of verbal cues (2 participants for Continuers; 3 participants for Assessments; and 1 participant for Repairs), which was not seen amongst the LD participants at all. Therefore, for this group of children with similar linguistic ability to the two main clinical groups, and less pronounced social-communication deficits than the Autism group, performance on the CCD was slightly better than that of the Autism group but not as good as that of the LD group.

Discussion

In this study we assessed conversations of children with and without autism for participants' competence at collaborating with another person to maintain a dialogue. We utilised concepts derived from the conversation analysis literature, which were measured using a qualitative coding scheme. As predicted, we found that in conversations with an adult interlocutor, children with autism manifested fewer typical collaborative cues than children with learning disabilities who were matched for aspects of general language ability. Within-group analyses on data from participants with autism indicated that although such abilities to collaborate in dialogue were not associated with the children's level of non-pragmatic language ability, they were associated with a very different measure of pragmatic ability (pragmatic items of the OWLS - but not to a significant degree on the CCC-2 SIDC), and also with their quality of social interaction (albeit as measured on ADOS videotapes that included the conversations assessed for communicative competence, so according to measures that were not fully independent). Group differences between participants with and without autism in the expression and use of collaborative cues was not entirely due to an absence of collaborative cues in the conversation of children with autism, but also reflected the fact that the cues they did produce were often atypical, especially in tending to be intermittent or rote in quality. The results lend support to the idea that the ability to engage in conversation is not just reflective of linguistic level, but involves social, pragmatic and interpersonal processes more broadly – and that among children with autism, one needs to consider how far the children's difficulties in fluent conversation might reflect their struggle to enter and maintain the flow of moment-to-moment interpersonal engagement.

The findings of this study should be interpreted with caution. The methodology employed in this study was novel in attempting to rate concepts from conversation analysis in a qualitative way, and a challenge was encountered with regard to inter-rater reliability, which was in the moderate range for most of the cues rated, and in the fair range for Appropriate Next Response, which had to be subsequently excluded from analysis. The difficulty arose in noticing incidents of the cues over the relatively long time-period of the ADOS (30-45 minutes): where an independent rater failed to notice one or two subtle incidents across the interaction, this led to disagreement between the raters on presence versus absence. In contrast, where both raters had observed these cues, there was little disagreement on whether they were typical or atypical, or on the kind of atypicality. This difficulty is evident in other studies which have taken a global, qualitative approach to coding. For example, Bauminger-Zviely and colleagues (2014) analysed the conversations of children with autism for pragmatic behaviours over a much shorter 10-minute period on a similar 3-point scale (almost never occurs, occurs sometimes and occurs all the time), and the two raters obtained 80% agreement (a less conservative measure of agreement than Cohen's kappa, see McHugh, 2012) through jointly coding the videos, rather than through independent coding. Canfield and colleagues' (2016) study of the quality of narratives produced by adolescents with autism during the ADOS reported an ICC (again, a more liberal measure of agreement than kappa see McHugh, 2012) of 0.61 for ratings of *story completeness*.

There are other methods available to overcome this difficulty, for example in the Yale In Vivo Pragmatic scale, pragmatic cues are only rated in response to specific probes given within the conversation (Simmons et al., 2014). This approach would help to minimise disagreements between raters. Other studies have utilised computer-based conversation analysis of video and transcript (e.g. Jones & Schwarz, 2009; Nadig et al., 2010), resulting in higher levels of inter-rater reliability on aspects such as discourse contingency. The drawback of such an approach is the resource and time intensive nature of the coding procedures (see Jones & Schwarz, 2009). On the other hand, the approach taken in the current study is more appropriate for clinical practice, and could potentially be incorporated in to clinical scales to allow therapists working with children with ASD to analyse relative strengths and weaknesses in pragmatic language in ASD. Steps can be taken to further develop and improve the CCD rating scale. As with other observational systems (e.g. ADOS, Lord et al., 2001), procedures around training and reliability of coders may be required to increase the reliability of this

approach. For example, coders of the ADOS are trained to observe and note incidents of the use of descriptive gestures during the assessment, and to use this information to assign a qualitative code for gestures. In a similar way, training to improve observation of verbal, non-verbal and paralinguistic cues on the CCD rating scale would help to overcome difficulties with inter-rater reliability, and potentially contribute a helpful tool to the study of pragmatics in autism.

A further limitation of this study was that all participants were linguistically able. Therefore extrapolations from this study to the underlying psychopathology of autism need to be circumspect, given the results may be most relevant for verbal individuals. Secondly, the ADOS yielded not only a measure of the quality of participants' social engagement, but also the conversation samples on which the ratings of communicative collaboration were made. Therefore these two sets of data derived from the application of distinctive measures were not wholly independent. To further support the thesis that pragmatic ability in conversation is linked to social engagement in autism, future research might use a dedicated conversational assessment such as the Yale In Vivo Pragmatic Protocol, designed exclusively to press for conversational competence (Schoen-Simmons, Paul & Volkmar, 2014), instead of rating conversation based on the ADOS.

Notwithstanding these qualifications, the present study provided novel evidence that the intricate process of maintaining dialogue with another is subtly impaired in autism, in ways that are not related to an individual's level of general language ability, in line with previous research (e.g. De Marchena, & Eigsti, 2016). The atypicalities among participants with autism included but also extended beyond the markedly abnormal use of gaze; Continuers, Assessments, Try Markers and Repairs were less frequently seen and/or more often atypical in nature. This challenges us to explain what psychological or social disability accounts for the children's difficulties.

[NOTE: Section on inferential pragmatics cut]

Theories that emphasise the primacy of joint action and the co-ordination of attitudes may go some way to explaining the present findings. Prelinguistic, preconceptual communication in infancy is configured by the propensity to relate to others as 'minded' beings, a view which traverses both cognitive perspectives (Baron Cohen, 1988, Tomasello, 1999) and more sociocultural writings (Hobson, 2002; Hobson, Chidambi, Lee & Meyer, 2006; Trevarthen, 1979). Participants' levels of language ability were not tightly bound to conversational abilities in the present study, and pragmatics

may be viewed not as a feature or application of language, but as a species of joint action and relation that happens to contain language. Clark argues that 'spontaneous, interactive language has its origins in joint activities' (Clark, 2004: 366), and maintains that conversation is collaborative in much the same way as a physical task such as moving a sofa together requires a joint goal, coordinated action, and communication to ensure effective collaboration. Therefore, paradigms from joint action research may be relevant in developing the findings of the current research. Future research might focus on investigating collaboration in dialogue along with other ways in which partners manage to coordinate to achieve a common end, for example, to produce duets in music or engage in a shared practical task. Current frameworks for understanding this ability include the idea that musicians represent the other musician's actions or intended actions as well as their own, and simulate the other person's expected response through their own motor systems in order to coordinate behaviour (Bekkering, De Brujin, Chijpers, Newman-Norlund, Van Schie & Muelenbroek, 2009; Sebanz & Knoblich, 2009; Tsai, Kuo, Jing, Hung & Tzeng, 2006). This implies that coordination of action, whether in music or in other forms of interaction such as conversation, may involve basic, pre-conceptual attunement to the experience of the partner (Trevarthen, 2011). This is in keeping with the finding that the degree of collaboration evident in the conversation of participants with autism correlated with their potential interpersonal engagement. Arguably, pairs collaborated better in conversation where there was a stronger degree of linkage and engagement.

There was evidence in the current study that collaborative cues in the conversation of children with autism were present but used in an atypical way, either too sparingly or discretely, or in an inflexible, rote manner that did not synchronise with the interlocutor's speech. Cues such as providing Continuers, Assessments, Appropriate Next Responses, Try Markers or Gaze to Regulate turn-taking and using Try Markers to invite a contribution from the other speaker were not absent amongst children with autism, who thus show that they do actively collaborate in these ways, but not consistently. What can explain this inconsistency?

In less demanding face-to-face interaction and when making requests the child with autism can often communicate non-verbally with success, but greater difficulty arises when joint attention is involved (Mundy, Sigman, Ungerer & Sherman, 1987). Similarly speakers with autism can successfully complete structured pragmatic tasks (e.g. Nadig et al., 2009; Nadig, Seth, & Sasson,

2015) but continue to demonstrate difficulties in naturalistic contexts. Previous research in conversation analysis has reported that children with autism can use eye gaze for different purposes, subtly meshed with gesture and vocalisation, but do so inconsistently (Dickerson, Rae, Stribling, Dautenhahn, & Werry, 2005). Wilkinson argues that this difficulty represents a general problem with "applying learned skills to functional purposes" (1998:75), although this may be an overly mechanistic way of framing the problem. For example, despite understanding pronouns and their referents (Lee, Hobson & Chiat, 1994), within conversation people with autism often mix these up (Baltaxe, 1977, Tager-Flusberg et al., 2005), when the referent of the pronoun becomes determined by the present *common ground*. Or again, echolalic utterances reveal that children with autism are capable of using intonation in a variety of ways (Prizant, 1983), yet their intonation in conversation often sounds mechanical, wooden, or exaggerated (Tager-Flusberg, 1981, Tager-Flusberg et al. 2005).

Persons with autism may possess verbal and non-verbal abilities in 'form', but face difficulty when it comes to 'function' (Wilkinson, 1998). One possibility discussed above is that in more cognitively-demanding situations the child with autism becomes less adept at processing all of the relevant information and producing attuned responses (Arnold et al., 2009; Kissine, 2012; Volden et al., 2007). If this is so, it is interesting that the situations which pose most difficulty are those very natural, unstructured, interpersonal exchanges and conversations which are fundamental to human interaction from a very early age (Bateson, 1975, Charman, 2005, Tomasello, 1999). It suggests that we might best look to a basic, fundamental difficulty with interpersonal engagement, or motivation to engage, to find out what underlies the pragmatic impairments themselves (e.g. Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012; Hobson, 2002, 2007, 2012).

Many recent researchers have reported similar findings around inconsistent conversational errors in autism, which tend to point to difficulty with a very basic level of reciprocity and cooperation (Arnold et al., 2009; Chuba, Paul, Miles, Klin and Volkmar, 2003, cited in Tager-Flusberg et al., 2005; Volden et al., 2007). Capps, Kehres and Sigman (1998) showed that children with autism used smiles and gestures as often as control children, and García-Pérez et al (2007) found the same thing with smiles, yet interactions and conversations involving participants with autism were still less fluid and engaged. Thus in interactions with others, children with autism do not respond sensitively and appropriately to the other and their common ground, despite demonstrating some degree of

competence in interacting with another person. It may be suggested that good conversational interaction is only partly a question of conceptually or consciously understanding what to do, or when to do it, and relates as well to affective or motivational factors that induce people to align with and appropriate another's perspective to coordinate and collaborate with them, for instance through the process of 'identifying with' the stance of someone else (Hobson, 2002; 2012; Hobson et al., 2012). It may be that children with autism have a weaker degree of identification with others which leads to fragile engagement in their exchanges, or that their motivation to engage with the other's perspective waxes and wanes throughout the course of an interaction or conversation (Hobson et al., 2012). Here an inconsistency of collaboration in dialogue may be understood with regard to a continuum of 'grip' and role-taking in interpersonal relatedness, rather than to an all-or-nothing conceptual ability (Hobson, García-Pérez & Lee, 2010).

The inconsistencies in children's behaviour have clinical implications, both for assessment and intervention. It is necessary to assess for the presence of an ability as well as its use in context – a child may perform well in a structured clinical setting with an adult, but struggle in a schoolyard with many children and multiple conversations. Thus assessments should focus on particular abilities and their usage in the complex interactions of daily life. Furthermore, finding areas of strength or existing skills in a child with autism can form the basis for therapeutic intervention, working to generalise and develop these abilities to other contexts, encouraging more dynamic and attuned joint action. Models that work from this premise include DIR Floortime (Wieder & Greenspan, 2003) and Relationship Development Intervention (Gutstein, 2009). Therapeutic approaches that aim to build collaboration and interpersonal engagement may create a chance of opening up a richer world of communication and social learning to children with autism.

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Table 1: Descriptive Data

*Note n=17.

	Gender	Chronological Age			ADOS			SCQ			Owls (Age Equiv)			MLU		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
LD group, n=18	16 male	12;4	2;8	7;9-15;5	6.3	3.7	2-13	6.6	4.2	1-16	5;10	1;8	3;4-8;0	5.9	1.4	3.2-8.2
Autism group, n=18	16 male	11;6	1;10	8;5-14;9	12.3	3.5	7-20	17.2	7.4	8-35	6;9	3;7	3;5-16;9	6.4*	1.3	3.8-8.1

Table 2.

Cohen's κ inter-rater reliability for Collaborative Competence in Dialogue ratings.

	Present vs. Absent (54 cases)	**Atypical vs. Facilitates Dialogue**
Continuers	0.44	0.80 (n=38)
Assessments	0.65	0.97 (n=28)
Appropriate Next Response	0.37	0.74 (n=50)
Try Markers	0.41	0.81 (n=23)
Gaze to Regulate	0.68	0.77 (n=42)
Gaze to Co-Regulate	0.54	0.92 (n=17)
Repairs	0.59	0.67 (n=22)

Table 3.

Means and Standard Deviations for CCD Ratings (Number of Typical Ratings) in LD and Autism Groups.

	LD (n=18) M(SD)	Autism (n=18) M(SD)	*t*-test	*p*
TCI	1.94 (1.59)	0.44 (1.04)	3.35	0.002
Continuers	0.39 (.50)	0.11 (0.32)	1.98	0.058
Assessments	0.05 (0.24)	0.05 (0.24)	0	1.0
Try Markers	0.28 (0.46)	0 (0)	2.56	0.015
Gaze to Regulate	0.50 (0.51)	0 (0)	4.12	<.001
Gaze to Co-regulate	0.39 (0.50)	0.11 (0.32)	1.96	0.056
Repairs	0.33 (0.49)	0.17 (0.38)	1.14	0.261

Table 4.

Within Autism group (n=18): Correlations among TCI and measures of Social Interaction and Language

	TCI	ADOS	CCC2[a] (GCC)	CCC2[a] (SIDC)	OWLS (OE)	OWLS % Pragmatic
TCI	**---**	-0.48*	-0.32	0.14	-0.10	0.59**
ADOS		---	-0.06	-0.18	-0.23	-0.49*
CCC2 (GCC)			---	-0.27	0.66**	-0.43*
CCC2 (SIDC)				---	-0.53*	0.44*
OWLS (OE)					---	-0.05

*p<.05, one-tailed, ** p<.01, one-tailed. [a] For correlations with CCC2, *n*=17.

Table 5.

Frequency of Absent, Typical and Atypical CCD Ratings by Group.

	LD			Autism			Fisher's Exact
	Ab	Typ	Aty[a]	Ab	Typ	Aty	on Aty
Continuers	3	7	8	5	2	11	*p*=0.86
Assessments	10	1	7	7	1	10	*p*=0.68
Try Markers	7	5	6	9	0	9	*p*=0.03
Gaze to Regulate	0	9	9	7	0	11	*p*=0.005
Gaze to Co-regulate	7	7	4	13	2	3	*p*=0.37
Repairs	5	4	7	11	1	4	*p*=0.63

[a] Ab = Cue rated as Absent; Typ = Cue rated as Typical; Aty = Cue rated as Atypical.