Mental state language and quality of conversational experience in deaf and hearing children

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Abstract

Deaf children from hearing parents show a protracted delay in their performance on standard 'theory of mind' measures that concern their knowledge of false beliefs and other reality incongruent mental states. Considerable evidence indicates that children's early experience of adults' mental state talk predicts their later social cognitive development. However, no previous study has analyzed access to conversation about mental states in very young deaf children. We compared the conversational input of hearing parents to young deaf and hearing children aged 17 to 35 months in the UK and Sweden. Parents of hearing children used far more cognitive mental state language with their infants and their conversations were characterized by more communicatively effective turn-taking than parents of deaf children. These findings indicate that conversational input about mental states to very young deaf children differs significantly in those areas of interaction thought to be crucial for later social cognitive development and this difference is robust across two different cultures.

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Exposure to mental state language and interaction with adults are crucial factors in the early development of social cognition. Caregivers' attunement to their infants' thoughts and feelings, their so-called “mind-mindedness” (Meins et al., 2002), predicts children's subsequent social-cognitive and social-emotional development, including performance on verbal elicited-response Theory of Mind (ToM) tasks. Similarly, Ruffman, Slade, and Crowe (2002) and Taumoepeau and Ruffman (2006) have reported that mothers’ references to mental states directed at children during the second year of life are correlated with their children’s later mental state language and emotion understanding. At the same time, the connectedness of the conversations between caregivers and infants is important. Ensor and Hughes (2008) coded video transcripts of observations of family interaction for quantity, connectedness, and content of mothers’ and children’s talk. Mothers’ connected turns, i.e. utterances semantically related to the child’s prior utterance, and mental-state references within connected turns with their 2-year-olds were independently associated with measures of children’s social-cognitive understanding.

Thus early interaction including the mental state content of conversations and the quality of the interaction between child and adult are part of the environmental determinants of children’s acquisition of social cognition. An extreme illustration of the importance of such factors comes from studies of children born deaf but raised by hearing parents who themselves are not fluent users of sign language. In the early stages of social cognitive development these children, even with early cochlear implants might experience a different quality of conversation and interaction during the period their parents adapt to their infant’s deafness. Many previous studies have reported that deaf children aged 4 years and above and from hearing families who do not use sign language effectively, display a protracted delay in

Theory of Mind (ToM) reasoning on explicit tests (Courtin & Melot, 2005; Figueras-Costa & Harris, 2001; Meristo, Hjelmquist, Surian & Siegal, in press; Morgan & Kegl, 2006; Pyers & Senghas, 2009; Peterson & Siegal, 1995, 1999, 2000; Schick, de Villiers, de Villiers, & Hoffmeister, 2007; Woolfe, Want, & Siegal, 2002). In elicited response methodologies the child is explicitly required to respond overtly to a question or prompt about the mental states of another person in the test. One issue with such tests used with children with language delay is that verbal demands may obscure the child's underlying cognitive abilities. In recent years, spontaneous methodologies exploiting visual preference measures through eye-tracking have demonstrated that children as young as 13 months of age display behaviors consistent with the hypothesis that they understand false belief in other minds (Kovács, Téglás, & Endress, 2010; Scott & Baillargeon, 2009; Senju, Southgate, Snape, Leonard, & Csibra, 2011; Southgate, Senju, & Csibra, 2007; Surian & Geraci, 2011; Surian, Caldi, & Sperber, 2007) as well as by their pointing gestures and helping behavior (Buttelmann, Carpenter, & Tomasello, 2009; Southgate, Chevallier & Csibra, 2010; for a review see Baillargeon, Scott & He, 2010). Indeed using eye tracking methods with deaf infants, a recent study reported that difficulties in understanding false belief exist in 2 year old deaf children compared with good performance by same aged hearing children (Meristo et al., 2012).

The ToM delay may be related to deaf children's difficulties in conversational understanding (Surian, Tedoldi & Siegal, 2010), but it does not extend to other areas of cognitive development and does not affect deaf children from deaf families who are exposed to a signed language from birth that provides continual access to a language environment (Meristo et al., in press; Meristo, Hjelmquist & Morgan, 2012; Remmel, Bettger, & Weinberg, 2001; Siegal & Peterson, 2008). So why do deaf infants with hearing parents show early signs of delays in social cognitive development? Performance on elicited-response theory of mind tests in both typically developing hearing and deaf children around

4-5 years of age has been seen to be influenced by language development (Milligan, Astington, & Dack, 2007; Schick, de Villiers, de Villiers, & Hoffmeister, 2007) . Language skills may be the crucial ingredient for explicit ToM assessments, but as recent studies of spontaneous ToM abilities have shown, social-cognitive abilities can be observed several months before children are using language. Thus it is possible that more general features of early communication play a role in the first stages of social cognitive development rather than the child's syntactic skills.

Following this argument social cognitive and social emotional understanding in typically developing hearing children has been linked to family conversational input about mental states (Meins et al., 2002; Brown, Donelan-McCall, & Dunn, 1996; Slaughter & Peterson, 2012; Slaughter, Peterson, & Mackintosh, 2007). Access to mental state language was identified as an important predictor of ToM development in interaction between mothers and deaf children aged 4–10 years (Moeller & Schick, 2006). Most of the children in this study were at an age where they should have been passing ToM tasks and so it is intriguing to know what their conversational experience would have been like when they were much younger.

Examining conversational input and communicative interaction between hearing parents and very young children may help to identify the origins of subsequent social cognitive delays in deaf children. In the investigation reported here, we examined parental mental state language directed at young deaf and hearing children in terms of content and interactional quality of the conversational input. Any differences observed may provide insights into the importance of early mental state conversations for children's social cognitive development. We were also interested in the effects of different language and cultural environments on children's early conversational experience. We examine this, by comparing infants and toddlers from the UK and Sweden. Both countries have a strong record in early identification of deafness and subsequent remediation services and so we will be able to evaluate development in children who experience both early and good quality intervention.

Method

Participants. The Swedish sample consisted of 10 hearing infants (4 female) and 10 deaf infants (6 female), all of whom had hearing parents. The mean age of the hearing group was 23 months (range: 19 to 28 months). The deaf infants had a mean age of 23 months (range: 17 to 26 months). They were healthy and without known additional disabilities such as cerebral palsy, autism, mental retardation, or visual impairment.

In the group of Swedish deaf infants, five used cochlear implants (CI) and five hearing amplifications (HA). The CI children had pre-implant hearing levels in the range of 65 to 120 dB hearing loss. The mean age of implantation was 14 months (range: 12 – 19 months) and the mean time since implantation was 7 months (range: 1 – 12 months). The HA children had hearing levels in the moderately to severely deaf range (between 50 and 80 dB hearing loss). The mean age of amplification was 12 months (range: 3 – 26 months) and the mean time since first use of HA was 14 months (range: 1 – 21 months). The deaf infants had hearing parents who had gained some acquaintance with Swedish Sign Language (SSL) and communicated with the infants in spoken Swedish supported with signs. However, none of the deaf infants showed proficiency in SSL as measured by an SSL adaptation of the MacArthur-Bates Communicative Development Inventories for British Sign Language (Woolfe, Herman, Roy, & Woll, 2010). In the deaf group, two infants had two older siblings aged 4 to 7 years. In the hearing group, three infants each had one older sibling aged 5 to 13 years. One infant in each group had a 2-month-old younger sibling. Five other infants were initially tested and excluded because they did not cooperate during the visit (1 deaf and 4 hearing children). Children’s language scores were measured as extremely poor using the Reynell Developmental Language Scales (Reynell, 1977).

The UK sample consisted of 20 deaf children (10 female) and 9 hearing children (5 female). The deaf children had a mean age at the time of first testing visit of 28 months (range: 22 months to 35 months) and the hearing children had a mean age of 28 months (range: 20 months to 35 months). The British sample was significantly older than the Swedish one (Deaf: $t(28)=3.34$, $p=.002$; Hearing: $t(17)=2.06$, $p=.055$). They were healthy and without known additional disabilities such as autism, mental retardation, or visual impairment.

Of the 20 deaf children, 16 had CIs and four HAs at the time of testing. The CI children had pre-implant hearing levels in the range of 80 to >140 dB of hearing loss. The mean age of implantation was 18 months (range: 12 – 29 months), and the mean time since implantation was 11 months (range: 1 – 19 months). The HA children had hearing levels in the moderately to severely deaf range (between 50 and 80 dB of hearing loss). The mean age of amplification was 4 months (range: 1–10 months) and the mean time since first use of HA was 24 months (range: 12 – 31 months). All deaf children had hearing parents who had minimal familiarity with British Sign Language (BSL). The children's language scores were assessed using the BSL and English MacArthur Bates CDI (Woolfe et al, 2010) with deaf children scoring extremely low. Three other children were excluded: two children did not cooperate during the first testing visit and one child who had cerebral palsy.

In the hearing group recruited from preschools located in the London area, two children had younger siblings (aged 2–9 months), one of whom also had an older sibling (8 years) whereas in the deaf group, 11 had 1–3 older siblings aged 4 to 9 years and four had one younger sibling each aged 5 to 12 months.

Procedure. The City University London Ethical Review Board and the Regional Swedish Government Ethical Review Board approved the procedure. The parents in both

Sweden and the UK were given 10 pictures portraying emotionally charged or mentalistic situations such as a father scolding his son and a boy clapping his hands after building a tower of blocks (Ruffman, Slade, & Crowe, 2002). In a video-recorded session, each parent was asked to look at the pictures together and talk (using any form of spoken, signed or gestural communication they wished) with their child about what they saw.

Mental state terms. Using the method devised by Ensor and Hughes (2008), parents' language use was analyzed for mental state categories and the quality of conversational turns. Categories included all references to *cognitive* terms (e.g. "think" or "know"), *emotions* (e.g. "happy", "pleased", "sad", "worried" or "bored"), and *desires* (e.g. "want", "like", "don't like" or "hope").

Conversational quality. Each conversational turn, defined as the utterances of one speaker bounded by another speaker's utterances, in the parent-child conversation was classified as *connected, initiated, failed* or *unclear*. *Connected* turns were defined as all utterances which were semantically related to the other interlocutor's previous turn. A turn was categorized as *initiated* when the speaker initiated a new topic that was unrelated to the previous turn and successful in eliciting a semantically related response from the other. *Failed* turns were coded as turns that were directed to the other interlocutor but failed to elicit a semantically related response. Utterances that were not understandable were classified as *unclear*. An additional category from Hughes and Ensor, conflictual turns, was excluded since these were infrequent and could be included as one of the other four categories.

For interrater reliability, two independent coders transcribed 10% of the parental conversations directed at the deaf and hearing groups. Cohen's kappa was $\kappa = 1.0$ for the mental state categories involving cognitions, desires, and emotions, and $\kappa = .97$ for the quality of conversational turns.

Results

Scores for parental mental state talk and turn-taking in the Swedish and British samples are shown in Table 1 (I THINK IT WOULD BE BETTER TO USE A FIGURE, in substituion or addition, GIVEN THE AMOUNT OF INFORMATION INCLUDED IN THE TABLE). To control for parents' verbosity, we calculated proportions of each type of reference in relation to total amount of words used by the parents. The British hearing group's mean (42.22) was much higher than that of the Swedish hearing group's mean (16.60) (t(17)=2.59; p=.019). This difference presumably reflects cultural differences as well age differences between the two cultures.

Table 1 about here

Mental state language. The mean numbers of minutes devoted to conversations about the pictures by the parents of deaf and hearing children respectively were 8.76 (*SD* = 5.26) and 7.85 (*SD* = 3.57) in Sweden and 7.24 (*SD* = 3.69) and 7.34 (*SD* = 3.61) in the UK. These times were not significantly different for children tested at either location, $t(18) = .454$, $p > .655$, $\eta^2 = .01$ and, $t(27) = .066$, $p > .948$, $\eta^2 = .01$ (see Table 1). The number of words used by the parents during the task was 728 for the deaf and 502 for the hearing group in Sweden ($t(18) = 1.20$, $p > .244$, $\eta^2 = .07$), and 498 for the deaf and 711 for the hearing group in the UK ($t(27) = 1.89$, $p > .069$, $\eta^2 = .12$).

For each sample, a 2 (group: deaf children vs. hearing children) X 3 (content: cognitive vs. desire vs. emotion references) ANOVA was conducted to examine differences in mental state language among the groups. There are developmental differences between different types of mental state concepts with desire preceding emotion and lastly beliefs (Peterson, Wellman, & Slaughter, 2012). For the Swedish infants, there was a main effect for content, $F(2, 36) = 7.15$, $p < .002$, $\eta_p^2 = .28$, and a significant group X content interaction effect, $F(2, 36) = 3.75$, $p < .033$, $\eta_p^2 = .17$. Parents of hearing infants referred to cognitions more often than did those of deaf infants, *t*(18) = 2.19, $p < .042$, $\eta^2 = .21$. There were no differences between the groups in references to desires (*t*(18) = 0.67, $p > .513$, $\eta^2 = .02$) or emotions (*t*(18) = 0.82, $p > .423$, $\eta^2 = .04$).

Similarly, for the British sample, there were a significant main effect for content, $F(2, 54) = 8.49$, $p < .001$, $\eta_p^2 = .24$, and a significant group X content interaction effect, $F(2, 54) = 4.67$, $p < .013$, $\eta_p^2 = .15$. Parents of hearing children again referred to cognitions more often than those of deaf infants, *t*(27) = 3.86, $p < .001$, $\eta^2 = .36$. There were no differences between the groups in references to desires (*t*(27) = 0.48, $p > .632$, $\eta^2 = .01$) or emotions (*t*(27) = 0.07, $p > .949$, $\eta^2 = .001$) (see Figure 1). Within-group comparisons are given in supporting information.

Insert Figure 1 about here

(Figure illustrating in a bar-graph the frequency of the three types mental state terms in the four groups)

Within-group analyses for the use of mental state language. For the Swedish sample, parents of hearing infants referred to cognitions significantly more often than to desires, *t*(9) = 3.32, $p < .009$, $\eta^2 = .55$. Although there was also a trend towards using more cognitive references than emotions, *t*(9) = 2.19, $p = .056$, $\eta^2 = .35$, the difference in the use of desire and emotion references was not significant, *t*(9) = 1.02, $p > .333$, $\eta^2 = .10$. By contrast, parents of deaf infants used references to cognitions and emotions equally, *t*(9) = .63, $p > .547$, $\eta^2 = .04$, but referred less often to desires than both cognitions *t*(9) = 2.32, $p < .045$, $\eta^2 = .37$, and emotions *t*(9) = 2.82, $p < .020$, $\eta^2 = .47$. There was a significant correlation between parents' proportional references to cognitions and children's age in the hearing group, $r = .55$, $p < .05$ (one-tailed). In the deaf group, there were no significant correlations between age and any of the measures of parents' references. For the British hearing sample, parents again referred to cognitions significantly more often than to desires, *t*(8) = 4.14, $p < .003$, $\eta^2 = .68$;

and emotions, $t(8) = 4.53$, $p < .002$, $\eta^2 = .72$. There were no significant differences in the deaf group in the usage of different mental state verbs (cognition vs. desire - $t(19) = .47$, $p > .646$, $\eta^2 = .01$; cognition vs. emotion $t(19) = 1.35$, $p > .192$, $\eta^2 = .09$; desire vs. emotion $t(19) = .47$, $p > .642$, $\eta^2 = .01$). The correlation between references to cognitions and children's age in the hearing group was $r = .81$, $p < .01$ (two-tailed), but there were no significant correlations in the deaf group between any of the measures of parents' references and children's age.

Turn-taking. To examine the quality of turn-taking in conversation, a 2 (group: deaf vs. hearing) X 3 (conversational turns: connected vs. initiated vs. failed) ANOVA was carried out for each sample on the proportions of each turn type in relation to the total amount of turns. For the Swedish dyads, there was a significant main effect for conversational turns ($F(2, 36) = 18.88$, $p < .001$, $\eta_p^2 = .51$) as well as a significant group X conversational turns interaction effect $F(2, 36) = 8.92$, $p < .001$, $\eta_p^2 = .33$. Parent-hearing infant dyads had more connected ($t(18) = 2.96$, $p < .008$, $\eta^2 = .33$) and initiated ($t(18) = 2.77$, $p < .013$, $\eta^2 = .30$) turns than did parent-deaf infant dyads, while there were more failed turns among parent-deaf infant dyads than among parent-hearing infant dyads ($t(18) = 3.02$, $p < .007$, $\eta^2 = .34$). For parent-hearing infant dyads, turns were significantly more likely to be connected than initiated, $t(9) = 5.73$, $p < .001$, $\eta^2 = .78$; but equally likely to be connected or failed $t(9) = .26$, $p > .805$, $\eta^2 = .01$; and initiated or failed $t(9) = 1.87$, $p > .094$, $\eta^2 = .28$. For parent-deaf infant dyads, turns were more likely to be failed than connected, $t(9) = 5.01$, $p < .001$, $\eta^2 = .74$; or initiated, $t(9) = 8.39$, $p < .001$, $\eta^2 = .89$, and also significantly more connected than initiated, $t(9) = 3.52$, $p < .007$, $\eta^2 = .58$. For parent-deaf infant dyads, children's age was significantly related to the proportion of connected turns, $r = .72$, $p < .05$; initiated turns, $r = .72$, $p < .05$; and failed turns, $r = -.72$, $p < .05$. There were no correlations for the parent-hearing infant dyads between age and any of the conversational quality measures.

Similarly, for the British sample, the main effect for quality of turns was significant: $F(2, 54) = 44.60$, $p < .001$, $\eta_p^2 = .62$) and well as the group X quality interaction effect, $F(2, 54) = 4.12$, $p < .022$, $\eta_p^2 = .13$. The parent-hearing child dyads produced significantly more connected turns than did the parent-deaf child dyads, $t(27) = 2.51$, $p < .019$, $\eta^2 = .19$. There were no significant differences in initiated ($t(27) = 1.42$, $p > .166$, $\eta^2 = .07$) or failed turns ($t(27) = 0.45$, $p > .657$, $\eta^2 = .01$). Among parent-hearing child dyads, turns were significantly more likely to be connected than initiated, $t(8) = 2.86$, $p < .021$, $\eta^2 = .51$; more likely to be connected than failed $t(8) = 7.63$, $p < .001$, $\eta^2 = .88$; and more likely to be initiated than failed $t(8) = 3.88$, $p < .005$, $\eta^2 = .65$. For the parent-deaf child dyads, turns were more likely to be connected than failed, $t(19) = 10.36$, $p < .001$, $\eta^2 = .85$; and more likely to be initiated than failed, $t(19) = 7.28$, $p < .001$, $\eta^2 = .74$. There were no differences in the amount of connected and initiated turns for the parent-deaf child dyads, $t(19) = 1.01$, $p > .324$, $\eta^2 = .05$. For parent-hearing child dyads, children's age was significantly positively related to the proportion of connected turns, $r = .74$, $p < .05$; and negatively related to the amount of initiated turns, $r = -.68$, $p < .05$. There were no correlations for the parent-deaf child dyads between the children's age and any of the conversational quality measures. While the UK deaf group are older than the Swedish deaf group we do not see any differences in the quality or content of the conversation addressed to these children by their hearing mothers.

Discussion

Parents of deaf infants and young children used significantly less cognitive mental state language and their conversations were characterized by less communicatively effective turn-taking compared to parents of hearing infants and children. By using exactly the same methodology employed in previous research with hearing children, we were able to pinpoint the possible predictors of child ToM development in the parents input (Ruffman, Slade & Crowe, 2002). These findings are the first such demonstration of differences in social-cognitive related interaction with 2 year old deaf children. The impact of childhood deafness on parent-child interaction in those areas thought to be crucial for future social-cognitive development, are apparent early in life. The notion that deaf children of hearing parents experience reduced access to conversations about the mind (Siegal & Peterson, 2000) is thus borne out in our data - conversations are simpler and less connected. The results from the Swedish and British samples were very similar providing converging cross-cultural evidence for differences between parents of deaf and hearing infants and toddlers in their use of mental state language and their involvement in communicatively effective turn-taking. We have shown that the pattern of mind-minded talk and connectedness is the same for both Swedish and somewhat older British groups.

While similar findings have been reported for older deaf children who use sign language (Moeller & Schick, 2006) the current study includes children who are being raised in mostly spoken language environments. Parents used very few signs from BSL and SSL. Thus a difficulty in using sign language by hearing parents can be mostly ruled out. Parents are using their native spoken languages but still produce a restricted amount of mental state language. Rather than seeing socio-cognitive development as being a result of the child's linguistic skills, it is the child and adults' skills in communicating with each other which triggers parents to employ more sophisticated mental state language in their conversations (Meristo, Hjelmquist, & Morgan, 2012). Deaf children who exhibit delayed language development do not communicate effectively and thus do not stimulate the increase in sophistication of the parent's mental state input.

While typically developing infants are not explicitly taught ToM abilities, they do receive sufficient relevant input. In this way through a continual process of communicative exchanges where the child and adult engage in a culturally appropriate set of conversation turns, the processes underpinning belief attribution can be practiced and automatized. We do not maintain that hearing infants have a grasp of the meaning of terms for mental states but that, even at a very early age, they can benefit from the pragmatic context of verbal and gestural communication in joint attention when these terms are employed. The deaf group have cochlear implants meaning they can access some sound, yet their difficulties in interaction, that clearly come out of the conversation data for both the British and Swedish samples, suggest that conversational input received from the hearing parent, new to the experience of interacting with a deaf infant, is impoverished.

It could be said that the parents in our sample with deaf children are interacting entirely appropriately, as they are matching their mind minded talk for the language skills their offspring have developed. They did make references to emotions and desires but not to epistemic mental states such as beliefs. This means that parents may have adapted their language by using simplified conversations that are more appropriate for young children (Peterson, Wellman & Slaughter, 2012). The characteristics of the deaf child drive the conversation in that the words, gestures, and homesigns used by hearing parents in an effort to communicate on a level with their deaf infants and children can make effective reference to concrete and observable concepts but encounter severe obstacles with abstract notions such as beliefs. If this were the only difference in our data we might predict that as the child's language develops, the parents would eventually begin to use more mental state language, as observed in older deaf children's interactions (Moeller & Schick, 2006). However what is potentially more problematic is the reduced amount of connected conversation in the deaf child-hearing mother dyads. Ensor & Hughes (2008) reported strong predictors of social-cognitive development come from the amount of connected conversation children experience. It is striking that the deaf children in our study have very little exposure to this factor. These children are not experiencing shared talk about joint references and thus having less time in a ‘culture of minds’ (Nelson, 2005). Moreover, unlike hearing infants (Akhtar, 2005), deaf infants cannot easily learn from overhearing conversations of others.

Only 2–5% of the total utterances in our hearing samples concerned references to cognitive mental states. This suggests that increasing talk about mental states to deaf children only by a small amount could make a lot of difference. However increasing language input may not be enough. The parents of the deaf children were also dealing with a child who might need a more sequential processing of input when directing attention to an object or picture. This is relevant for planned social-cognitive interventions. Future early interventions for families with deaf children should include training in conversation about the mind as well as regular speech and language therapy to include strategies for managing communication.

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Table 1. Means and standard deviations for measures of parental mental state talk and turn-taking (with percentages in parentheses) * $p < .05$; ** $p < .01$

	Swedish sample					British sample				
	Deaf (N=10)		Hearing (N=10)			Deaf (N=20)		Hearing (N=9)		
Measure	*M*	*SD*	*M*	*SD*	*t*	*M*	*SD*	*M*	*SD*	*t*
Child age (mos)	23.08	3.43	23.41	2.93	.23	28.15	4.12	27.56	5.57	.32
Time (minutes)	8.76	5.26	7.85	3.57	.45	7.24	3.69	7.34	3.61	.07
Total utterances (words)	728.30	509.38	501.90	306.91	1.20	497.95	312.59	711.00	181.48	1.89
Total mental state words	14.00 (2.26)	9.01 (1.02)	16.60 (3.15)	12.61 (1.56)	1.52	14.05 (3.30)	12.51 (2.70)	42.22 (5.55)	28.36 (2.48)	2.12*
Cognitive references	5.70 (0.83)	5.31 (0.72)	11.30 (1.96)	9.65 (1.46)	2.19*	8.10 (1.44)	9.55 (1.37)	31.67 (4.08)	24.96 (2.31)	3.86**
Desire references	2.60 (0.33)	2.50 (0.36)	1.80 (0.44)	1.32 (0.35)	.67	3.65 (1.10)	4.88 (2.61)	4.78 (0.67)	3.99 (0.59)	.48
Emotion references	5.70 (1.05)	3.97 (0.73)	3.60 (0.77)	3.50 (0.79)	.82	2.30 (0.76)	3.56 (1.59)	5.78 (0.79)	2.86 (0.26)	.07
Total number of turns	148.80	133.23	161.70	80.42	.26	58.05	36.85	81.89	57.91	1.35
Mean length of turns	10.08	3.46	7.62	4.14	1.44	12.80	19.72	13.11	10.22	.04
Connected turns	37.90 (19.47)	56.25 (14.00)	75.50 (43.00)	46.34 (20.84)	2.96**	29.75 (44.93)	23.82 (18.99)	63.56 (65.88)	56.19 (24.66)	2.51*
Initiated turns	15.80 (9.07)	19.89 (4.75)	30.50 (17.60)	18.77 (8.50)	2.77*	16.55 (36.23)	7.72 (20.47)	13.56 (24.82)	3.84 (18.72)	1.42
Failed turns	95.10 (71.31)	73.90 (18.73)	55.40 (39.06)	32.80 (28.15)	3.02**	1.30 (1.56)	3.21 (3.27)	0.44 (1.02)	0.88 (2.18)	0.45
Unclear	0.50 (0.14)	1.27 (0.36)	0.40 (0.34)	0.97 (0.87)	.69	10.75 (18.81)	8.16 (12.11)	4.33 (8.28)	3.46 (6.84)	2.42*