Contextualizing Conversational Strategies: Backchannel, Repair and Linguistic Alignment in Spontaneous and Task-Oriented Conversations

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Abstract

Do people adjust their conversational strategies to the specific contextual demands of a given situation? Prior studies have yielded conflicting results, making it unclear how strategies vary with demands. We combine insights from qualitative and quantitative approaches in a within-participant experimental design involving two different contexts: spontaneously occurring conversations (SOC) and task-oriented conversations (TOC). We systematically assess backchanneling, other-initiated repair and linguistic alignment. We find that SOC exhibit a higher number of backchannels, a reduced and more generic repair format and higher rates of lexical and syntactic alignment. TOC are characterized by a high number of specific repairs and a lower rate of lexical and syntactic alignment. However, when alignment occurs, more linguistic forms are aligned. The findings show that conversational strategies adapt to contextual demands.

Keywords: conversational dynamics; common ground; interactive alignment; backchannels; repair

Introduction

How do we continuously update mutual knowledge and coordinate behaviors in conversations? The issue has been defined as grounding: a constant evaluation of whether we share mutual beliefs, knowledge, and understanding sufficient for the purpose of the situation. (Clark & Brennan, 1991). A diverse set of disciplines have approached this issue, from psycholinguistics to conversation analysis, highlighting several conversational strategies for coordinating interactions. Interlocutors might ensure common ground by subtly confirming their understanding (*backchanneling*), more explicitly signaling misunderstanding and correcting each other (*conversational other-repair*), or by re-using each other's linguistic forms (*linguistic alignment*). Even if such conversational strategies are often viewed as ubiquitous in interaction, one might expect them to vary considerably across individuals, and more importantly across different types of contexts. Conversations involve a plurality of linguistic and social games, from exchanging specific information to maintaining a social reputation; from coordinating decisions to ensuring a comfortable emotional environment (Fay et al., 2018; Fusaroli, Rączaszek-Leonardi, & Tylén, 2014; Fusaroli & Tylén, 2016). Thus, different contexts of conversation might afford different grounding strategies. For instance, conversations between pilots and airport control towers require a higher need of referential precision, and therefore more strict monitoring of the common ground (Prinzo & Britton, 1993). On the contrary, small talk and dinner conversations are arguably more focused on building and maintaining social relations, possibly not necessitating the same need for detailed and continuously monitored referential precision. Indeed in more casual chats people have been observed to not always realize that they are talking about different things, or even that they shift partners mid-conversation in an instant messaging system (Dunbar, Marriott, & Duncan, 1997; Galantucci & Roberts, 2014). Thus, different conversational contexts may require different dimensions and degrees of coordination.

Understanding how the joint use of multiple conversational strategies adapts to the activity at hand is crucial. Cognitive science, management, and other disciplines are increasingly focusing on how to promote effective team coordination and the conversational patterns underlying it (Fusaroli & Tylén, 2016; Pentland, 2012; Wiltshire, Butner, & Fiore, 2018). Clinical research is investigating how social impairment develops and unfolds across a wide spectrum of neuropsychiatric conditions, and atypical conversational strategies are likely to play a role in impaired social functioning (Bolis, Balsters, Wenderoth, Becchio, & Schilbach, 2017; Lavelle, Healey, & McCabe, 2014; McCabe & Healey, 2018; Wadge, Brewer, Bird, Toni, & Stolk, 2018). Further, effective human-computer and human-robot interactions also require a detailed understanding of when and how grounding happens (Loth, Jettka, Giuliani, & De Ruiter, 2015). However, conversational strategies have traditionally been investigated across different disciplines, with varied methodological approaches and foci. Only recently the field has started combining qualitative insights with quantitative methodologies (De Ruiter & Albert, 2017; Dingemanse & Enfield, 2015) and systematically assessing the role of contexts and activities (Fusaroli et al., 2017; Healey, Purver, & Howes, 2014; Reitter & Moore, 2006). In the following, we define the relevant conversational strategies and how they might be adjusted to different contextual demands, and then present a study systematically assessing them across two different contexts: Spontaneously Occurring (SOC) and Task Oriented Conversations (TOC).

Conversational strategies and context

By conversational strategies, we here refer to a heterogeneous set of linguistic behaviors often investigated separately under the headline of *backchannels*, *repair* and *alignment*. Backchannels are defined as head nods or short utterances consisting of a word (e.g. '*uh-huh, 'yes', 'okay'*), or short sentences, often repeating the previous turn (e.g. A: *'let's meet Monday at 10', B: 'Monday at 10'*). They do not take the floor in a conversation, but are used to exhibit interest, understanding, and perhaps even agreement with the speaker's utterance. Thus, backchannels signal a shared common ground and that the speaker can continue with their speech turn (Bangerter & Clark, 2003; Jurafsky, Shriberg, Fox, & Curl, 1998; Schegloff, 1982; Yngve, 1970). Therefore, (Hypothesis 1, H1) we would expect that TOC involve a higher occurrence of backchannels than SOC. This hypothesis is supported by previous observational work (Fusaroli et al., 2017). Note that here we focus on vocal backchannels only.

The second strategy that we examine, conversational repair, also creates feedback on the level of mutual understanding between interlocutors. However, while backchannels mainly provide positive feedback, conversational repair works by providing negative feedback, signaling impending communicative trouble and a need to re-establish common ground. Repair can take different linguistic forms and levels of specificity in the feedback to the interlocutor. Here we focus on other-initiated repair, where a listener indicates trouble in hearing or understanding. The listener can use a repair request to signal that there is a problem with understanding, and thereby invite the speaker to clarify what was said and "repair" mutual understanding. Previous studies have defined three categories of repair (Dingemanse et al., 2015; Fusaroli et al., 2017). Open repair refers to problems on a general level of understanding, where the repair initiation does not specify what or where the problem is (e.g., *huh?*, *what?*, *what did you say?*). In contrast, restricted repair points to specific parts of the previous sentence that need clarification (e.g., *'who?'* or *'where*?'). Restricted suggestions are even more specific, pointing to the specific source of uncertainty and offering a suggestion as to how to repair it (e.g., '*did you say Monday?'* or '*X or what?*'). A previous study has found that repair is more frequent in TOC, due to the higher demand for precision in mutual understanding (Colman & Healey, 2011). Therefore, we also expect (H2) repair to occur more often in TOC than in SOC. Further, we expect (H3) the more specific forms of repair to be driven by the need for accuracy: restricted suggestion repairs should be higher in TOC, with restricted request and open repairs being frequent in SOC. Both hypotheses have preliminary support in a previous study (Fusaroli et al., 2017).

A third strategy is the reciprocal alignment of linguistic forms. As interlocutors hear each other using, for instance, specific words, they prime each other to re-use them. Linguistic alignment is argued to implicitly increase similarity of interlocutors' mental situation models, and thereby catalyze increased rapport and interpersonal coordination (Dale, Fusaroli, Duran, & Richardson, 2013; Pickering & Garrod, 2004). In particular, here we focus on lexical, syntactic and semantic alignment. Lexical alignment indicates the tendency to re-use an interlocutor's lexical choices ("do we *ignore it*?", "yes, let's *ignore it*"). Syntactic alignment indicates the tendency to reuse the interlocutor's syntactic constructions beyond lexical choices ("*you have passed* the youth hostel?", "yes and *I have reached* the top of the map", where the sequence of subject and verb forms are repeated). Semantic alignment indicates the tendency to keep talking about the same topics, beyond lexical and syntactic alignment. Since linguistic alignment is argued to facilitate joint task performance, we expect (H4a) it to be higher in TOC than SOC. Two studies support this hypothesis: syntactic alignment is observed to be higher in task oriented conversational corpora than in more spontaneous conversational corpora (Healey et al., 2014; Reitter & Moore, 2006). However, given that alignment is often associated with building and maintaining rapport (Ireland et al., 2011), one could also expect (H4b) it to be higher in SOC than TOC. Indeed, one previous study supports this second hypothesis (Fusaroli et al., 2017).

In summary, SOC and TOC involve different contextual demands and therefore may emphasize different aspects of the common ground. SOC have a more marked social function in the maintenance of relations, and a lower need for detailed and accurate referential understanding than TOC. We therefore expect TOC to display more precise building and assessment of shared situation models through backchannels, repair, and perhaps alignment.

The current study

While previous studies support at least some of our hypotheses, they mostly investigate one conversational strategy at a time, often with widely different methods or data. Further, all previous studies rely on cross-sectional conversational corpora, that is, the individuals included do not overlap across corpora, making it harder to assess whether any observed differences are indeed a function of different contexts. Additionally, the corpora were often collected in a heterogeneous fashion, with varying numbers of interlocutors and different ongoing activities. Here we aim to more rigorously investigate the role of conversational strategies by controlling these contextual variables. We experimentally elicited multiple SOCs and TOCs in a within-subject design. This allowed us to get a more detailed picture of how participants use conversational strategies in different interactional settings, assessing both contextual, pair and individual variability, as well as their reciprocal relations.

Besides the hypotheses sketched above, we also explore how the three conversational strategies relate to each other, and how they are affected by the contrast between conditions. It has been argued that social interactions display signatures of self-organization dynamics, that is, conversational behaviors become interdependent within and between interlocutors, so that the increase in one strategy might result in decrease in another. For instance, a high rate of lexical alignment provides high informational redundancy and might make repairs less necessary. Further, these relations are likely to be modified by contextual demands, such that different types of conversations might result in very different interrelations. (Dale et al., 2013; Fusaroli et al., 2014).

Methods

We elicited conversations from 39 dyads (78 Danish individuals). All participants were native speakers of Danish (M age = 23.19, SD = 3.58, males = 33, females = 45). The dyads were composed of 15 female dyads, 9 male dyads, and 15 mixed-gender dyads. The participants in 8 of the 39 dyads knew each other prior to the experiment. Each dyad produced two SOCs and two TOCs. The members of each dyad were first offered a sheet of open-ended conversation prompts (e.g. “find two tv-series that your interlocutor would like to watch”) and asked to freely chat while the experimenter was busy elsewhere (first SOC). Participants were then asked to engage in two joint problem-solving tasks: the map task (Anderson et al., 1991) and a categorization task (the alien game; Tylén, Fusaroli, Smith, & Arnoldi, 2016). Both tasks require participants to collaborate to solve the tasks effectively (2 TOCs). Finally, the participants were asked to freely chat again, or to use the conversation prompts (second SOC). Note that SOCs were elicited in an experimental context, which limits the degree of spontaneity of the conversations. They are nevertheless more spontaneous than TOCs. Each conversation lasted approximately 10 minutes, for a total of 40 minutes per dyad (2 SOCs and 2 TOCs). In the SOC condition, we had a total of 34,544 speech turns and an average of 443 speech turns per conversation. In the TOC condition, we had a total of 45,607 speech turns, with an average of 585 turns per conversation. All conversations were transcribed orthographically using ELAN (Brugman & Russel, 2004) and manually coded for backchannels and the three different types of repair by independent coders naïve to the purpose of the study (intercoder reliability: kappas > 0.6). Coding schemes were developed based on prior work (Dingemanse, Kendrick, & Enfield, 2016; Yngve, 1970) and are available at https://bit.ly/2LtUmax. Alignment was calculated as cosine similarity between successive conversational turns. Lexical alignment was based on lemmatized words, syntactic alignment on 2-grams of part-of-speech tags, and semantic alignment on FastText word2vec representations of Danish (Bojanowski, Grave, Joulin, & Mikolov, 2017; Duran, Paxton, & Fusaroli, accepted). While 2-grams are only a rough proxy for syntax, exploratory analyses of 3- and 4-grams yielded similar results. Previous work has also used comparisons to surrogate pair baselines, created by artificially interleaving the utterances of interlocutors from different pairs (Healey el al. 2014). Since the current work is focusing on a within pair manipulation, we leave such baselines for future work.

Bayesian multilevel models with weakly informative priors were used. Backchannel and repairs were modelled according to a Bernoulli likelihood function. Specific types of repairs were analyzed within the subset of repair utterances only. Alignments were fit to a Zero Inflated Beta likelihood function to account for the high amount of turns with no alignment (zero-inflation, see distribution plots here: https://bit.ly/2LtUmax). Note that we report alignment rate as the negative of the inflation term, thus indicating the log odds rate of any alignment instead of the rate of no alignment, and the alignment level as the log odds of the cosine similarity when there are occurrences of alignment.

All parameters were modelled as correlated and predicted by task, including varying effects by interlocutor nested within pair. LOOIC-based stacking weights assessed the relevance of the predictors (Vehtari, Gelman, & Gabry, 2017). Evidence ratio (ER) was used to test evidence in favor of our hypotheses. While ER is a continuous scale, indicative thresholds have been proposed with values of 3 corresponding to moderate evidence for the hypothesis and values of 0.3 to moderate evidence against the hypothesis. Full posterior distributions of varying effects were used to exploratorily estimate and visualize correlations between backchannels, repair and alignment as *r* Pearson coefficients[1]. Only correlations with an absolute coefficient above 0.2 and credibility intervals not overlapping with 0 were included. Global strength was calculated as the sum of the absolute value of all edges in the network. The implementation relied on brms, ggplot, igraph, Stan and R (Bürkner, 2017; Carpenter et al., 2017; Csardi & Nepusz, 2006).

[1] We also built a multivariate outcome model including all previous models and the correlation between outcomes in the same model. However, the model could not be fit due to its complexity.

Results

Estimates of the occurrence rate of the conversational strategies by condition are reported in Figure 1. Detailed results of the effects of task are reported in Table 1 and Figure 1.

Table 1: Conditional effects on conversational strategies. *Estimates represent the log-odds probability of the behavior in question, separately for each condition. Evidence ratio (ER) indicates the relative evidence in favor of our hypotheses as specified in "The current study" (against the alternative hypotheses). "Lex", "Syn" and "Sem" stand respectively for lexical, syntactic and semantic alignment.*

Outcome	Spontaneous	Task-Oriented	ER
Backchannel	-0.69 (-0.8, -0.58)	-1.45 (-1.57, -1.33)	*< 0.001*
Repair	-3.55 (-3.91, -3.17)	-2.86 (-3.11, -2.51)	*> 1000*
- Open	-0.79 (-1.08, -0.48)	-2.20 (-2.45, -1.97)	*> 1000*
- Restricted	-1.32 (-1.61 -1.02)	-1.80 (-2.05 -1.54)	= 132
- Suggestion	0.01 (-0.25 0.27)	1.02 (0.78 1.26)	> 1000
Lex Rate	0.22 (0.11, 0.33)	0.06 (-0.04, 0.16)	*= 332.3*
Lex Level	-0.79 (-0.83, -0.75)	-0.68 (-0.72, -0.64)	*> 1000*
Syn Rate	0.65 (0.52 0.77)	0.50 (0.40 0.59)	= 73.07
Syn Level	-0.78 (-0.83 -0.74)	-0.75 (-0.78 -0.73)	= 6.49
Sem Rate	1.47 (1.13 1.79)	1.61 (1.25 1.96)	= 2.93
Sem Level	0.36 (0.15 0.54)	0.34 (0.16 0.51)	= 1.3

Conversational strategies vary considerably across individuals and pairs. For instance, some pairs consistently show use of backchannels above average, while others consistently below. Analogously, some individuals consistently show higher use of, for instance, backchannels than their interlocutor. Further, the use of conversational strategies is interrelated, as shown in Figure 2. Alignment strategies are strongly and positively related (except for levels of lexical alignment), while repair and backchannel seem less related. Interestingly, the type of conversation seems to affect the relations between strategies, with task-oriented conversations displaying weaker relations (global strength of SOC = 2.91, TOC = 1.67).

Discussion

This study aimed to assess the impact of different contextual demands (SOC vs. TOC) on three conversational strategies and their interrelations. It used a more rigorous within-subject design than previous studies. We hypothesized that backchannel (H1) and repair (H2) would be used more in TOC than SOC, and that the specificity of the repair would also be higher in TOC than SOC (H3). We contrasted two hypotheses for linguistic alignment (H4a-b), as the previous evidence was contradictory, indicating sometimes higher alignment in SOC, sometimes in TOC.

We found high occurrence of backchannels, however, contrary to H1 this was higher in SOC (33.4% of utterances) than TOC (19%). While backchannels certainly play a role in grounding given their high occurrence in TOC, the findings suggest that they might be even more important in free conversation and thus related to, for instance, the maintaining

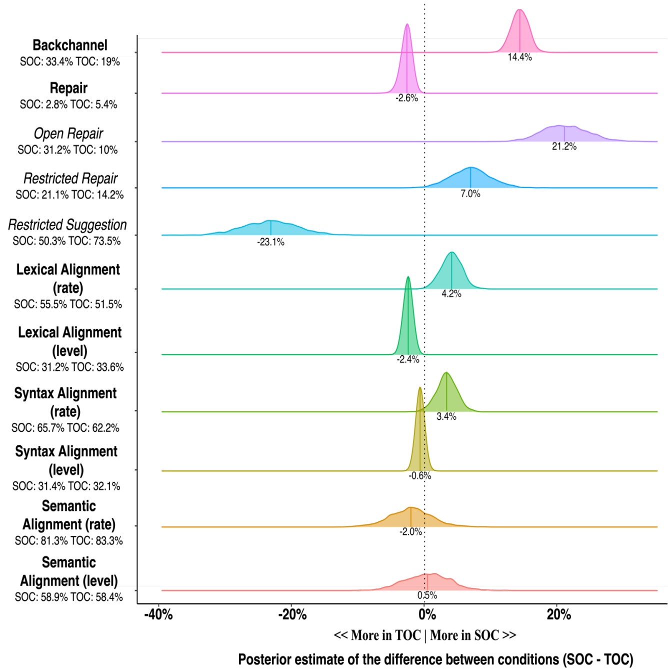

Figure 1 - Effects of task on the conversational strategies of interest. *The column on the left includes posterior estimates of the proportional use of the strategies across the two conditions, the ridge plots indicate the posterior estimates of the differences between conditions. Note that backchannels and repairs are calculated on the total number of speech turns, while repair types are calculated on repair turns.*

of social relations. Indeed, backchannels have been argued to strengthen the social relationship by making both interlocutors part of the conversation even though one speaker holds the floor (Duncan & Fiske, 1977), as well as by consistently displaying interest and attention to the speaker (Levinson, Brown, & Levinson, 1987). The large variation in the use of backchannels is in line with a previous study (Heldner, Hjalmarsson, & Edlund, 2013).

We found that conversational repair is less frequent than backchannelling. In line with H2 and H3, we found that repair was more frequent in TOC (5.4% of utterances) than in SOC (2.8% of utterances), and that the relative frequency of types of repair was affected by contextual demands. More specific repair was more frequent in TOC than SOC, while less specific repair was more common in SOC than TOC. This supports our prediction that in SOC, referential precision is less important than in TOC, where attention to details and accuracy of the information is crucial to solve the collective task at hand (Dingemanse et al., 2015; Fusaroli et al., 2017). Thus, in TOC interlocutors more carefully monitor potential misunderstandings and, given the higher attention to details, tend to prefer the strongest (in this case, most specific) repair form they are able to use in that situation (Clark & Schaefer,

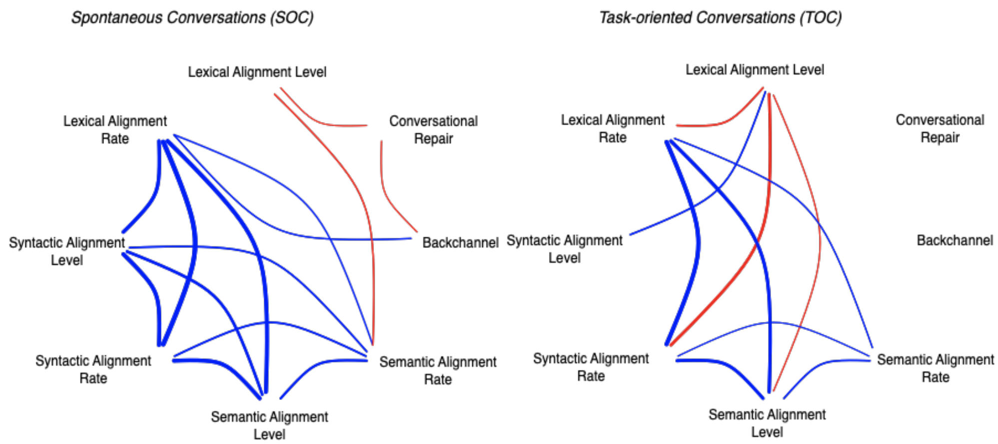

Figure 2 - Exploratory correlation network between individual usage of conversational strategies. Blue lines indicate positive correlations, red lines negative ones. Thickness of the line is proportional to the strength of the correlation, from 0.2 (backchannel and repair in SOC) to 0.9 (rates of syntactic and lexical alignment in SOC).

1987). Our findings suggest that interlocutors use repair as an adaptive strategy, adjusted to target the optimal way of grounding in order to meet specific contextual demands. We found partial support for both H4a and H4b. More than 50% of utterances displayed some lexical alignment, more than 60% syntactic alignment, and more than 80% semantic alignment. However, pervasive, the rate of lexical and syntactic alignment was affected by the type of conversation: higher in SOC than TOC (H4b). While the small effect size should warrant caution, alignment rate might be more related to building and maintaining social relationships. Previous studies have indeed argued that high rates of alignment can lead to informational redundancy, which might hamper task-oriented coordination, in situations that afford interlocutors to provide complementary information in a more synergistic fashion (Fusaroli et al., 2012; Fusaroli et al., 2014; Fusaroli & Tylén, 2016). When interlocutors do align, we find that a relatively high number of linguistic forms is aligned (alignment level): more than 30% of lexical and syntactic choices, and more than 50% of semantic variance. However, lexical and syntactic alignment levels are higher in TOC than in SOC (H4a), indicating that TOC presents fewer instances of alignment, but once alignment is there, more forms are aligned. This might again be due to the demand for precision affording more specific alignment strategies (as in the case of repair). Together with the zero-inflated distribution of alignment, this seems to suggest that we are confronted by two different alignment phenomena that have so far been conflated. The lack of clear differences in semantic alignment between SOC and TOC also seems to indicate that in both types of conversations interlocutors do speak about similar topics, although the specific strategies (lexical and syntactic choices) differ. Future work will include exploration of the effect of 3- and 4-grams on parts-of-speech tags and whether stratifying syntactic by lexical alignment preserves the same pattern of results.

The different conversational strategies, backchannels, repair and alignment, form a dense network of interdependencies (Figure 2). We show that the different forms of alignment are strongly related: interlocutors using alignment do so consistently for all forms of alignment, with the interesting exception of levels of lexical alignment (suggesting that verbatim lexical repetitions might play a different role; e.g., Fusaroli et al., 2014). However, contextual demands affect this network: while backchannels and repairs are negatively related to each other and connected to the rest of the network in SOC, in TOC they are isolated and generally the network displays sparser and weaker connections. This was an unexpected result that requires follow-up work.

In this study, we attempt to develop a more theory-driven and cumulative approach to the study of conversational strategies. Increased control enabled us to more robustly infer how contextual demands change the use of conversational strategies and affect their relations, with results at least partially different from previous less-controlled studies. This provides new insights into how we build effective coordination in conversations, and may illuminate some of the mechanisms underlying social impairment. We are aware of the limitations of this initial work. We have contrasted two macro-categories of conversation: task-oriented and spontaneously occurring. These categories are heterogeneous. The two tasks employed in TOC have somewhat different contextual demands. The two spontaneous conversations in SOC happen at the beginning and end of the experimental setup, influencing interlocutors' feeling of familiarity. Pairs display a high variability in joint performance in the tasks and rapport. This highlights the importance of considering differences across individuals and pairs in studies of conversations (which is also receiving increased attention in other areas of psycholinguistics; Kidd, Donnelly, & Christiansen, 2018). Future work will further explore these dimensions: analyzing differences between interlocutors who know or do not know each other in advance, introducing measures of performance and rapport, as well as accounting for progress familiarity and assessing how conversational strategies evolve over time as interlocutors become familiar with each other and with the tasks. A more direct manipulation of contextual demands, for instance, more continuously varying the need for accurate mutual understanding, is a necessary next step. Future work will also further articulate the interrelations between strategies and contextual demands.

Conclusion

In a controlled within-participant design, we show that contextual demands afford diverse uses of conversational strategies. Spontaneously occurring conversations display higher frequencies of backchannels and a higher rate of lexical and syntactic alignment, possibly related to higher needs for relation building and maintenance. Task-oriented conversations display higher occurrence of repair (in particular of specific repairs) and levels of lexical and syntactic alignment, possibly related to needs for high precision. Our results suggest that backchannels, repair and alignment serve complementary functions, and that interlocutors flexibly adapt these grounding strategies contingent on current contextual demands. By focusing on how pairs and individuals adjust their strategies to contextual demands, we can better understand the patterns of effective communication, and how communication might fail. Future work might extend this approach to include measures of coordination success as well as investigation of these phenomena in contexts of social impairment.

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