Finding Common Ground: Referential communication in parent-child pairs

Anonymous CogSci submission

Abstract

Include no author information in the initial submission, to facilitate blind review. The abstract should be one paragraph, indented 1/8 inch on both sides, in 9˜point font with single spacing. The heading 'Abstract' should be 10˜point, bold, centered, with one line of space below it. This one-paragraph abstract section is required only for standard six page proceedings papers. Following the abstract should be a blank line, followed by the header 'Keywords' and a list of descriptive keywords separated by semicolons, all in 9˜point font, as shown below.

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Introduction

As social beings, humans communicate with each other constantly. We use words and gestures to convey different messages, but communication relies on more than just the ability to speak or gesture—it requires mutual understanding. Conversational partners must take into account each other's knowledge and adjust their speech accordingly. For example, adults talk to young children with simpler words and sentence structures than when conversing with fellow adults. This sensitivity to other people allows us to achieve mutual understanding, or common ground, with our conversational partners. While research shows that adults readily form common ground with one another (Brennan & Clark, 1996; Clark & Wilkes-Gibbs, 1986), studies with children have yielded mixed results (Branigan, Bell, & McLean, 2016; Glucksberg & Krauss, 1967). Children eventually become skilled conversationalists, but little is known about how they acquire and refine their communicative skills. The present study focuses on referential communication between children and caregivers, to further understand how children develop communicative abilities, and the role that parents play in scaffolding this development.

Conceptual Pacts

Providing sufficient information is essential to successful communication (Grice, 1975), and doing so often requires reasoning about other people's knowledge. For example, adults can use canonical labels to refer to most objects, but may need to provide further information when speaking with children, who have less vocabulary knowledge. Linguists have found that successful communication relies on common ground—shared knowledge that is constructed and modified in verbal communication. Common ground ensures that conversational partners have some mutual understanding upon which their communication can be based on. In referential communication, which may center around referents that are not immediately present, common ground can be particularly important. Referential communication patterns in adults have been widely studied, mostly using matcher-director paradigms. In these paradigms, participants are paired up and asked to talk about abstract shapes or pictures. The goal of the game is for the director to guide the matcher to select a particular picture solely via verbal communication. These studies capture how common ground is shaped between two conversational partners. Clark and Wilkes-Gibbs (1986) found that common ground can be established using conceptual pacts, which are agreed-upon terms or phrases used to describe a particular referent. The researchers also found a pattern of conceptual pact formation. Over a few rounds of the game, utterances became shorter and more certain, and conversational partners eventually converged upon a name for each abstract shape. It is important to note that different conceptual pacts were formed for each pair of participants. That is, common ground is more than common sense—it is mutual knowledge that is built between partners within a conversation.

Conceptual pacts are partner-specific, but malleable, and facilitates cooperation between conversational partners. The formation of conceptual pacts is collaborative and partner-specific, such that interlocuters mutually come to agreement (whether explicitly or implicitly) about these pacts, and continue to reuse them with one another, but not necessarily with new partners (Brennan & Clark, 1996; Clark & Schaefer, 1989). At the same time, the mutual knowledge between partners is temporary and fluid—it can be changed even within the span of a single conversation, based on shifting goals or informational needs (Ibarra & Tanenhaus, 2016). Conceptual pact formation is not only a natural process that occurs in conversation, it is also beneficial for partners completing cooperative tasks (Fusaroli et al., 2012). These studies, along with many others in the field, show that adults readily form conceptual pacts with one another in conversation, and that these pacts can facilitate cooperation.

Similar matcher-director studies have been conducted in children, but have yielded mixed results. An early study by Glucksberg and Krauss (1967) found that young children

were unable to form common ground with each other in a matcher-director task, even though they were able to complete the task when familiar pictures were used. Although young children may struggle to negotiate conceptual pacts with peers, they do expect speakers to be referentially consistent, just like older children and adults (Graham, Sedivy, & Khu, 2014). Other studies have shown that children are able to form referential pacts with others by the age of 6, and by age 10, are sensitive to multiple partners' knowledge states (Branigan et al., 2016; Köymen, Schmerse, Lieven, & Tomasello, 2014). Taken together, these studies suggest that children's ability to reliably form conceptual pacts with one another emerge in early childhood, and continue to develop through middle childhood.

Thus far, research on children's communicative development have largely focused on peer interactions. While these studies allow us to see how children's referential abilities differ at various ages, they may not capture the full picture. Children do not only interact with each other. Indeed, much of young children's daily interactions involve adults such as caregivers and teachers. To better understand how children become skilled conversationalists, we must explore the role that adults play in children's communicative development.

Parent-Child Interaction

Young children interact with their caregivers on a daily basis. Research in the field of language development has found that linguistic input from parents and caregivers are predictive of children's language learning outcomes (Weisleder & Fernald, 2013). While many studies have examined how parental speech influences children's acquisition of vocabulary and grammar, less research has been done on how parents scaffold children's communicative development more broadly. Language learning does not occur in isolation, and a broader understanding of language development requires that we study that communicative contexts in which language is used. Parents and caregivers are sensitive to their children's needs, and are able to adapt their language accordingly. When interacting with young children, parents modify their sentence structure and content based on their children's vocabulary knowledge (Leung, Tunkel, & Yurovsky, in press; Masur, 1997). In an observational study by Masur (1997), parents and children played with toy animals. The author found that parents used different sentence structures when referring to animals, depending on whether their children were familiar with the animal's canonical label. In a more recent study, Leung et al. (in press) examined parents' speech in a communicative game, where parents guided children to select animals on an iPad screen. Results showed that parents used longer sentences with more adjectives when referring to animals that they believe their children do not know. Taken together, these studies show that parents are able to sensitively adapt their language based on their children's developmental level. How might conversing with more linguistically-advanced interlocuters influence children's communicative development? There is some evidence that adults can scaffold children's referential communication (Glucksberg & Krauss, 1967; Matthews, Lieven, & Tomasello, 2010). As mentioned above, preschoolers were unable to complete the matcher-director task with peers in Glucksberg & Krauss' (1967) study. However, in a follow up study, experimenters asked preschoolers to name the abstract objects prior to playing the game. When an adult experimenter used the preschoolers' preferred referent names, children were able to complete the task. This finding suggests that children's failure to complete the referential communication task may lie in their inability to negotiate conceptual pacts with one another, rather than an inability to map a referent name onto a referent.

Explicit feedback may also influence children's referential communication abilities. Matthews et al. (2010) conducted a training study, in which young children received explicit feedback from adult experimenters in a referential communication setting. Participants who underwent training were more likely to spontaneously produce unambiguous referential expressions at test, indicating that feedback can support the development of communicative abilities. However, both studies discussed here examine adult-child interaction in a highly constrained setting: the adults are experimenters with a clear script of how to speak to the child participants. To better understand how adults may scaffold children's communicative development, we must study adult-child interactions in a more naturalistic setting.

The present study aims to explore how parents and children interact to form referential pacts in conversation. Based on prior developmental research showing that sensitivity to conceptual pacts emerge in early childhood, and referential abilities gradually develop through middle childhood (Branigan et al., 2016; Graham et al., 2014; Köymen et al., 2014), we opted to study 4-8 year-old children. This study was intended to be largely exploratory, with no particular a priori hypotheses about the results. The main goal of this is to understand whether and how parents scaffold children's communicative development, by comparing parent-child referential communication across ages.

Experiment 1: Parent-Child Interaction

Methods

Participants Children (ages 4, 6, and 8) and their parents were recruited from a database of families in the local community, to achieve a planned sample of 60 parent-child pairs. A total of 75 children and their parents participated, but data from 12 pairs were dropped due to experimental error or failure to complete the study. The remaining sample of 63 parent-child dyads were included in analysis.

Stimuli Twelve solid black images of tangrams, and colored versions of the same tangrams, were selected from a database of Public Domain images. The tangram images were normed on Amazon Mechanical Turk (mTurk) for pairwise similarity. Two images were excluded from the set based on similarity judgments, forming the final set of 10 images used for the study.

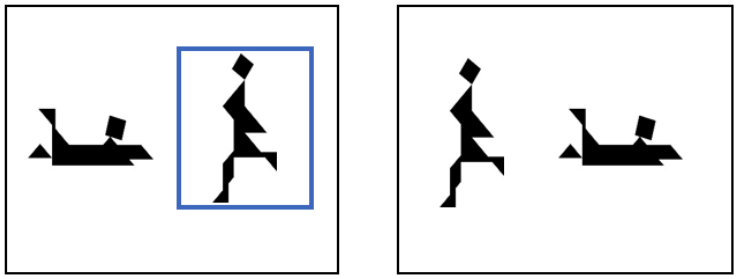

Figure 1: Example of iPad screens for the director (left) and matcher (right) during the game.

Procedure Each parent-child pair played a cooperative game with iPads. Pairs sat at a table with a divider in the middle, which prevented parents and children from looking at each other's iPad screens during the game. The game was a simplified version of the matcher-director task used in Clark & Wilkes-Gibbs (1986). Parents and children were told that they would take turns being the director and matcher. They were told that the director should describe the image inside the blue square, and the matcher should select an image based on the director's description. After instruction, the practice and experimental trials began. On each experimental trial, two solid black tangrams appeared on the iPad screens. The same images appeared on each screen, but their positions were randomized. On the director's screen, one image appeared inside a blue square, while the images on the matcher's screen simply appeared on a white background (Figure 1). Upon selection of an image on the matcher's screen, the selected image became colorful, and a sound is played (independent of accuracy). After each trial, the roles were switched. Practice trials followed the same structure as experimental trials, but images of fruits and vegetables were used during this round. All sessions were videotaped.

Design There were 4 blocks of 10 trials. Each tangram appeared as the target once during each block, such that each tangram was the target four times during the game. Trials within blocks were randomized. The 10 tangrams were shuffled and randomly assigned to either the parent or the child for the first round. For each tangram, parents were the director twice, and children were the director twice. In each round, the targets appeared with different foils. Tangrams were paired such that similar tangrams did not appear together, based on norming data from mTurk. Pairing dissimilar tangrams together was one way to ensure that the task was not too difficult for the younger age groups.

Data Processing All videos were transcribed using an Open-Source coding software, Datavyu (2014). Additionally, the transcripts are currently being coded for conceptual pact formation. Referring expressions for each of the 10 tangrams are coded using the following criteria (see Table 1 for examples): (1) Whether the initial and final terms within a trial matched (for trials with more than one turn) (2) Whether partners explicitly agreed upon / accepted the referring expression (3) Whether the referring expression matched one's own previous expression (4) Whether the referring expression matched the partner's previous expression

Table 1. Example of qualitative coding. Each referring expression is coded on four dimensions, using binary 1/0 codes. Round Speech (1) (2) (3) (4) 1 OK this one uh looks like a person walking with their head down N/A 0 N/A N/A 2 It looks like someone is walking and he had a sad day N/A 0 N/A 1 3 Uh someone who had a sad day N/A 0 0 1 4 It looks like someone had a sad day N/A 0 1 1

Results

Reduction in length of referring expression We began our analyses by calculating mean length of referring expressions for each target, and examining change in length across rounds. Only the directors' speech was included in this calculation. Collapsing across parents and children, and all age groups, the length of referring expressions decreased somewhat linearly from Round 1 to Round 4 (Figure 2). When splitting by age group, analyses revealed that dyads with older children used shorter referring expressions overall, while the main effect of length reduction held across groups (Figure 3). The difference in length of referring expressions was particularly clear between 4-year-olds and 8-year-olds, with 6-year-olds falling somewhat in between the two groups.

We then analyzed parents and children's referring expressions separately. When splitting parents and children, and plotting by age groups, we still found an overall reduction in length of referring expression (Figure 4). However, when looking only at children's referring expressions, the three groups did not appear to differ. On the other hand, the three groups of parents differed in their length of referring expressions. Specifically, parents of 4-year-olds used longer referring expressions throughout the game. Note that only 2 rounds are plotted in this figure, because each partner is the director twice for each target tangram.

Reaction Time We analyzed reaction time for each trial. Reaction time was stored automatically by the game's computer code, and can be understood as time taken to complete the trial (rather than reaction time to a stimulus per se). Reaction times longer than 20000ms (2 minutes) were discarded. Since the game did not have an option for pausing, trials had

abnormally long reaction times when dyads needed to take a break from the game (e.g. children needing to use the bathroom). Similar to length of referring expressions, reaction time decreased from Round 1 to Round 4 for pairs in all age groups (Figure 5). When split by age group, reaction times showed similar patterns to length of referring expression, such that dyads with older children were faster overall (Figure 6).

Discussion

Our main effect of reduction in length of referring expression replicates the effect found in Clark and Wilkes-Gibbs (1986), suggesting that parents and children were forming conceptual pacts with one another as the game progressed (Figure 2). This effect was found across all three age groups, and patterns were largely similar across groups. Our results show that children as young as 4 are able to cooperate with a more linguistically capable partner to form conceptual pacts in conversation. Taken together with prior research suggesting that 4-year-olds are not yet able to form conceptual pacts with their peers (Glucksberg & Krauss, 1967), our findings indicate that adults could scaffold younger children's conversational abilities to facilitate effective referential communication.

Older children and their parents used shorter referring expressions overall (Figure 3). This finding may reflect older children's more advanced linguistic skills compared to their younger counterparts, such that they produce more succinct (and perhaps more efficient) referring expressions. Older children may also require less descriptive information about the target tangram in order to identify it. These explanations are not mutually exclusive, but further analysis suggests that the latter may reflect our data more accurately.

When analyzing length of referring expression separately for parents and children, we found that the age difference was largely driven by parents (Figure 4). While children's length of referring expression did decrease across rounds, patterns did not seem to differ across age groups. On the other hand, parents of 4-year-olds used longer referring expressions than parents of older children. One potential reason for why parents used longer referring expressions with younger children could be that these children required more scaffolding. Younger children may have difficulty focusing on relevant dimensions of the target tangram, such that parents need to provide more information in order for their children to select the correct tangram. Qualitative analysis is currently underway, and will be helpful for understanding the reason parents use varying lengths of referring expressions with their children. Our analyses thus far suggest that parents may be adapting their speech for effective communication, using longer, more informative sentences with younger children, and shorter ones with older children.

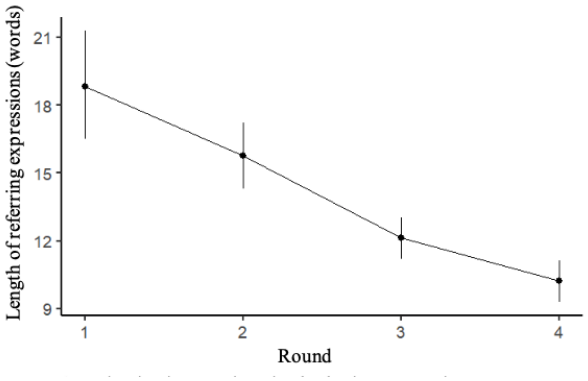

Figure 2: Reduction in mean length of referring expressions across four rounds.

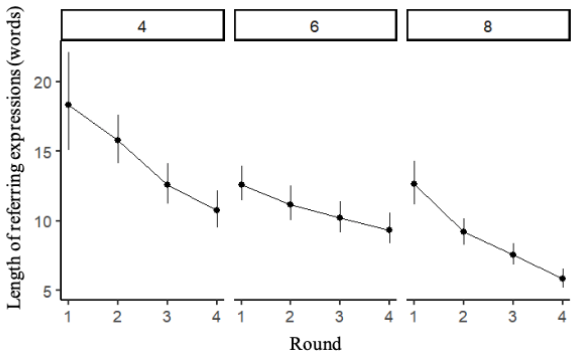

Figure 3: Change in length of referring expressions, split by age groups.

Reaction times decreased across rounds for all parent-child pairs (Figure 6). Our reaction time analyses showed patterns similar to that of length of referring expressions. While dyads across age groups showed the same pattern of decreasing reaction time, older children and their parents were faster overall. These results show that parents and children are calibrated to each other during the game. If reaction times did not match length of referring expressions, that could indicate that parents and children were providing too little or too much information to each other, such that the two measures would be mismatched. Thus, the intuitive finding that reaction times matched referring expression lengths serves to strengthen the argument that parents calibrate to their children in communicative settings.

Thus far, our analyses show that children can cooperate with their parents to form conceptual pacts about novel referents. Given that children as young as 4 years old were successful in forming referential pacts with others, our results suggest that parents, who are more linguistically-advanced, can scaffold children's communicative abilities. Qualitative analysis is currently ongoing, and will be helpful for answering the following questions: How do parents and children each drive the referential pact formation process? How do these roles change across development? A deeper understanding of the characteristics of parent-child referential communication across development will shed light onto the how

children develop their conversational skills, and how parents may scaffold the process.

Future Directions

Adult conceptual pact formation has been widely studied, and the effects have been fairly robust. The present study rests upon the assumption that adults readily form conceptual pacts with one another in referential communication settings, but a direct comparison between parent-child pairs and adult-adult pairs playing the same game may be helpful. We are currently recruiting adult participants to play the same communication game. Since our study uses a simplified version of Clark and Wilkes-Gibbs' (1986) original paradigm, recruiting adult participants would be helpful for understanding children's developmental trajectory between ages 4 and 8. Our data would allow us to ask how parent-child pairs differ from adult-adult pairs, both quantitatively and qualitatively.

A useful follow-up would be to alter the trials, such that similar tangrams are paired together. Currently, tangrams that are most dissimilar to each other are paired, as a way to ensure that the game would not be too difficult for young children. Anecdotally, however, the researchers have noticed that older children occasionally comment on the game being too easy. Other than increasing the difficulty of the game, pairing similar tangrams also has the important benefit of allowing us to understand how different pressures influence referential communication and conceptual pact formation. The follow-up study could be directly compared to the current study, and would allow us to further explore how parents calibrate to their children in referential communication settings.

Acknowledgements

Place acknowledgments (including funding information) in a section at the end of the paper.

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