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RESPONSES TO CAREGIVER VIOLATIONS OF COMMUNICATION IN TYPICALLY DEVELOPING CHILDREN, CHILDREN WITH AUTISM SPECTRUM DISORDER, AND CHILDREN WITH DOWN SYNDROME

by

ANN MARIE GROSSNIKLAUS

Under the Direction of Lauren B. Adamson

ABSTRACT

Examining responses to violations of communication may provide insight into children’s communicative competencies not apparent during reciprocal interactions. In this study, the caregivers of 18-month-old typically developing children, 30-month-old children with autism spectrum disorder (ASD), and 30-month-old children with Down syndrome followed our suggestion to playfully violate communication with their children in two contexts: requesting and social interacting. Caregivers of children with ASD made fewer bids and violations, which their children accepted less often than typically developing children; they also used instrumental behaviors more often when responding. Children with Down syndrome responded to their caregivers similarly to typically developing children, and used more high-level communicative behaviors in the requesting, versus social interacting, context. This study highlights the bidirectional nature of parent-child interactions, and suggests that violations of communication may serve as a “press” to elicit child behaviors not present during reciprocal communication.

INDEX WORDS: Parent-child interactions, Violations of communication, Autism spectrum disorder, Down syndrome, Toddlers, Responsiveness
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by

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December, 2013
DEDICATION

This work is dedicated to my family, who never lost faith in me, no matter what the circumstances. This work is also dedicated to my uncle Kenny, my grandparents, and everyone in my family whose life has been touched by intellectual disability. Finally, I would like to dedicate this work to my friends, for their continual emotional support.
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1. Introduction

Early interactions with a primary caregiver are essential to the child’s development of reciprocal communicative interactions. In the course of typical development, caregiver-child interactions during infancy serve as a regulatory system for the infant to adjust his or her behavioral states to those of the caregiver (Tronick, 1982). However, these states often go through periods of mismatch, in which reparations of communication are crucial in order for the infant to garner meaning from the interaction (Tronick & Beeghly, 2011). Previous research has shown that studying these periods of mismatch or interruptions of reciprocal communicative interactions adds to our understanding of the child’s communicative development.

In a seminal study, researchers investigated very young infants’ reactions to a mother’s disruption of a face-to-face interaction (Tronick, Als, Adamson, Wise, & Brazelton, 1978). After an initial play period, the mother continued to face her infant but became unresponsive, assuming what has been termed a “still-face.” Infants were found to be affectively wary of their mothers during the interruption period, to show a decrease in positive affect, and to display a pattern of attempting to re-engage their mothers and then looking away, which has been subsequently called the “still-face effect” (Tronick et al., 1978; see Adamson & Frick, 2003, for a summary of research using the still face paradigm). This study demonstrated the importance of maternal responsiveness in early infant-mother interactions, as well as the infant’s emerging ability to self-regulate in the event of a nonresponsive partner. A recent meta-analysis (Mesman, van Ijzendoorn, & Bakermans-Kranenburg, 2009) revealed that in over 80 empirical studies using the still-face paradigm, the still-face effect remained robust in different circumstances, regardless of
the child’s gender, risk status (for example, siblings of children with autism spectrum disorder) and variations in the still-face procedure.

It is possible that the still-face effect is strong because the still-face procedure effectively challenges infants’ understanding of typical interactions with their caregivers, regardless of individual child characteristics and changes in the procedure. However, there is a gap in the current literature on how both typically and atypically developing children respond to more subtle violations of expectations in communicative interactions with their primary caregiver. Aside from the still-face studies, previous studies examining children’s affective expressions to their caregivers have focused on their affect during reciprocal communication, rather than during violations of communication. Therefore, the present study examines children’s affective expressions during a situation that has not often been investigated, caregiver violations of communication. The main purpose of the current study was to examine how typically developing children, as well as children with autism spectrum disorder (ASD) and with Down syndrome, responded to violations of their expectations during a communicative interaction with their caregivers. We were specifically interested in two different types of caregiver communicative acts: (1) caregiver bids for communication, in which the caregiver attempts to draw the child into a communicative interaction, and (2) caregiver violations of communication, in which the caregiver actively disrupts the child’s expectations of a communicative interaction. An example of a caregiver violation of communication is when a caregiver does not comply with the child’s request for an object. We examined overall responsiveness, specific communicative behaviors, and affective responses of both typically developing children aged 18 months and atypically developing children aged 30 months to caregiver bids and violations.
Examining a child’s responsiveness, specific communicative behaviors, and affective responses to a violation of communication may provide insight into the child’s understanding of the communicative interaction that is not readily apparent during a reciprocal interaction. A violation of communication could serve as a communicative “press” in which children are pressured to showcase their communicative abilities in order to repair the interaction with their parent. Children with ASD and children with Down syndrome may have problems with certain communicative skills and affective regulation that are significantly different from those of typically developing children’s communicative development. Studying atypically developing children’s responses to violations of communication may aid researchers in understanding these children’s communicative competencies and their communication profile in different contexts.

Key to this study is our examination of children’s responses to, and reparations of, violations in communication with their primary caregiver as opposed to an experimenter. A brief literature review follows, describing previous research that has addressed the issue of children’s ability to repair violations of their communicative expectations with an experimenter, followed by a review of studies exploring aspects of the ability of children with ASD and children with Down syndrome to repair communicative interactions.

1.1 Children’s Ability to Repair Violations of Communication

In an important early study, Ross and Lollis (1987) probed typically developing infants’ reactions to violations of communication by examining their responses to interruptions of a turn-taking game. Infants were observed four times longitudinally between the ages of 9 and 18 months. After a game consisting of at least four infant turns was established, the experimenter paused for a 15-second interval, looking at the infant with a neutral facial expression but not engaging the infant. Infants as young as nine months showed a baseline level of ability to take
turns at appropriate times and frequently; these basic turn-taking abilities did not show any developmental gains with age. However, the infants’ responses to the interruption periods provided strong evidence for their awareness of the turn-taking structure as well as their role in the game. Infants emitted more communicative signals for their partner to resume his or her turn during the interruption period than during the reciprocal game period. As the infants grew older, their communicative signals to the adult increased in clarity, and the signals they used were more effective at repairing the communication violation. Over the nine months of the study, the infants showed an increasing recognition of roles in the turn-taking game; the infants’ frequency of taking the adult’s turn instead of their own turn during the interruption period increased fourfold (Ross & Lollis, 1987). This study demonstrated that information about a child’s communicative development, such as their ability and effort to repair a violation of communication, might be gleaned from observing the child’s responses during a violation of communication.

More recent studies from Tomasello and colleagues have used the Ross and Lollis (1987) experimental paradigm of examining children’s responses to a communicative interruption when interacting with an adult. These researchers have expanded upon the original paradigm to examine children’s understanding of joint intentionality, shared commitments, and cooperation. Warneken, Chen, and Tomasello (2006) studied 18-month-old and 24-month-old typically developing children’s responses to an experimenter’s interruption of four types of interactions. These interactions included four conditions: one problem-solving task and one social game in which the experimenter held a parallel role to the child, as well as one problem-solving task and one social game in which the experimenter’s role was complementary to the child’s role. The researchers found that in all four conditions, when the experimenter interrupted his role for a 15-second period, both the 18-month-old and the 24-month-old children actively attempted to re-
engage the experimenter using communicative behaviors, although the 24-month-olds were generally more skilled than the 18-month-olds. When this experiment was replicated with three chimpanzees using similar tasks, none of the chimpanzees ever made an attempt to communicate to the experimenter about the interruption of communication. These results led the authors to conclude that shared intentionality is an aspect of communication unique to humans. A second study expanded upon the original Warneken et al. (2006) study by examining children with ASD with a mean chronological age of 40.3 months, and children with developmental delay with a mean chronological age of 43.0 months. This study found that during interruption periods, children with ASD attempted to reengage the partner less often than children with developmental delays; in cases where the children with ASD did attempt to reengage the partner, they had poorer coordination of eye gaze with other communicative behaviors than children with developmental delay (Liebal, Colombi, Rogers, Warneken, & Tomasello, 2008). The authors concluded that cooperative behavior and joint intentionality may represent areas of communicative difficulty in children with ASD.

A third study enlarged upon the Warneken et al. (2006) study but used two different experimental manipulations. In this study, all of the games the researchers used could be either played alone or with a partner. Additionally, the study introduced two different conditions: one in which the experimenter invited the child to play a game together with her, the *joint commitment* condition, and another in which the experimenter joined the child as the child was already playing the game, the *no joint commitment* condition. In the joint commitment condition, two- and three-year-old children reacted to the adult experimenter’s interruption with communicative actions attempting to reengage the experimenter, although they could have easily played the game alone. However, in the no joint commitment condition, children attempted to
reengage the adult significantly less often than in the joint commitment condition (Gräfenhain, Behne, Carpenter, & Tomasello, 2009).

Another recent study from Warneken and colleagues (Warneken, Gräfenhain, & Tomasello, 2012) used the Ross & Lollis (1987) paradigm to examine joint intentions and cooperation in 21- and 27-month-olds. Here they hypothesized that children might attempt to re-engage a nonresponsive partner in order to accomplish a task. Therefore, they studied children’s responses to an experimenter’s interruption of a task in four different conditions. In two of the conditions, the experimenter was needed to complete the task; in one condition she appeared “unable” to help the child achieve the goal, in the second, she was “unwilling” to help the child. In the third and fourth conditions, the experimenter was not needed to achieve the task, and was again either “unable” or “unwilling” to help complete the task. The researchers found that whether or not the experimenter was actually needed to accomplish the task, children at both ages attempted to re-engage the experimenter at comparable levels; however, they attempted to re-engage the “unable” partner more frequently than the “unwilling” partner (Warneken et al., 2012). This study provided support for the claim that typically developing children are not merely attempting to re-engage a partner to use him or her as a tool to accomplish a goal, but rather view a partner as someone with whom they must cooperate in order to achieve a goal.

The present study focused on children’s responses to a caregiver violation of communication that built upon an already existing communication system. This contrasted with previous studies, which examined children’s reactions to an interruption of communication with an unfamiliar adult experimenter. We sought to increase generalizability by examining semi-naturalistic dyadic interactions that may better reveal how children and their caregivers repair
breakdowns of communication outside of the laboratory, and how children attempt to re-engage a partner with whom they have extensive communicative experience.

In the current study, we focused on how children responded when their caregivers violated their expectations in two contexts, one where the caregiver did not comply with the child’s request (i.e., the requesting context) and the other a turn-taking game where the caregiver failed to follow an established pattern of turn taking (i.e., the social interacting context). Games and requesting episodes are two contexts which can showcase the infant’s developing skills in interactions. We focused on the reactions to communication violations of three different groups of children, comprised of typically developing children, children with ASD, and children with Down syndrome. The comparison of these three groups provides us with information regarding the three groups of children’s differing communicative development. As noted previously, the context of a violation of communication serves as a “press” to elicit communication in children with developmental disabilities that they would not exhibit during a reciprocal communicative interaction.

In the remaining part of this literature review we will focus on scientific evidence concerning both the competence and impairments of children with ASD and children with Down syndrome in three domains crucial to the ability to repair communicative interactions — requesting, social interacting, and affective communication.

1.2 Requesting

In typically developing children, requesting is a skill that emerges around 8 months of age. This skill requires the requester to have some knowledge about the action-related abilities of the requestee (Bruner, Roy, & Ratner, 1982). In terms of atypically developing children, many researchers have noted children with ASD’s relative strength in requesting, as compared to their
deficits in joint attention (Chiang, Soong, Lin, & Rogers, 2008; Loveland & Landry, 1986; Mundy, 1995; Mundy, Sigman, Ungerer, & Sherman, 1986; Mundy & Stella, 2000; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Wetherby, 1986). Children with ASD are more likely to use interactive actions, such as requesting, that lead to environmental consequences, than they are to use interactive actions that lead to social consequences such as sharing attention and interests (Wetherby, 1986). Other researchers have described this distinction as children with ASD being relatively competent in using communicative gestures to request for objects, but displaying a deficit in using the same types of gestures to initiate joint attention about an object (Mundy, 1995; Mundy et al., 1986; Chiang et al., 2008). Children with ASD are also more likely to use contextually-restricted forms of communication to request, such as touching an object or using an adult’s hand as a tool to obtain an object, than they are to use contextually-flexible forms of communication, such as pointing and showing (Loveland & Landry, 1986; Stone et. al., 1997; Wetherby, 1986). Some researchers have pointed to a possible difference in the neurological systems involved in requesting and sharing attention, which may account for the asynchrony between the two systems in children with ASD (Mundy, 1995).

In contrast to children with ASD, children with Down syndrome appear to have difficulty making nonverbal requests. Additionally, these children’s deficits in expressive language may render them particularly impaired in a requesting context. In an influential study, Smith and von Tetzchner (1986) found that compared to mentally age-matched typically developing children, children with Down syndrome exhibited deficits in nonverbal requesting behaviors. The authors also found that this deficit was related to expressive language delays at follow-up visits. Subsequent investigations of children with Down syndrome’s nonverbal requesting abilities have compared children with Down syndrome to mentally age-matched children with other
intellectual disabilities and typically developing children. The children with intellectual
disabilities were not significantly different from the typically developing children in terms of the
frequency of their requesting behaviors; however, children with Down syndrome used
significantly fewer nonverbal requesting behaviors than the two comparison groups (Mundy,
Sigman, Kasari, & Yirmiya, 1988). Mundy, Kasari, Sigman, & Ruskin (1995) replicated the
1988 finding that children with Down syndrome displayed fewer nonverbal requests than
mentally age-matched typically developing children. Evidence from previous research suggests
that a deficit in nonverbal requesting behavior is unique to Down syndrome. However, these
deficits may be restricted to requesting for objects; nonverbal requests for social interacting may
not be impaired (Fidler, Philofsky, Hepburn, & Rogers, 2005). Additionally, in a communicative
interaction with their primary caregiver, children with Down syndrome have been found to be
unengaged more often in requesting, versus social interacting, contexts (Adamson, Bakeman,
Deckner, & Romski, 2009).

1.3 Social Interacting

Social interacting, specifically turn-taking games, provides insight into the infant’s
development of joint attention abilities (Bruner, 1977). Joint attention refers to the child’s ability
to integrate communicative interactions between himself, his caregiver, and an object or event;
children’s coordination of these triadic interactions emerges by 13 months of age in typically
developing children (Adamson, 1995; Bakeman & Adamson, 1984). In terms of atypical
development, social impairment is one of the well-known core deficits in children with ASD, and
is a diagnostic criterion of the disorder. A deficit in joint attention is well-documented in children
with ASD (Adamson et al. 2009; Adamson, McArthur, Markov, Dunbar, & Bakeman, 2001;
Chiang et. al, 2008; Dawson et al., 2004; Loveland & Landry, 1986; McArthur & Adamson,
1996; Mundy, 1995; Mundy et al., 1986; Mundy & Stella, 2000; Mundy, Sigman, & Kasari, 1990; Stone et al., 1997; Wetherby, 1986). When children with ASD interact socially with an adult, extensive difficulties permeate the interaction; the child rarely attends to the adult partner, and episodes of coordinated joint attention are infrequent (Adamson, Bakeman, Deckner, & Nelson, 2012; McArthur & Adamson, 1996). This can lead to a disruption of communication between the adult and the child. The adult might attempt to repair this disruption by using literal communication to direct the child’s attention, such as tapping on an object or waving it in front of the child’s face. Previous studies have found that adults interacting with children with ASD use literal bids paired with conventional bids for joint attention far more frequently than they do with typically developing children and children with other developmental disorders (Adamson et al., 2001; McArthur & Adamson, 1996). Some researchers have suggested that the disturbances in joint attention skills that children with ASD present can be traced back to an earlier disturbance in dyadic interactions with an adult. Specifically, children with ASD may have particular difficulties engaging in triadic interactions that are most similar to their earlier experiences in dyadic interactions, such as reciprocal turn-taking (Chiang et al., 2008).

The social impairments of children with ASD are not limited to a disturbance in joint attention interactions. Compared to mentally age-matched developmentally delayed children and typically developing children, children with ASD oriented less often to social stimuli in their environment, and were less responsive to communicative partners’ expressions of distress (Dawson et al., 2004). In contrast to typically developing children and children with Down syndrome, children with ASD have been found to be less interested in social interacting than they are with familiar objects (Adamson, Deckner, & Bakeman, 2010).
In contrast to children with ASD, the responses to caregiver violations of a turn-taking game by children with Down syndrome may serve to highlight these children’s aptitude for social interacting. Children with Down syndrome display higher frequencies of social interacting behaviors, such as the request for a repetition of a game, compared to mentally age-matched typically developing children (Mundy et al., 1988). During playtime and mealtimes at school, children with Down syndrome have been found to interact significantly more with their classmates than both children with ASD and younger typically developing children (Attwood, Frith, & Hermelin, 1988). The interest of children with Down syndrome in interacting with an adult experimenter increased over the course of a year-long study compared to typically developing children, whose interest in interacting with the experimenter declined (Adamson et al., 2010). This interest in social interacting makes children with Down syndrome competent partners in conversation, and they are more skilled than typically developing language-matched children in maintaining a topic over several conversational turns. They are also more proficient than their language-matched peers at repairing conversational breakdowns (Tager-Flusberg, 1999; Tager-Flusberg & Anderson, 1991). Overall, researchers have found that when interacting with their primary caregivers, the diagnosis of Down syndrome has a less pervasive effect on communication than the diagnosis of ASD (Adamson et al., 2012).

1.4 Affective Communication

Affective expression is another aspect of communication that differs in children with ASD and children with Down syndrome. Overall, positive affective expression appears to constitute a particular area of difficulty for children with ASD and a particular area of strength for children with Down syndrome. In terms of affective communication in social interacting, children with Down syndrome show higher levels of positive affective expression directed
towards adults than their typically developing peers and peers with ASD. Their consistently high level of positive affect may serve to enhance their social communication, leading to a relative strength in social interacting. In a study comparing the affective expression of children with intellectual disabilities, ASD, and typically developing children during a joint attention context and a requesting context, the children with intellectual disabilities showed uniformly higher levels of positive affect across both contexts compared to the two other groups (Kasari, Sigman, Mundy, & Yirmiya, 1990). The group of children with intellectual disabilities was comprised of nine children with Down syndrome and nine children with intellectual disabilities of unknown origin. Therefore, a uniformly higher level of positive affective expression may not be unique to children with Down syndrome and may extend to other children with intellectual disabilities.

Comparing the affective expressions of children with ASD to children with Down syndrome has shown that children with ASD display significantly lower levels of positive affect towards both parents and experimenters (Joseph & Tager-Flusberg, 1997). Another study examining affective exchanges between children with ASD and their mothers found that compared to typically developing children, children with ASD displayed qualitative differences in their expression of affect (Dawson, Hill, Spencer, Galpert, & Watson, 1990). Children with ASD were much less likely to combine smiles with eye contact when interacting with their mothers in a face-to-face setting; therefore, their smiles lacked communicative intent compared to their typically developing peers. Children with ASD also were much less likely to smile in response to their mother’s smiles, and the mothers of children with ASD were less likely to smile in response to their children’s smiles (Dawson et al., 1990). Recently, researchers found that compared to 18-month-old typically developing children and 30-month-old children with Down syndrome, 30-month-old children with ASD interacting with their primary caregivers were rated
as having lower levels of positive affect (Adamson et al., 2012). These results suggest a disruption in the affective regulation of children with ASD and their caregivers.

1.5 The Current Study

In the current study, we focused on how children responded when their caregivers violated their expectations in two contexts, one a requesting situation where the caregiver did not comply with the child’s request and the other a social interacting situation where the caregiver failed to follow an established pattern of turn taking. Requesting and social interacting formats entail different communicative skills. During a violation of communication in a requesting situation, children may be pressed to use various skills associated with joint attention, such as eye contact, gestures, vocalizations, verbalizations, as well as potentially simulating affective distress, in order to gain help obtaining or acting on an object. In contrast, in the social interacting context of a turn-taking game, children may be pressed to show understanding of their own, as well as the adult’s, role in a turn-taking game in order to repair the breakdown of communication. The study compared three groups of children: typically developing children, children with ASD, and children with Down syndrome, interacting with their caregivers across two different communicative contexts: requesting and social interacting. Typically developing children were observed at 18 months, and the atypically developing groups were observed at 30 months. These groups were comparable on language level. The ages were chosen because 18-month-old typically developing children may be at a developmental point when they undergo accelerated language production and comprehension, which has been called a vocabulary “spurt” (see Goldfield and Reznick, 1990; Reznick & Goldfield, 1992). Thus, typically developing children at age 18 months, as well as their language-matched atypically developing peers, may show a mixture of both verbal and non-verbal communication.
1.6 Study Hypotheses

The present study had two overarching aims: (1) to describe children’s responsiveness to caregiver bids and violations and (2) to describe children’s specific communicative behaviors and affective responses to caregiver bids and violations. We expected that children’s responses to caregiver bids would provide insight into how children respond to a typical communicative interaction with their caregiver, contrasting with how children respond to a caregiver violation of communication, which is less common.

1.6.1 Caregiver communicative acts.

To meet our first goal, we characterized caregiver communicative acts (bids and violations) before describing children’s responsiveness to these acts. Our first step was to compare the frequency of caregiver communicative acts as well as the form (literal, conventional, or both) of caregiver communicative acts. Literal caregiver communicative acts contained an element that made these acts more perceptually salient to the child, for example, tapping on an object while inviting the child to play with the object. We hypothesized that there would not be a significant difference in the frequency of caregiver communicative acts between the three groups, replicating previous research (Adamson et al., 2001; McArthur & Adamson, 1996). However, we anticipated that caregivers of children with ASD and caregivers of children with Down syndrome would use more literal communicative acts than the caregivers of typically developing children.

1.6.2 Overall child responsiveness.

We expected that typically developing children’s overall responsiveness would not differ between the requesting and social interacting contexts. We hypothesized that children with ASD would be less responsive in both contexts (i.e., would accept caregiver communicative acts less
often) than typically developing children and children with Down syndrome. Accepting a caregiver communicative act meant that the child responded in a manner consistent with the caregivers’ communication, for example, agreeing to the caregiver’s invitation to play. Furthermore, we anticipated that children with ASD would show the more rejecting (such as cutting off the communicative interaction completely) and unaware (such as oblivious) responses to caregiver communicative acts for communication than both of the other groups. We expected that the responses of children with Down syndrome would be moderated by context, such that they would be more accepting in the social interacting context and less accepting (i.e., showing more unaware and rejecting responses) in the requesting context. We expected that children with Down syndrome would show differing responsiveness given their relative strength in social interacting contexts, but difficulties in requesting contexts.

1.6.3 Children’s low- and high-level responses.

We formed a communicative score by categorizing children’s responses as containing at least one low-level response, or at least one high-level response. The breakdown of many low- and high-level communicative responses was derived from the coding scheme for the Early Social Communication Scales (Mundy et al., 2003). Additional behaviors of interest added to the current study were broken into low- and high-level responses based on the clarity and complexity of the response. A low-level communicative response was less complex and clear than a high-level communicative response. We postulated that typically developing children would use high-level communicative behaviors more frequently than both comparison groups. We expected that children with ASD would use low-level communicative behaviors more frequently than typically developing children. However, we anticipated that the communicative score of children with ASD would be moderated by context, such that these children would have a higher
communicative score when responding to caregiver communicative acts in the requesting context than in the social interacting context. We anticipated that children with Down syndrome would use low-level communicative behaviors more frequently than typically developing children. We expected that the communicative score of children with Down syndrome would also be moderated by context; however, we anticipated that these children would have a higher communicative score of responses in the social interacting context than in the requesting context.

1.6.4 Specific communicative behaviors.

We expected typically developing children to use verbalizations and take the adult’s turn significantly more frequently than children with ASD and Down syndrome. We anticipated that children with ASD would show a higher frequency than both comparison groups of touching the object, grabbing the object, and using the partner as a tool. We expected that children with ASD would use eye contact and alternate gaze less often than both typically developing children and children with Down syndrome. We expected that children with Down syndrome would use gestures as a means to communicate more frequently than both comparison groups; in particular, the reaching gesture.

1.6.5 Affective responses.

We hypothesized that the affective responses of typically developing children to caregiver communicative acts would be moderated by context, such that these children would display more positive affect during caregiver communicative acts in the social interacting context than in the requesting context. Children with ASD were expected to show uniformly lower levels of positive affect to caregiver communicative acts across the two communicative contexts. We expected that children with Down syndrome would show uniformly higher levels of positive
affect during periods of caregiver communicative acts across the two communicative contexts, compared to their typically developing peers and peers with ASD.
2. Method

2.1 Participants

This study used an existing archive of video records that was compiled for a project investigating parent-child interactions in typically developing children (TD), children with autism spectrum disorder (ASD), and children with Down syndrome (DS) (Adamson, Bakeman, & Deckner, 2004; Adamson et al., 2009, see also Adamson et al., 2012). The sample consisted of 56 typically developing children (28 boys), 23 children with ASD (20 boys), and 29 children with Down syndrome (19 boys). These children were observed 5 times over the course of a year; for the purposes of this study, we focused on the first visit at 18 months of age for the typically developing children, and the visit closest to age 30 months for the children with ASD and Down syndrome. We selected these ages so that the children in the three groups would be comparable on language as assessed using the *MacArthur Communication Development Inventory* (CDI; Fenson et al., 1993). Raw CDI scores for the 18-month old TD children averaged 69.9 (SD = 71); mean scores for the 30-month-old ASD and DS groups were 113.5 (SD = 159.4) and 50.5 (SD = 65.2), respectively. These scores did not differ significantly per a One-Way Analysis of Variance (ANOVA).

The typically developing toddlers were recruited from a larger pool of parents who volunteered to participate in a university research study in the department of psychology. The mean age at the first observations of the typically developing toddlers was 18.1 months (SD = 0.3). The children with ASD were recruited by three clinicians in the metropolitan Atlanta area. Upon agreeing to participate in the study, diagnosis was confirmed in the ASD group by the administration of the Autism Diagnostic Interview-Revised by an on-site trained research assistant (ADI-R; Lord, Rutter, & Le Couteur, 1994). At the first visit, the mean age of the ASD
sample was 30.8 months ($SD = 4.6$). All of the children in the ASD sample were receiving clinical services, including 96% participating in speech therapy and occupational therapy, and 83% attending a special needs preschool. Children in the Down syndrome sample were recruited using a network of referral services for children with communication delays. The mean age of the children with Down syndrome was 30.3 months ($SD = 4.9$) at the initial visit. All but one child in the DS sample were receiving clinical services, including 97% receiving speech-therapy, 83% receiving occupational therapy, and 62% of the children attending a special needs preschool.

The TD, ASD, and DS samples were diverse, with 79% of TD, 83% of ASD, and 79% of DS children classified as European American. Additionally, 16% of TD, 0% of ASD, and 21% of DS children were African American, and 4% of TD, 13% of ASD, and 0% of DS children were Hispanic. The majority of the children’s parents were well-educated, with 75% of the TD, 65% of the ASD, and 79% of the DS parents having earned at least a bachelor’s degree.

We used the term “caregiver” in this study to indicate the interactions between our participants and their primary caregivers. The vast majority of our 108 participants were mother-child dyads ($n = 106$), however, two dyads were father-child, both in the Down syndrome group.

### 2.2 Procedure for Data Collection

Children and their caregivers were observed interacting in a 4.6 m × 3.1 m playroom in the Developmental Laboratory at Georgia State University. Each observational session lasted two hours on average. The sessions were recorded by two video cameras situated behind one-way mirrors. These one-way mirrors were on opposing walls of the playroom, permitting the child and parent to be captured by at least one video camera during the entire play session. In
order for observers to simultaneously view both recordings of the interactions, the video recordings were synchronized with a common vertical interval time code (VITC).

2.3 Communication Play Protocol

The current study examined caregiver-child interactions during the Communication Play Protocol (CPP) portion of the observation sessions (Adamson et al., 2004; 2009; 2012). The CPP encouraged parent-child communication over the course of six 5-minute long “scenes” in which the child was the star of the play and the parent was the supporting actor. These scenes were structured to facilitate interaction over three specific communicative contexts: requesting, commenting, and social interacting. Both video records and transcripts of the observational sessions were available in the project archive.

For the purposes of this study, we examined one scene in the communicative context of requesting (the “I Want” scene), and one scene in the communicative context of social interacting (the “Take Turns” scene). The length of the “I Want” scene was 310.28 s ($SD = 11.96$) on average and did not differ by group. The mean length of the “Take Turns” scene was 312.83 s ($SD = 13.78$) and also did not differ by group. In the “I Want” scene, three highly desirable toys were placed on a shelf above the child’s reach but within the parent’s easy reach. The toys included two toys provided by the laboratory and one of the child’s favorite toys from home. The parent was instructed by means of a “cue card” to momentarily pretend not to understand the child’s request before giving the child the toy. The cue card suggestion stated, “Readily agree to help [your child]. But initially act puzzled about which toy. Then make a mistake offering [your child] another toy. Finally, go ahead and give [your child] the toy” (Adamson & Bakeman, 1998). In the “Take Turns” scene, the director brought in toys designed to facilitate turn-taking interactions. The cue card for this scene suggested that the caregiver
“encourage [your child] to communicate, tease her a bit by pausing before you take some of your turns” (Adamson & Bakeman, 1998).

2.4 Transcripts

For the purposes of the current study, we used each utterance from previously transcribed transcripts as our primary unit of analysis for caregiver communicative acts. These transcripts originated from a study by Adamson and Bakeman (2006). For the earlier study (2006), a pair of transcribers transcribed each scene of the CPP. The first transcriber viewed the scene from one camera angle and transcribed the scene, and the second reviewed the transcript while viewing the scene from the second camera angle. A third, senior transcriber reviewed the transcript if one of the original two transcribers was new to transcription. Occasionally, transcribers made corrections to the transcripts if an utterance was misheard or missed altogether.

2.5 Coding Schemes

Table 1 summarizes the codes used to determine the (1) type and the form of caregiver’s communicative acts and (2) the codes used to determine the type of responsiveness by the child to the caregiver’s communicative acts, the types of child’s specific communicative behaviors including low- and high-level behaviors, and the types of child’s affective communication. This coding scheme was used to code both the requesting and social interacting contexts. Please see Appendix A for a detailed description of the coding scheme manual.
<table>
<thead>
<tr>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caregiver codes</td>
</tr>
<tr>
<td>Caregiver communicative act</td>
</tr>
<tr>
<td>Bid</td>
</tr>
<tr>
<td>Violation</td>
</tr>
<tr>
<td>Form of caregiver communicative act</td>
</tr>
<tr>
<td>Literal</td>
</tr>
<tr>
<td>Conventional</td>
</tr>
<tr>
<td>Both</td>
</tr>
<tr>
<td>Child codes</td>
</tr>
<tr>
<td>Responsiveness to caregiver communicative acts</td>
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<td>Accept</td>
</tr>
<tr>
<td>Aware, but not responding</td>
</tr>
<tr>
<td>Unaware</td>
</tr>
<tr>
<td>Reject</td>
</tr>
<tr>
<td>Specific communicative behaviors</td>
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<tr>
<td>Low-level behaviors</td>
</tr>
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<td>Vocalization</td>
</tr>
<tr>
<td>Eye contact</td>
</tr>
<tr>
<td>Alternate gaze</td>
</tr>
<tr>
<td>Nod head yes</td>
</tr>
<tr>
<td>Shake head no</td>
</tr>
<tr>
<td>Palm (indicating gesture)</td>
</tr>
<tr>
<td>Palm extend (reach)</td>
</tr>
<tr>
<td>Touch/hold object</td>
</tr>
<tr>
<td>Grab object</td>
</tr>
<tr>
<td>Use partner as a tool</td>
</tr>
<tr>
<td>Push/throw away object</td>
</tr>
<tr>
<td>Take own turn</td>
</tr>
<tr>
<td>High-level behaviors</td>
</tr>
<tr>
<td>Verbalization</td>
</tr>
<tr>
<td>Point</td>
</tr>
<tr>
<td>Hold out (show)</td>
</tr>
<tr>
<td>Hold up (take)</td>
</tr>
<tr>
<td>Adult turn</td>
</tr>
<tr>
<td>Child affective communication</td>
</tr>
<tr>
<td>Positive affect</td>
</tr>
<tr>
<td>Negative affect</td>
</tr>
<tr>
<td>Neutral affect</td>
</tr>
<tr>
<td>Both positive and neutral affect</td>
</tr>
</tbody>
</table>
2.6 Caregiver Codes

2.6.1 Type of caregiver communicative act.

The code of caregiver bid for communication originated from a previous study by Adamson et al. (2001). A caregiver bid occurred when the parent invited the child to take part of an activity, or sustain the activity by attempting to re-engage the child. For example, a caregiver bid occurred when the caregiver took a reciprocal turn in the social interacting context, since he or she was actively sustaining the communicative interaction. A caregiver violation occurred when he or she disrupted the interaction by either pretending not to understand a child’s request in the requesting context, or forgetting his or her role during a turn-taking game in the social interacting context. A non-applicable communicative act was coded when the caregiver communicated with the child other than by using a bid or violation, for example, commenting to the child.

2.6.2 Form of caregiver communicative act.

The codes of literal versus conventional caregiver communication were derived from earlier coding schemes developed by Adamson and Bakeman (1982; 1983). A caregiver bid or violation was either purely literal, purely conventional, or contained both literal and conventional elements. A purely literal communicative act contained no conventional elements of communication such as language or conventional gestures, and it was used to make the object of focus more perceptually salient. An example of a purely literal communicative act would be shaking a toy in front of the child’s face in order to get his or her attention. A purely conventional bid contained no literal aspects of communication; therefore, using only language and conventional gestures were considered to be purely conventional bids. An example of a purely conventional bid would be the caregiver pointing to the shelf and stating, “look at the
If a communicative act contained a literal and conventional element simultaneously, it was coded as both literal and conventional.

### 2.7 Child Codes

**2.7.1 Type of child responsiveness to caregiver communicative acts.**

Coders characterized the type of children’s responsiveness to caregiver communicative acts as one of four mutually exclusive codes: *accept, aware, but not responding, unaware, and reject*. These codes were adapted from the Adamson et al. (2001) coding scheme.

**Accept.** When the child accepted the caregiver communicative act, he or she responded to the caregiver in an active, communicative manner that did not cut off the communicative interaction. Generally, the child responded in a manner compliant with what the caregiver was asking of him or her. For example, the caregiver might have asked, “What do you want?” and the child gestured emphatically toward the shelf.

**Aware, but not responding.** When the child was aware, but not responding to the caregiver communicative act, he or she noticed the act, but did not respond to it. A common example of aware, but not responding occurred when the child watched passively as the caregiver either made a bid or a violation of communication.

**Unaware.** When the child was unaware of the caregiver communicative act, he or she typically continued with the activity as if no caregiver bid or violation occurred.

**Reject.** When the child rejected the caregiver communicative act, he or she actively responded to the caregiver communicative act in a way that cut off the communicative interaction. For example, if the caregiver asked, “Where’s your ball?” and the child shook his or her head to indicate “no” or used a vocalization combined with negative affect, this would be coded as a rejecting response.
2.7.2 Specific communicative behaviors.

If the child responded by accepting or rejecting the initial caregiver communicative act, specific child behaviors associated with this response were also coded. The child could respond to a caregiver communicative act with one or more communicative behaviors that have been previously identified as low- and high-level communicative behaviors. The codes of eye contact, alternating gaze, and pointing were derived from the Early Social Communication Scales coding scheme (Mundy et al., 2003). The codes of own turn and adult turn were adapted from the Ross and Lollis (1987) coding scheme, which characterized children’s reactions to adult’s violations of a turn-taking game. The palm, palm extend, hold up, and hold out codes originated from Özçalıshkan and Goldin-Meadow’s (2005) gesture coding scheme.

2.7.2.1 Low-level behaviors.

There were twelve low-level communicative behaviors coded in the present study. These behaviors included vocalizations, eye contact with the parent, alternating gaze between the parent and the object, the child nodding his head to indicate “yes”, shaking his head to indicate “no”, the child’s gesture of extending his palm towards an object to indicate the object, coded as palm, the child extended his arm while reaching toward an object to request the object, coded as palm-extend, the child taking his own turn, the child touching the object, grabbing the object, using the partner as a tool, and/or pushing away the object.

2.7.2.2 High-level behaviors.

There were five high-level communicative behaviors coded in this study. These behaviors included verbalizations and pointing toward an object, the child holding out the toy to the caregiver, indicating his/her desire to give the parent the toy, the child holding up the toy to show the parent the toy, and the child taking the adult’s turn for her. Again, based on the definitions of
Mundy et al.’s (2003) Early Social Communication Scales, high-level behaviors were more clear and complex than low-level behaviors. *Verbalizing* indicates a clarity/refinement of a vocalization; *pointing* also indicates the refinement of a reaching gesture. *Holding up* the toy and *holding out* the toy were considered high-level behaviors because these behaviors are associated with more complex joint attention behaviors; the communicative purpose of these behaviors is very clear, unlike *alternating gaze* from the parent to the object that could indicate both a request or a joint attention behavior. Finally, *taking the adult’s turn* indicated that the child had a rudimentary understanding of the adult’s, versus the child’s, role in the turn-taking interaction.

2.7.3 Type of child affect.

Following each caregiver bid or violation, the presence of children’s *positive* or *negative* affect was noted. If positive or negative affect was not present, it was assumed that the child’s affective expression remained *neutral*. If the child displayed both negative and positive emotional reactions, this indicated a “mixed” affective response, and was coded as *both*.

2.8 Data Coding Procedure

The first author of the study and two research assistants coded both the “I Want” scene and the “Take Turns” scene of the Communication Play Protocol; these scenes correspond to the requesting context and the social interacting context, respectively. Coding was done using Mangold International’s INTERACT software. This allowed the coders to review behaviors of interest in slow motion, and embed the onset and offset times of specific codes into the software. It also allowed for the coders to embed a hierarchical coding scheme into the software; that is, once a behavior of interest was noted, the coders selected subsequent codes that followed the behavior of interest.
2.8.1 Types of caregiver communicative acts.

Caregiver utterances and caregiver nonverbal communicative acts were coded by two independent observers as three options: caregiver bids, caregiver violations, or as non-applicable communicative acts. To accurately characterize each caregiver utterance and nonverbal communicative act, coders viewed the 5-minute video clip of a scene while simultaneously examining a previously recorded transcription of all caregiver and child utterances in the scene. Coders noted next to each utterance on the transcript whether the utterance was a caregiver bid, a caregiver violation, or a non-applicable caregiver utterance, which had no notation and was simply left in the original form on the transcript. After one pass of reviewing the video record and the transcript simultaneously, the coder viewed the video record again and pressed a computer key whenever a caregiver bid or violation occurred; thus, recording the onset and offset time of the communicative act in the INTERACT software. Additionally, we computed the total number of caregiver communicative acts per scene by adding together the caregiver bids, caregiver violations, and non-applicable caregiver communicative acts in each scene.

2.8.2 Children’s responsiveness, specific communicative behaviors, and affective responses.

To characterize children’s responsiveness, specific communicative behaviors, and affective responses to caregiver bids and violations, we employed a hierarchical coding scheme using Mangold International’s INTERACT software. A second pair of independent coders viewed caregiver bids and violations that were entered into the INTERACT software prior to this stage of data collection. Coders viewed each caregiver communicative act and corresponding child response as many times as necessary, to ensure that no specific child behaviors were overlooked. Additionally, coders were instructed to consult the transcripts if needed, to make
certain that the child response corresponded to the correct caregiver communicative act. This strategy was especially useful when several caregiver communicative acts occurred in succession over a short period of time (i.e., a 10- or 20-second interval).

2.9 Inter-Observer Agreement

Inter-observer agreement was assessed on 20% of the corpus coded by two sets of independent coders. Forty-four 5-minute scenes were randomly selected to calculate inter-observer agreement on identifying caregiver bids and violations, and 35 5-minute scenes were randomly chosen to compute inter-observer agreement on the form of the caregiver communicative act, overall child responsiveness, specific child behaviors, and child affect. The coders were blind to which video segments were used to calculate inter-observer agreement. Cohen’s kappa, a statistic that assesses the reliability of a categorical scale while correcting for chance agreements, was computed to assess inter-observer agreement (Cohen, 1960).

For caregiver bids and violations, Cohen’s kappa (κ) values were .79 and .68, corresponding to 87% and 86% inter-observer agreement in the requesting and social interacting contexts, respectively. These Cohen’s kappa statistics indicated acceptable inter-observer agreement, given the small number of codes (three; caregiver bid, caregiver violation, or non-applicable communicative act) and the moderate variability of the codes (i.e., caregiver communicative acts were most likely to be non-applicable, followed by caregiver bids, and finally caregiver violations) (Bakeman & Quera, 2011).

For the form of the caregiver communicative act, overall child responsiveness, specific child behaviors, and child affect, two types of Cohen’s kappa statistics were used to calculate inter-observer agreement. The first was the Cohen’s kappa statistic for event alignment agreement, which indicated that observers first segmented a stream of behavior into specific
events, and then coded the string of events that followed the initial event (in this case, a caregiver bid or violation). The tolerance for the event-alignment kappa value was 5, with an 80% overlap. Values for the event alignment kappa statistic ranged from .74 – .91. Given the small number of mutually exclusive and exhaustive codes, as well as the moderate to high variability of the use of the codes, all event alignment kappa statistics indicated acceptable inter-observer agreement. The second Cohen’s kappa statistics was the statistic for time-unit agreement, which referred to the second-by-second agreement of the occurrence of specific behaviors (Bakeman & Quera, 2011). The tolerance for the time-unit agreement kappa value was ± 2 1/10 seconds Values for the Cohen’s kappa statistic for time-unit agreement ranged from .81 – .94. Again, given the small number of possible codes for many of the variables, as well as the variability of the codes, all of our kappa statistics indicated acceptable inter-observer agreement.

2.10 Sample Reduction

The primary goal of the present study was to describe children’s responses to caregiver violations of communication. We were especially concerned with the number of participants who did not experience a caregiver violation of communication in either the requesting or social interacting context. In the requesting context, the number of participants who did not experience a violation of communication was 0, 3, and 4 for the TD, ASD, and DS groups, respectively. In the social interacting context, the number of participants who did not experience a violation of communication was 22, 9, and 4 for the TD, ASD, and DS groups, respectively. Therefore, we made the decision to drop participants from the context where they did not experience a violation of communication, but to retain them as participants in the context in which they did experience a violation of communication. Only one participant did not experience a violation of communication in both contexts; this participant was dropped altogether from the study. By
dropping participants only from the context where they did not experience a caregiver violation, we could retain as many participants as possible for the study as a whole, in order to retain enough power to detect statistically significant effects. Additionally, conceptually, if a child experienced a caregiver violation at least one context, the child’s response to the violations he or she did experience was valuable in answering the overarching question of how children responded to caregiver interruptions of communication. Table 2 describes the sample sizes for the requesting and social interacting contexts after dropping participants.

Table 2. Sample sizes for Requesting, Social Interacting, and Comparison Conditions, After Dropping Participants

<table>
<thead>
<tr>
<th>Communicative Context</th>
<th>Diagnostic Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typical</td>
</tr>
<tr>
<td>Original sample</td>
<td>56</td>
</tr>
<tr>
<td>Requesting</td>
<td>56</td>
</tr>
<tr>
<td>Social Interacting</td>
<td>34</td>
</tr>
<tr>
<td>Requesting and Social Interacting Comparison</td>
<td>33</td>
</tr>
</tbody>
</table>
3. Results

3.1 Frequency of Caregiver Communicative Acts

In the requesting context, across the three groups of children, caregivers made an average of 19.5 bids per 5-minute observational period (SD = 14.4), 20.2 violations (SD = 12.1), and 95 total communicative acts (SD = 29). In the social interacting context, caregivers made an average of 19.4 bids per observational period (SD = 9.9), 8.0 violations (SD = 7.7), and 107 total communicative acts (SD = 28.2). Figure 1 illustrates the distribution of the frequency of caregiver communicative acts for each group in both communicative contexts. The frequency of caregiver communicative acts was analyzed using One-Way Analyses of Variance (ANOVA). Table 3 summarizes the findings of diagnostic group differences for the frequency of caregiver communicative acts.
Figure 1. Frequency of caregiver bids and violations. In the requesting context, $N = 56$, 20, and 25 for the TD, ASD, and DS groups, respectively. In the social interacting context, $N = 34$, 14, and 25 for the TD, ASD, and DS groups, respectively. From the x-axis upwards, the dark lines of the boxes represent the 1st quartile, the median, and the 3rd quartile of the distribution. The whiskers represent the range of the distribution, and numerals above the whiskers represent the number and the approximate location of outliers.
Table 3. Frequency and Form of Caregiver Communicative Acts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diagnostic group</th>
<th>TD</th>
<th>ASD</th>
<th>DS</th>
<th>$F$-ratio or $\chi^2$</th>
<th>$\eta^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
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<td>.093</td>
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<td>.12</td>
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<tr>
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<td>0.11</td>
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<td>.95</td>
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<td>84</td>
<td>0.75</td>
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<td>.69</td>
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</table>

Note. In the requesting context $N = 56, 20, and 25$, and in the social interacting context $N = 34, 14, and 25$ for the TD, ASD, and DS groups, respectively. For the requesting context, % literal is the percentage of bids and violations containing a literal element. For the social interacting context, the percentage scores are, for bids, the percentage of caregivers for whom at least 60% of their bids contained a literal element and, for violations, the percentage of caregivers for whom 100% of their bids contained a literal element. Means that do not differ significantly per a Tukey post hoc test, $p < .05$, share a common uppercase subscript and means that do not differ significantly per a Tukey post hoc test, $p < .10$, share a common lowercase subscript.

For the purposes of this study, we considered any effect at the $p \leq .05$ level to be significant, and any effect that was significant at the $p \leq .10$ value as marginally significant. We hypothesized there would be no group differences in terms of the frequency of caregiver bids and violations. Contrary to our hypotheses, there were group differences in the frequency of caregiver bids and violations. In terms of violations, in the requesting context, children with ASD experienced significantly fewer violations of communication than typically developing children; children with Down syndrome did not differ significantly from either group. There was a marginally significant group difference for the frequency of caregiver violations in the social
interacting context. Children with ASD experienced fewer violations than children with Down syndrome, and typically developing children did not differ significantly from either group. In terms of caregiver bids, there was a marginally significant group difference of the frequency of caregiver bids in the requesting context. Children with ASD experienced fewer caregiver bids in the requesting context than children with Down syndrome; typically developing children did not differ from either group.

3.2 Form of Caregiver Communicative Acts

To characterize the number of caregiver communicative acts that contained a literal element, we combined the number of acts coded as purely literal and as both literal and conventional to account for all instances when the caregiver exhibited a literal element during a communicative act. This score was then transformed into a percentage of the total number of caregiver communicative acts. Due to the participants’ extremely frequent use of a literal element when communicating in the social interacting context, we employed a binary recode to analyze the percentage of caregiver bids and violations that contained a literal element for the social interacting context. Such recording was not necessary in the requesting context where the frequency of the caregivers’ use of a bid or violation that contained a literal element was not extremely skewed and was normally distributed.

In the social interacting context 99.3% of caregiver produced at least one communicative act that contained a literal element. Therefore, in the social interacting context, we chose to recode the percentages of caregiver communicative acts that contained a literal element as a binary variable, but to use different cut-off percentages based on how negatively skewed the percentages were for bids and violations. For caregiver bids, 80% of the participants used a bid that contained a literal element at least 60% of the time, whereas 20% of the participants used a
bid that did not contain a literal element less than 60% of the time. We chose 60% as the cut-off percentage for recoding caregiver bids, to parallel as closely as possible the 85%/15% split for caregiver violations, described below. For caregiver bids, a score of 0 indicated that the caregiver used a violation that contained a literal element less than 60% of the time, whereas a score of 1 indicated that the caregiver used a bid that contained a literal element 60% or more of the time.

In terms of caregiver violations in the social interacting context, 85% of the participants’ used a literal element every time they violated the interaction. Therefore, we used 100% as the cut-off percentage for recoding caregiver violations. A score of 0 indicated that the caregiver used a violation that contained a literal element less than 100% of the time, whereas a score of 1 indicated that the caregiver used a violation that contained a literal element 100% of the time. Thus, 85% of the participants received a score of 1, and 15% received a score of 0. We then used a chi-square test to examine group differences for the percentage of bids and violations that contained a literal element in the social interacting context.

Figure 2 illustrates the distribution of the form of caregiver communicative acts. Given the extreme skew of bids and violations that contained a literal element in the social interacting context, we provide descriptive data for each group in the requesting context only.
Figure 2. Percentage of the form of caregiver bids and violations that contained a literal element in the requesting context. \(N = 56, 20, \text{and} 25\) for the TD, ASD, and DS groups, respectively. From the x-axis upwards, the dark lines of the boxes represent the 1\textsuperscript{st} quartile, the median, and the 3\textsuperscript{rd} quartile of the distribution. The whiskers represent the range of the distribution, and numerals above the whiskers represent the number and the approximate location of outliers.

We anticipated that the caregivers of typically developing children would use fewer bids and violations that contained a literal element than the caregivers of children in the atypically developing groups. Table 3 summarizes the findings of diagnostic group differences for the form of caregiver communicative acts. Contrary to our hypotheses, there were no significant group differences in the percentage of bids that contained a literal element in either the requesting or social interacting context.
3.3 Children’s Responsiveness to Caregiver Communicative Acts

Descriptive data for the percentage of children’s responses that were accepting are provided in Figure 3, for each diagnostic group and both contexts.

![Box plots showing children's percentage of responses that were accepting in the requesting and social interacting contexts for TD, ASD, and DS groups.](image)

**Figure 3.** Children’s percentage of the response of accept. In the requesting context, \( N = 56, 20, \) and 25 for the TD, ASD, and DS groups, respectively. In the social interacting context, \( N = 34, 14, \) and 25 for the TD, ASD, and DS groups, respectively. From the x-axis upwards, the dark lines of the boxes represent the \( 1^{st} \) quartile, the median, and the \( 3^{rd} \) quartile of the distribution. The whiskers represent the range of the distribution, and numerals above the whiskers represent the number and approximate location of outliers.

Figure 4 illustrates the distribution of the percentage of children’s responses that were aware, but not responding for each diagnostic group and both contexts.
As the codes of accept, aware, but not responding, unaware, and reject were mutually exclusive and exhaustive, we calculated the percentage of children’s responses for each of these codes. The percentage of children’s responses that were accept and aware, but not responding, were subjected to One-Way Analyses of Variance (ANOVA). The percentage of children’s responses that were unaware and reject were highly skewed, with 47.1% of children’s responses never containing the code of unaware, and 62.9% of children’s responses never containing the code of reject. Therefore, we recoded these two variables as binary variables; 0 indicated that the child never used the response of either reject or unaware, and 1 indicated that the child used the response of either reject or unaware at least once. We used a chi-square analysis to examine possible group differences in the percentage of reject or unaware responses in both the requesting and social interacting contexts.

Figure 4. Children’s percentage of the response of aware, but not responding. In the requesting context, $N = 56$, 20, and 25 for the TD, ASD, and DS groups, respectively. In the social interacting context, $N = 34$, 14, and 25 for the TD, ASD, and DS groups, respectively. From the x-axis upwards, the dark lines of the boxes represent the 1st quartile, the median, and the 3rd quartile of the distribution. The whiskers represent the range of the distribution.
In terms of children’s overall responsiveness to caregiver bids and violations, we predicted that typically developing children’s responsiveness would not differ between contexts. Results supported this hypothesis. We hypothesized that children with ASD would be less responsive in both contexts than their comparison groups, and that they would show more rejecting and unaware responses than the other two groups. Partially supporting our hypothesis that children with ASD would accept caregiver bids less frequently than typically developing children and children with Down syndrome, children with ASD accepted fewer caregiver bids in the requesting context than typically developing children. We anticipated that children with Down syndrome would be more accepting in the social interacting context and less accepting in the requesting context. In terms of caregiver violations, partially supporting our hypothesis that children with Down syndrome would be less accepting in the requesting than the social interacting context, children with Down syndrome were aware, but not responding, to caregiver violations of communication in the requesting context more often than typically developing children, and children with ASD did not differ significantly from either group. Also partially supporting this hypothesis, there was a marginal effect of the percentage of children who accepted caregiver violations in the requesting context, with children with Down syndrome accepting violations less often than typically developing children; again, children with ASD did not differ significantly from either group. In terms of caregiver bids, we found that children with Down syndrome were aware but not responding to caregiver bids in the requesting context more often than typically developing children, but neither group differed significantly from children with ASD.

There were no significant group differences in terms of children’s responsiveness to caregiver communicative acts in the social interacting context, contrary to our hypothesis that
children with Down syndrome would be more responsive in the social interacting context than the requesting context. Please see Table 4 for group differences in children’s overall responsiveness.
Table 4. *Children's Responsiveness to Caregiver Communicative Acts*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diagnostic group</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TD</td>
<td>ASD</td>
<td>DS</td>
<td>F-ratio or $\chi^2$</td>
<td>$\eta^2$</td>
<td>$p$</td>
</tr>
<tr>
<td><strong>Requesting bids</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% accept</td>
<td>37</td>
<td>24</td>
<td>32</td>
<td>3.42</td>
<td>.066</td>
<td>.037</td>
</tr>
<tr>
<td>% aware</td>
<td>36</td>
<td>48</td>
<td>49</td>
<td>4.35</td>
<td>.082</td>
<td>.015</td>
</tr>
<tr>
<td>% (% reject &gt; 0)</td>
<td>27</td>
<td>30</td>
<td>28</td>
<td>0.05</td>
<td>—</td>
<td>.97</td>
</tr>
<tr>
<td>% (% unaware &gt; 0)</td>
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<td>70</td>
<td>76</td>
<td>1.82</td>
<td>—</td>
<td>.40</td>
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<td><strong>Requesting violations</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% accept</td>
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<td>.056</td>
<td>.061</td>
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<td>.079</td>
<td>.018</td>
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<td>% (% reject &gt; 0)</td>
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<td>55</td>
<td>56</td>
<td>0.50</td>
<td>—</td>
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<tr>
<td>% (% unaware &gt; 0)</td>
<td>46</td>
<td>30</td>
<td>44</td>
<td>1.65</td>
<td>—</td>
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<tr>
<td><strong>Social interacting bids</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>% accept</td>
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<td>33</td>
<td>44</td>
<td>1.24</td>
<td>.034</td>
<td>.30</td>
</tr>
<tr>
<td>% aware</td>
<td>40</td>
<td>43</td>
<td>46</td>
<td>0.26</td>
<td>.007</td>
<td>.77</td>
</tr>
<tr>
<td>% (% reject &gt; 0)</td>
<td>29</td>
<td>43</td>
<td>40</td>
<td>1.10</td>
<td>—</td>
<td>.58</td>
</tr>
<tr>
<td>% (% unaware &gt; 0)</td>
<td>56</td>
<td>86</td>
<td>56</td>
<td>4.24</td>
<td>—</td>
<td>.12</td>
</tr>
<tr>
<td><strong>Social interacting viol.</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% accept</td>
<td>44</td>
<td>49</td>
<td>48</td>
<td>0.10</td>
<td>.003</td>
<td>.90</td>
</tr>
<tr>
<td>% aware</td>
<td>35</td>
<td>39</td>
<td>43</td>
<td>0.47</td>
<td>.013</td>
<td>.62</td>
</tr>
<tr>
<td>% (% reject &gt; 0)</td>
<td>21</td>
<td>21</td>
<td>20</td>
<td>0.01</td>
<td>—</td>
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<td>% (% unaware &gt; 0)</td>
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<td>21</td>
<td>20</td>
<td>0.37</td>
<td>—</td>
<td>.83</td>
</tr>
</tbody>
</table>

*Note.* In the requesting context $N = 56$, 20, and 25, and in the social interacting context $N = 34$, 14, and 25 for the TD, ASD, and DS groups, respectively. % reject > 0 is the percentage of participants who responded by rejecting at least one time. % unaware > 0 is the percentage of participants who were unaware of the caregiver communicative act at least one time. Means that do not differ significantly per a Tukey post hoc test, $p < .05$, share a common uppercase subscript and means that do not differ significantly per a Tukey post hoc test, $p < .10$, share a common lowercase subscript.
3.4 Children’s Use of Low- and High-Level Behaviors

We coded children’s responses to caregiver communicative acts as either containing at least one low-level behavior, or at least one high-level behavior, as binary variables. These variables were subjected to a chi-square analysis to examine group differences. Additionally, we were interested in context differences in children’s use of high-level behaviors. We used McNemar’s tests to examine the percentage of children who exhibited at least one high-level behavior in the requesting, versus the social interacting, contexts in order to assess context differences within the three diagnostic groups.

Table 5 summarizes the differences between diagnostic groups in terms of the use of low- and high-level behaviors. We hypothesized that typically developing children would use high-level behaviors more frequently across both contexts. Partially supporting this hypothesis, in the requesting context, typically developing children were more likely to respond to caregiver violations with high-level behaviors than children with ASD, but children with Down syndrome did not differ significantly from either group. Again, in partial support of our hypothesis, in the requesting context, we found that typically developing children were more likely to respond to caregiver bids by using high-level behaviors than children with ASD; however, children with Down syndrome did not differ significantly from either group. We hypothesized that children with ASD and Down syndrome would use low-level behaviors more frequently across both contexts. Contrary to our hypotheses, there were no significant group differences in children’s use of low-level behaviors in either context.
Table 5. *Children's Low-and High-Level Responses to Caregiver Communicative Acts*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diagnostic group</th>
<th></th>
<th></th>
<th>$\chi^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TD</td>
<td>ASD</td>
<td>DS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requesting bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% at least 1 low level</td>
<td>91</td>
<td>85</td>
<td>100</td>
<td>3.60</td>
<td>.16</td>
</tr>
<tr>
<td>% at least 1 high level</td>
<td>95\textsubscript{b}</td>
<td>60\textsubscript{a}</td>
<td>80\textsubscript{ab}</td>
<td>6.28</td>
<td>.04</td>
</tr>
<tr>
<td>Requesting violations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% at least 1 low level</td>
<td>96</td>
<td>100</td>
<td>96</td>
<td>0.77</td>
<td>.68</td>
</tr>
<tr>
<td>% at least 1 high level</td>
<td>89\textsubscript{b}</td>
<td>65\textsubscript{a}</td>
<td>76\textsubscript{ab}</td>
<td>13.70</td>
<td>.001</td>
</tr>
<tr>
<td>Social interacting bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% at least 1 low level</td>
<td>88</td>
<td>100</td>
<td>96</td>
<td>2.63</td>
<td>.29</td>
</tr>
<tr>
<td>% at least 1 high level</td>
<td>50</td>
<td>64</td>
<td>56</td>
<td>0.84</td>
<td>.66</td>
</tr>
<tr>
<td>Social interacting viol.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% at least 1 low level</td>
<td>71</td>
<td>88</td>
<td>77</td>
<td>2.71</td>
<td>.26</td>
</tr>
<tr>
<td>% at least 1 high level</td>
<td>47</td>
<td>57</td>
<td>36</td>
<td>1.71</td>
<td>.43</td>
</tr>
</tbody>
</table>

Note. In the requesting context $N = 56$, 20, and 25, and in the social interacting context $N = 34$, 14, and 25 for the TD, ASD, and DS groups, respectively. % at least 1 low level indicates the percentage of participants that used at least one low level behavior in response to caregiver communicative acts. % at least one high level indicates the percentage of participants that used at least one high level behavior in response to caregiver communicative acts. Percentages that do not differ significantly as determined by the three required pair-wise Fisher’s exact tests, $p < .05$, share a common subscript.

Please see Table 6 for the effects of context by group. In terms of the communicative context, we hypothesized that typically developing children’s use of high-level behaviors would not differ across contexts. Contrary to our hypotheses, typically developing children were significantly more likely to use high-level behaviors in the requesting context for both caregiver bids and violations. We anticipated that children with ASD would use high-level behaviors more often in the requesting context than in the social interacting context. Contrary to this hypothesis, children with ASD did not differ in their use of high-level behaviors between contexts. Finally,
we expected that children with Down syndrome would use high-level behaviors more frequently in the social interacting context than in the requesting context. However, children with Down syndrome actually used high-level behaviors significantly more frequently when responding to violations in the requesting context, versus the social interacting context.

Table 6. Context Differences of Children's High-Level Responses to Caregiver Communicative Acts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Communicative Context</th>
<th></th>
<th></th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Requesting (%)</td>
<td>Social interacting (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TD</td>
<td>33 (100)</td>
<td>17 (51)</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>ASD</td>
<td>9 (75)</td>
<td>8 (67)</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>DS</td>
<td>16 (76)</td>
<td>11 (52)</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td>Violations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TD</td>
<td>29 (88)</td>
<td>16 (48)</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>ASD</td>
<td>9 (75)</td>
<td>7 (58)</td>
<td>.50</td>
<td></td>
</tr>
<tr>
<td>DS</td>
<td>16 (76)</td>
<td>8 (38)</td>
<td>.008</td>
<td></td>
</tr>
</tbody>
</table>

Note. In the sample comparison, N = 33, 12, and 21 for the TD, ASD, and DS groups, respectively. Scores are the number of participants that used at least one high level behavior in response to caregiver communicative acts (percentage are given in parentheses). McNemar tests comparing requesting and social interacting contexts within each diagnostic group were used to calculate the p-values.

3.5 Children’s Use of Specific Communicative Behaviors

We looked for differences for the specific communicative behaviors that we hypothesized would be different between groups. Each of these variables was highly skewed. In terms of object manipulation, for the code of touching the object, 46.8% of children’s responses never contained this behavior, 94.8% of children’s responses never contained the code of using the partner as a tool, and 75.9% did not contain grabbing the object. In terms of the child’s gaze when responding to the caregiver communicative act, 56.3% of children’s responses never included eye contact, and 95.1% never included alternating gaze. 37.6% of children’s responses
did not contain a reaching gesture, and 46.8% did not include verbalizations. Finally, 95.1% of children’s responses did not include taking the adult’s turn. Therefore, for these specific communicative behaviors, we used a binary recode to indicate if a child never used the behavior (a score of 0), or used the behavior at least once (a score of 1). These variables were subjected to chi-square analyses to test for group differences.

Table 7 displays the results of group differences of specific communicative behaviors in the requesting context. We postulated that typically developing children would verbalize and take the adult’s turn more often than children in the other two groups. In the requesting context, in terms of both caregiver bids and violations, typically developing children verbalized more frequently than children with Down syndrome. However, typically developing children verbalized significantly more often than children with ASD only when responding to caregiver bids; there was no significant difference between the two groups in the frequency of verbalizations when responding to caregiver violations. We hypothesized that children with ASD would touch the object, grab the object, and use the partner as a tool more often than children with Down syndrome and typically developing children. We also hypothesized that children with ASD would use eye contact and alternate gaze less often than the two comparison groups. In the requesting context, there were marginally significant group differences in terms of using the partner as a tool. When responding to caregiver bids, children with ASD used the partner as a tool more frequently than both typically developing children and children with Down syndrome. However, when responding to caregiver violations, children with ASD used the partner as a tool only more frequently than children with Down syndrome; typically developing children were not significantly different from either group.
Finally, we anticipated that children with Down syndrome would reach (palm-extend) more often to communicate than the comparison groups; however, there were no group differences in the use of the palm-extend gesture.

Table 7. Percentage of Children Displaying Specific Communicative Behaviors to Caregiver Bids and Violations in the Requesting Context

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diagnostic group</th>
<th></th>
<th></th>
<th>(\chi^2)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>TD</td>
<td>ASD</td>
<td>DS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Touch object</td>
<td>21</td>
<td>25</td>
<td>36</td>
<td>1.93</td>
<td>.38</td>
</tr>
<tr>
<td>% Use partner as tool</td>
<td>2a</td>
<td>15b</td>
<td>4a</td>
<td>8.14</td>
<td>.017</td>
</tr>
<tr>
<td>% Grab object</td>
<td>9</td>
<td>10</td>
<td>16</td>
<td>0.91</td>
<td>.63</td>
</tr>
<tr>
<td>% Eye contact</td>
<td>46</td>
<td>25</td>
<td>32</td>
<td>3.47</td>
<td>.18</td>
</tr>
<tr>
<td>% Alternate gaze</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>1.11</td>
<td>.57</td>
</tr>
<tr>
<td>% Reach</td>
<td>64</td>
<td>50</td>
<td>76</td>
<td>3.27</td>
<td>.19</td>
</tr>
<tr>
<td>% Verbalizations</td>
<td>75B</td>
<td>40A</td>
<td>52A</td>
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<td>.010</td>
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<tr>
<td>Violations</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>% Touch object</td>
<td>61</td>
<td>40</td>
<td>48</td>
<td>2.94</td>
<td>.23</td>
</tr>
<tr>
<td>% Use partner as tool</td>
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<td>25b</td>
<td>4a</td>
<td>4.84</td>
<td>.089</td>
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<tr>
<td>% Grab object</td>
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<td>35</td>
<td>40</td>
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<td>% Alternate gaze</td>
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<tr>
<td>% Reach</td>
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<td>80</td>
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<tr>
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<td>60B</td>
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<td>9.16</td>
<td>.010</td>
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*Note.* In the requesting context \(N = 56, 20,\) and 25, and in the social interacting context \(N = 34, 14,\) and 25 for the TD, ASD, and DS groups, respectively. Scores are percentages of children who exhibited the specific behavior at least once. Percentages that do not differ significantly as determined by the three required pair-wise Fisher’s exact tests, \(p < .05,\) share a common uppercase subscript and percentages that do not differ significantly, \(p < .10,\) share a common lowercase subscript.

\(^a\) % Use partner as a tool for bids differed significantly \(p < .05\) in the omnibus chi-square test, but only differed significantly \(p < .10\) per Fisher’s exact tests.
Table 8 provides a summary of the results of our analyses of group differences of specific communicative behaviors in the social interacting context. An inspection of these results indicates that there were no group differences in terms of children’s specific communicative behaviors in the social interacting context, which does not support our hypotheses of the same group differences in terms of specific behaviors for both the requesting and social interacting contexts.

Table 8. Percentage of Children Displaying Specific Communicative Behaviors to Caregiver Bids and Violations in the Social Interacting Context

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diagnostic group</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TD</td>
<td>ASD</td>
<td>DS</td>
<td>$\chi^2$</td>
<td>$p$</td>
<td></td>
</tr>
<tr>
<td><strong>Bids</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Touch object</td>
<td>88</td>
<td>100</td>
<td>96</td>
<td>2.33</td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>% Use partner as tool</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>1.95</td>
<td>.38</td>
<td></td>
</tr>
<tr>
<td>% Grab object</td>
<td>26</td>
<td>36</td>
<td>16</td>
<td>1.99</td>
<td>.37</td>
<td></td>
</tr>
<tr>
<td>% Eye contact</td>
<td>41</td>
<td>29</td>
<td>40</td>
<td>0.71</td>
<td>.70</td>
<td></td>
</tr>
<tr>
<td>% Alternate gaze</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1.16</td>
<td>.56</td>
<td></td>
</tr>
<tr>
<td>% Reach</td>
<td>29</td>
<td>36</td>
<td>44</td>
<td>1.34</td>
<td>.51</td>
<td></td>
</tr>
<tr>
<td>% Verbalizations</td>
<td>41</td>
<td>57</td>
<td>36</td>
<td>1.68</td>
<td>.43</td>
<td></td>
</tr>
<tr>
<td>% Adult turn</td>
<td>12</td>
<td>0</td>
<td>8</td>
<td>1.82</td>
<td>.40</td>
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</tr>
<tr>
<td><strong>Violations</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Touch object</td>
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<td>57</td>
<td>60</td>
<td>2.33</td>
<td>.38</td>
<td></td>
</tr>
<tr>
<td>% Use partner as tool</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>1.95</td>
<td>.38</td>
<td></td>
</tr>
<tr>
<td>% Grab object</td>
<td>35</td>
<td>29</td>
<td>32</td>
<td>0.42</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>% Eye contact</td>
<td>38</td>
<td>21</td>
<td>52</td>
<td>3.56</td>
<td>.17</td>
<td></td>
</tr>
<tr>
<td>% Alternate gaze</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>2.36</td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>% Reach</td>
<td>47</td>
<td>36</td>
<td>68</td>
<td>4.38</td>
<td>.11</td>
<td></td>
</tr>
<tr>
<td>% Verbalizations</td>
<td>50</td>
<td>24</td>
<td>30</td>
<td>3.29</td>
<td>.19</td>
<td></td>
</tr>
<tr>
<td>% Adult turn</td>
<td>15</td>
<td>21</td>
<td>12</td>
<td>0.63</td>
<td>.73</td>
<td></td>
</tr>
</tbody>
</table>

*Note. In the requesting context $N = 56, 20, and 25$, and in the social interacting context $N = 34, 14, and 25$ for the TD, ASD, and DS groups, respectively. Scores are percentages of children who exhibited the specific behavior at least once.*
3.6 Children’s Affective Responses

The codes of positive, negative, and both affective responses were highly skewed in both contexts, with 70.1% of children’s affective responses never exhibiting positive affect, 60.3% of responses never including negative affect, and 98.3% of children’s responses never including both negative and positive affect. Again, to account for this skewness, we used a binary recode to indicate if a child never used the affective response of positive, negative, or both (a score of 0) or if the child used these responses at least once (a score of 1). We tested for group differences between these variables using chi-square analyses. The code of neutral affective response was normally distributed; therefore, One-Way Analyses of Variance (ANOVA) were performed to examine group differences for this response. Figure 5 illustrates the distribution of the frequency of neutral child affect for each group in both communicative contexts.

Please see Table 9 for diagnostic group differences in terms of affective responses. We anticipated that typically developing children would show more positive affective responses in the social interacting, versus the requesting, context. Partially supporting this hypothesis, in the social interacting context, typically developing children showed significantly higher levels of positive affect than children with ASD to violations and marginally significantly higher levels to bids. We expected that children with ASD would show uniformly lower levels of affective responses across the two contexts. This expectation was partially supported by children with ASD showing marginally lower levels of positive affect than the other two groups to bids in the social interacting context, and significantly lower levels of positive affect in response to caregiver violations in the social interacting context. We expected that children with Down syndrome would show uniformly higher levels of affective responses across the two contexts. Partially supporting our hypothesis that children with Down syndrome would show uniformly
higher levels of positive affect, similar to typically developing children, in the social interacting context, children with Down syndrome showed higher levels of positive affect than children with ASD in response to violations and marginally higher levels of positive affect in terms of caregiver bids.

Figure 5. Percentage of children's affective responses to bids and violations that were neutral. In the requesting context, $N = 56, 20, \text{ and } 25$ for the TD, ASD, and DS groups, respectively. In the social interacting context, $N = 34, 14, \text{ and } 25$ for the TD, ASD, and DS groups, respectively. From the x-axis upwards, the dark lines of the boxes represent the 1st quartile, the median, and the 3rd quartile of the distribution. The whiskers represent the range of the distribution, and numerals above the whiskers represent the number and approximate location of outliers.
Table 9. *Children's Affective Communication*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Diagnostic group</th>
<th></th>
<th>F-ratio or $\chi^2$</th>
<th>$\eta^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TD</td>
<td>ASD</td>
<td>DS</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Requesting bids</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% neutral</td>
<td>94</td>
<td>89</td>
<td>93</td>
<td>1.31</td>
<td>.026</td>
</tr>
<tr>
<td>% any negative</td>
<td>30</td>
<td>40</td>
<td>32</td>
<td>0.63</td>
<td>—</td>
</tr>
<tr>
<td>% any positive</td>
<td>16</td>
<td>35</td>
<td>28</td>
<td>3.52</td>
<td>—</td>
</tr>
<tr>
<td>% any positive and negative</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.81</td>
<td>—</td>
</tr>
<tr>
<td><strong>Requesting viol.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% neutral</td>
<td>85</td>
<td>86</td>
<td>84</td>
<td>0.12</td>
<td>.002</td>
</tr>
<tr>
<td>% any negative</td>
<td>66</td>
<td>50</td>
<td>52</td>
<td>2.33</td>
<td>—</td>
</tr>
<tr>
<td>% any positive</td>
<td>20</td>
<td>30</td>
<td>36</td>
<td>2.66</td>
<td>—</td>
</tr>
<tr>
<td>% any positive and negative</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Social interacting bids</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>% neutral</td>
<td>90</td>
<td>94</td>
<td>86</td>
<td>1.38</td>
<td>.038</td>
</tr>
<tr>
<td>% any negative</td>
<td>32</td>
<td>50</td>
<td>28</td>
<td>2.03</td>
<td>—</td>
</tr>
<tr>
<td>% any positive</td>
<td>47_b</td>
<td>14_a</td>
<td>48_b</td>
<td>5.15</td>
<td>—</td>
</tr>
<tr>
<td>% any positive and negative</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1.63</td>
<td>—</td>
</tr>
<tr>
<td><strong>Social interacting viol.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% neutral</td>
<td>82</td>
<td>92</td>
<td>76</td>
<td>1.79</td>
<td>.049</td>
</tr>
<tr>
<td>% any negative</td>
<td>32</td>
<td>29</td>
<td>20</td>
<td>1.12</td>
<td>—</td>
</tr>
<tr>
<td>% any positive</td>
<td>35_B</td>
<td>0_A</td>
<td>52_B</td>
<td>10.81</td>
<td>—</td>
</tr>
<tr>
<td>% any positive and negative</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td>1.13</td>
<td>—</td>
</tr>
</tbody>
</table>

*Note.* In the requesting context $N = 56, 20,$ and $25$, and in the social interacting context $N = 34$, $14,$ and $25$ for the TD, ASD, and DS groups, respectively. Scores for neutral affect are the percentage of children’s responses to bids and violations that were neutral. Other scores are percentages of children who exhibited the indicated affective response at least once. Means that do not differ significantly per a Tukey post hoc test, $p < .10$, share a common lowercase subscript. Percentages that do not differ significantly as determined by the three required pair-
wise Fisher’s exact tests, $p < .05$, share a common uppercase subscript and percentages that do not differ significantly, $p < .10$, share a common lowercase subscript.
4. Discussion

The main goal of the current study was to describe how different groups of children (typically developing, children with ASD, and children with Down syndrome) responded to caregiver violations of a communicative interaction in two different contexts: requesting and social interacting. The findings of this study highlight the reciprocal nature of parent-child communication. The idea of parent-child interactions as reciprocal, bidirectional, and mutual has been of great interest in recent years, with researchers using sophisticated statistical modeling to interpret these interactions (Kochanska & Aksan, 2004). The current study demonstrates, along with previous literature (Tronick, 1982; Beeghly & Tronick, 2011), that if the interaction between parent and child is interrupted, children display subtle differences in the way they respond to violations of communication. Additionally, our study provides deeper insight into how atypically developing children repair communicative interactions when responding to their primary caregivers. This study also adds to our current understanding of children’s affective expressions during a relatively unexplored setting, caregiver violations of communication. Finally, our study provides support for the idea of caregiver violations as a communicative press, providing children with the opportunity to potentially exhibit communicative behaviors not present during reciprocal communication.

Generally, most caregivers exhibited both bids and violations in the requesting context, and bids in the social interacting context. However, a substantial number of the caregivers of typically developing children and children with ASD did not commit violations in the social interacting context. We investigated the possibility that some children did not experience violations of communication based on gender or language level. We divided children into two language groups: in the emerging verbal group, the child’s vocabulary level was below 50
words; a vocabulary of under 50 words indicates that the child may not yet have reached an acceleration or “spurt” in language acquisition (Adamson et al., 2009; Goldfield and Reznick, 1990). In the *minimally verbal* group, children had a vocabulary of less than 10 words, indicating that the child had not yet begun to talk (Adamson, Romski, Bakeman, & Sevcik, 2010). Odds ratio analyses and corresponding confidence intervals were calculated for each diagnostic group on both gender and the *emerging verbal* and *minimally verbal* language levels, to see if these variables might have accounted for why some children experienced violations of communication and others did not. None of the odds ratio analyses were significant, indicating that the children who experienced a violation of communication did not differ from the children who did not experience a violation of communication on gender, as well as the two language levels.

An alternative explanation for the fewer violations across groups is that our criterion for establishing a turn-taking game was rather stringent, with two rounds of parent-child turns necessary in order to constitute a turn-taking game. Although by 12 months, children have been shown to take an active role in turn-taking interactions, by this age, only 10% of all mother-child social interactions were spent playing games (Gustafson, Green, & West, 1979). Additionally, research on peer games among 15- to 24-month-old toddlers suggests that reciprocal games increased with age, and games with role-reversals developed during this time period; however, “games were not impressively frequent occurrences” (Ross, 1982, p. 516). Therefore, reciprocal turn-taking games may have been generally more difficult to establish in the current study; thus, caregivers had fewer opportunities to violate the game, or did not want to interrupt a game that was not firmly grounded.

Most children responded to caregiver bids and violation by either accepting or being aware, but not responding; they rarely rejected or were unaware of a bid or violation. This
pattern held for all groups and for both contexts. This indicated that, by and large, all groups of children responded in ways that did not actively disrupt the communication with their parent, although they frequently did not actively respond to parental communication. In both contexts, children often used at least one low-level response to caregiver bids and violations. Children seemed more likely to use at least one high-level response to bids and violations in the requesting context, versus the social interacting context; however, this pattern did not hold true for children with ASD. Additionally, it appeared that when a violation of communication occurred in both contexts, children’s use of specific communicative behaviors increased at comparable levels, although there were slight group variations in the requesting context. This suggests that when faced with a communicative press, most children increased their frequency of communicative behaviors. Children’s most common affective response to caregiver bids and violations in both contexts was to display neutral affect. However, when responding to caregiver violations in the social interacting context, children with ASD were less likely than the other groups to display positive affect.

Taken together, these results reveal subtle differences in the way different groups of children respond to a naturalistic interruption of communication with their primary caregiver. For 18-month-old typically developing children, and 30-month-old children with ASD and Down syndrome, these differences were more apparent in a requesting, versus a social interacting, context. Next, we will discuss patterns that emerged specifically for each group of children.

4.1 Typically Developing Children

This study provides information about what typically occurs when caregivers violate communication with their 18-month-old children in both a requesting and social interacting context. Generally, the caregivers of typically developing children followed our instructions to
provide bids and playfully violate their children’s requests, however, they violated much more often in the requesting, versus social interacting, context. In terms of their overall responsiveness, typically developing children most frequently accepted, or were aware, but not responding to caregiver bids and violations in both contexts. As anticipated, typically developing children displayed high-level communicative behaviors to both bids and violations frequently, although they were more apt to do so in the requesting versus the social interacting context. Overall, typically developing children seemed to acknowledge their caregivers’ violations of communication and attempted to repair the communicative interaction when a violation occurred.

One possible explanation for typically developing children’s more frequent use of high-level behaviors in the requesting context than in the social interacting context is that requesting requires more complex social cognitive skills and thus, more complicated behaviors. Typically developing children have the emerging ability to actively engage in turn-taking interactions by age 6 months. Previous longitudinal research with infants observed at ages 6, 8 and 12 months demonstrated that as infants grew older, their turn-taking games with their mothers developed. At 6 months, infants took passive roles in turn-taking interactions, whereas by 12 months, the infants were taking an active role in the game (Gustafson et al., 1979). Requesting, on the other hand, is a skill that emerges around 8 months of age (Bruner et al., 1982). Previous research has described the attentional demands of early social interacting and turn-taking as dyadic (i.e., between the child and parent), whereas requesting is considered triadic (i.e., involves the child, parent and an object). Therefore, requesting might require more complex social cognitive skills than social interacting (Mundy et al., 1986). For example, the child must have a basic understanding of the abilities of the person from whom they are requesting (Bruner et al., 1982).
Alternatively, as children grow older and engage in more sophisticated turn-taking, they may still be refining their abilities to differentiate the role of each partner in a turn-taking game. Previous research has demonstrated that between the ages of 9 and 18 months, children showed an increasing ability to differentiate between the child’s, versus adult’s, role in a turn-taking game; however, this transition was gradual (Ross & Lollis, 1987). Although children have acquired the ability to differentiate between each partner’s role in a turn-taking game by age 18 months, they may still be refining their skills in these games, and thus, engage in less complex behaviors than during a requesting context.

In terms of typically developing children’s specific communicative behaviors, as anticipated, they verbalized frequently to bids and violations, especially in the requesting context. In the requesting context, when responding to caregiver violations for communication, six out of the 56 typically developing children used their partner as a tool. Perhaps for these children, if their parents persisted in violating the communicative interaction, these children used as many behaviors in their communicative repertoire as possible, including both low- and high-level behaviors, in order to repair the interaction. Finally, typically developing generally used neutral affect most frequently in all contexts when responding to bids and violations; however, they appeared to use positive affect at least once more often in the social interacting context. In typically developing children, the emergence of the comprehension of humor occurs around 9 to 10 months of age, and is based on violations of social understandings and conventions. When their expectations of social interactions are violated, infants at this age may engage in teasing behaviors (Reddy, Williams, & Vaughan, 2002). Therefore, typically developing children appeared to show an understanding of the teasing nature of turn-taking games in the social interacting context.
4.2 Children with ASD

In this study, the presence of ASD affected both caregiver’s communication and how children responded to their caregivers. Children with ASD were less responsive to their caregivers and in turn, their caregivers provided them with fewer opportunities to communicate. This was particularly apparent in the requesting context, where it was generally more challenging to establish a reciprocal communicative interaction between children with ASD and their caregivers. Children with ASD accepted fewer bids in this context than typically developing children. Past research has demonstrated that children with ASD show deficits in responding to caregiver bids for communication (Adamson et al., 2001). Perhaps the caregivers of children with ASD found their children more difficult to engage, since this group of children accepted bids less frequently. Therefore, the caregivers of children with ASD may have had fewer opportunities to commit a violation of communication in the requesting context.

In the social interacting context children with ASD experienced fewer violations of communication than children with Down syndrome, reflecting their difficulties with turn-taking interactions. Previous research has demonstrated that children with ASD respond less frequently than both typically developing children and children with intellectual disabilities to bids for turn-taking with an experimenter, and that their turn-taking sequences were briefer than the two comparison groups (Mundy et al., 1986). The finding that children with ASD experienced fewer violations in both contexts compared to the other groups suggests that their caregivers were aware of their children’s communicative difficulties and adjusted their communication accordingly. Previous research has shown that the caregivers of children with ASD are just as attuned to their children’s communication as the caregivers to typically developing children and children with other developmental delays. However, in follow-up assessments, children with
ASD showed greater joint attention and language gains only if their caregivers were synchronized and undemanding of their children’s focus; that is, the caregivers matched both the child’s focus and activity (Siller & Sigman, 2002). In the current study, caregivers were instructed to direct their child’s attention (i.e., by inviting the child to play with a toy on the shelf) and violate the child’s focus (i.e., by pretending to not understand the toy the child requested). Therefore, although the caregivers in our study adjusted their communication to their children’s responses, they did so in a manner quite differently than has been previously investigated.

Children with ASD’s communicative difficulties had a pervasive effect on their responses to caregiver bids and violations. We expected that across contexts, children with ASD would use high-level behaviors more often in the requesting context, compared to the social interacting context, given their relative skill in instrumental requesting (Mundy, 1995; Mundy et al., 1986; Chiang et al., 2008). However, results did not support this hypothesis. Children with ASD used high-level behaviors less often in response to both bids and violations than typically developing children in the requesting context. Additionally, there was no difference in their use of high-level behaviors in response to bids and violations between the requesting context and the social interacting context. One explanation for our unexpected finding is that because these children were provided with fewer opportunities for bids than children with Down syndrome, and fewer violations than typically developing children, they had fewer opportunities than their comparison groups to respond with high-level communicative behaviors. As we computed high-level responses as a binary variable (i.e., the behavior occurred at least one time), children with ASD had fewer chances to respond by using a high-level behavior at least once, since these children did not have as many opportunities to respond to a caregiver communicative act. Alternatively,
previous research has shown that compared to children with developmental language delay and
typically developing children, children with ASD use fewer attention-directing behaviors such as
pointing, showing, looking, and touching across multiple contexts (adult-directed play,
requesting, and free play). Children with ASD’s use of these behaviors did not differ across the
three contexts (Landry & Loveland, 1989). It may be the children with ASD’s communicative
impairments are so all-encompassing that regardless of context, they are not able to showcase
their communicative abilities compared to children with other developmental delays.

When children with ASD did respond to caregiver bids and violations, they tended to do
so in an instrumental, rather than communicative, manner. One particularly interesting finding is
that in the requesting context, children with ASD tended to use their partner as a tool more
frequently than the other two groups. This follows previous findings that children with ASD are
more likely to use contextually-restricted forms of communication than typically developing
children and children with other developmental delays (Loveland & Landry, 1986; Stone et al.,
1997; Wetherby, 1986). Although using the partner as a tool is commonly thought of as a
characteristic of ASD, the scientific literature on this particular behavior is rather sparse.
Contextually-restricted forms of communication, such as using the partner as a tool and touching
an object, are much more difficult to interpret as communicative in nature compared to other
behaviors such as pointing and showing, which are easily interpreted as communicative
(Loveland & Landry, 1986). Therefore, using the partner as a tool may be an instrumental
behavior that is not communicative in nature. Although this behavior was more common in
children with ASD, it fits under their communicative profile as having more communicative
difficulties than typically developing children, as well as children with other developmental
delays.
One possible exception to children with ASD’s overarching communicative difficulties in this study was that they verbalized at levels comparable to typically developing children when responding to caregiver violations in the requesting context. Previous research has shown that children with ASD follow the same developmental trajectory in terms of language development as both typically developing children and children with Down syndrome; in fact, lexical knowledge may be a relative strength in children with ASD (Tager-Flusberg, Paul, & Lord, 2005). However, since these children display difficulties with the pragmatic use of language (Tager-Flusberg et al., 1990), their language use may not have effectively repaired a communicative interaction in the current study. It is of note that children with ASD increased their verbalizations when confronted with a violation of communication in the requesting context. Perhaps these children also felt a press to clarify their communication when confronted with an unfamiliar interaction (i.e., use a more complex behavior such as a verbalization), but they were unable to do so effectively due to their difficulties in pragmatic language use.

Finally, in terms of affective communication, there is evidence that children with ASD might not have understood the “teasing” nature of the turn-taking games in the social interacting context, especially in terms of caregiver violations of communication. Consistent with previous research, children with ASD showed lower levels of positive affect to both bids and violations than comparison groups in the social interacting context (Adamson et al., 2012; Dawson et al., 1990; Joseph & Tager-Flusberg, 1997). However, this also points to a potential deficit in these children’s understanding of humor and teasing. Previous research has shown that compared to typically developing children, 10-year-old children with ASD used less playful behaviors such as smiling, unusual intonation, and exaggerated gestures when teasing a primary caregiver. Typically developing children and their parents were also found to understand the positive and
playful nature of teasing more often than children with ASD and their parents (Heeley, Capps, Keltner, & Kring, 2005). It is important to note that the literature on understanding teasing in toddlers with ASD compared to typically developing toddlers is sparse; therefore, comparing the behaviors of 30-month-old children with ASD to school-aged children with ASD must be interpreted cautiously. Overall, in the present study children with ASD showed difficulties in engaging with their primary caregivers. When they did engage, their communicative impairments hindered their ability to repair violations of communication.

4.3 Children with Down syndrome

Children with Down syndrome in the current study behaved similarly to typically developing children, although some impairments were present. The caregivers of children with Down syndrome appeared to be attuned to their children’s communication, and children displayed more complex behaviors in a context that has been previously shown to be difficult for these children to navigate (i.e., requesting). Compared to children with other developmental delays such as ASD, the caregivers of children with Down syndrome appeared to tailor their communication to their children by providing them with more bids in the requesting context and violations in the social interacting context than the caregivers of children with ASD. Previous research has shown that parents of children with Down syndrome have had success at tailoring their communication to their children’s communicative abilities. Parents of adolescents with Down syndrome were more likely to use a higher number of different words when their children had low to average levels of receptive syntax and nonverbal cognition, compared to the parents of younger language-matched typically developing children, providing support for the argument that the caregivers of children with Down syndrome were “tuning” into their children’s communicative capabilities (Johnson-Glenberg & Chapman, 2004). In the current study, perhaps
given children with Down syndrome’s relative unresponsiveness to caregiver bids and violations of communication in the requesting context – they were more likely to show aware, but not responding responses than typically developing children to bids and violations, and accepted fewer violations than typically developing children – their parents provided them with more opportunities to respond. Knowing that their children are particularly skilled in social interacting, the parents of children with Down syndrome may have felt more confident in providing them with more violations in this context.

Although unexpected, the finding that children with Down syndrome used high-level behaviors more frequently in response to caregiver violations in the requesting context, as opposed to the social interacting context, is arguably the most interesting finding of the study. This finding demonstrates that when pressed to communicate in a context that has been previously found to be especially challenging for children with Down syndrome, given their difficulties with instrumental requesting (Mundy et al. 1995; Mundy et al. 1998; Smith & von Tetzchner, 1986), these children delved into their communicative repertoire. However, previous researchers did not examine children with Down syndrome’s responsiveness to violations of communication in a requesting setting. It is of note that the children in our study only increased their high-level communicative responses in terms of caregiver violations of communication, rather than caregiver bids for communication. Therefore, it seems as though the pressure occurring during a caregiver interruption of communication genuinely had an impact on when children with Down syndrome chose to engage in more complex behaviors. This highlights the role of missteps in communication, demonstrating that they are a process that can reveal and support emerging communicative skills (Ross & Lollis, 1987).
Future research may focus on the type of caregiver communication towards children with Down syndrome as either directive or suggestive. Directive communication is less open to interpretation as suggestive communication. For example, the open-ended question, “which toy do you want to play with?” would be an example of a suggestive bid, whereas the statement “let’s play with the doll” would be a directive bid. Children with Down syndrome have been found to be more compliant and use higher-level behaviors when their caregivers use more directive than suggestive communication (Landry & Chapieski, 1989; Landry, Garner, Pirie, & Swank, 1994). Directive bids and violations may be tailored to children with Down syndrome’s communicative capabilities; this structured communication may allow children with Down syndrome to communicate more effectively than less structured communication.

Finally, the finding that children with Down syndrome used high-level communicative behaviors more often to violations of communication has therapeutic implications. Previously, violations of a child’s routine have been used in intervention settings to strengthen requesting behavior in children with intellectual disabilities. In “milieu teaching,” the interventionist interrupts a routine activity to encourage requesting behavior. For example, when rolling a ball back and forth with the child, the interventionist may pause and ask, “What do you want?” and wait for the child’s response. If the child does not respond, or responds with an inappropriate or incomplete response, the interventionist aids him in completing his desired request. As the child progresses, fewer prompts and physical assistance are needed for the child to achieve his desired request. The intervention continues until the interventionist can elicit the child’s request by simply pausing the routine. This aspect of milieu teaching has successfully taught verbal and nonverbal requesting skills to young children with developmental delays (A.P. Kaiser, personal communication, January 25, 2011; Kaiser, Hemmeter, & Hester, 1997). Additionally,
interrupting the child’s activity is used as a therapeutic technique in “Floor Time,” an intervention for children with developmental delays. In Floor Time, the parent is told to “playfully obstruct” the child’s ongoing activity in order to facilitate an interaction between the parent and the child (Greenspan & Wieder, 1998, p. 147).

However, some communicative impairments of children with Down syndrome were apparent in the current study; specifically, their lack of verbalizations compared to typically developing children in the requesting context. This may reflect the particular deficits in expressive vocabulary of children with Down syndrome, as compared to their receptive vocabulary (Chapman, 1997; Caselli et al., 1998; Hoff, 2009). Additionally, it must be noted that despite the finding that these children used more high-level communicative behaviors to caregiver violations in the requesting, versus the social interacting context, that these children frequently appeared more passive to their caregiver’s communication than typically developing children. Although this study demonstrated a relative communicative strength on the part of children with Down syndrome compared to children with ASD, when pressed to communicate in a particularly difficult context, some communicative impairments remained.

Finally, it is interesting to compare children with Down syndrome and children with ASD’s understanding of humor and teasing. Both groups of children are developmentally delayed; however, they display very different patterns in terms of the expression and potential understanding of affective communication. In the present study, children with Down syndrome tended to exhibit an understanding of the “teasing” nature of the social interacting context as compared to children with ASD, by exhibiting positive affect more often during both bids and violations of the social interacting context. This may reflect children with Down syndrome’s relatively higher use of positive affect than children with ASD (Dawson et al., 1990; Joseph &
Tager-Flusberg, 1997), or alternatively, that they have a better understanding of teasing than children with ASD. Previous research investigating humor in children with ASD and Down syndrome ranging in age from 3 to 7 years old has shown that children with Down syndrome produce episodes of humor significantly more frequently than children with ASD when interacting with their mothers. Additionally, children with Down syndrome produced and responded to humor involving nonverbal incongruity more often than age and language matched children with ASD (St. James & Tager-Flusberg, 1994). Humor involving non-verbal incongruity is directly related to violating an expectation; for example, a child pretending to make a horse jump over a fence several times and then pausing before taking the final turn is an illustration of non-verbal incongruity, and violates the mother’s expectation that the child will continue his or her established pattern of play. This directly relates to the current study, as most violations in the social interacting context involved the parent behaving in a manner incongruent with the child’s expectation by pretending not to take his or her turn. Perhaps children with Down syndrome were more adept than children with ASD at understanding the humorous nature of the incongruity of their parents not taking their turn as expected. Additionally, research based on parent reports of 3-4 year old children with ASD and Down syndrome has shown that children with ASD initiate teasing less often than children with Down syndrome, and the parents of children with ASD tease their children less often than the parents of children with Down syndrome (Reddy et al., 2002).

4.4 Study Limitations

One major limitation of the current study was the small sample size. The original sample consisted of 56 typically developing children, 23 children with ASD, and 29 children with Down syndrome. Since we excluded participants who did not experience a violation of communication
from the context in which they did not experience a violation, our sample sizes were reduced considerably, especially in the social interacting context. The small sample size in the social interacting context proved difficult to detect diagnostic group differences, with only 34, 14, and 25 typically developing children, children with ASD, and children with Down syndrome, respectively. Additionally, the unequal sample sizes between the requesting and social interacting contexts made comparisons between the two contexts difficult, and the comparison sample was very small with 33, 12, and 21 typically developing children, children with ASD, and children with Down syndrome, respectively. However, we attempted to control for the small sample sizes by using proportions scores when possible.

The semi-naturalistic design of the study had both pros and cons. Unlike previous studies, we had the opportunity to systematically observed children’s responses to their parents’ naturalistic violations of communication. Nonetheless, this design introduced challenges, such as the groups of children experiencing an unequal number of opportunities to respond to bids and violations. In the future, a less naturalistic setting may lessen some of these challenges; for example, one might ask the parent to violate the interaction a specific number of times. However, by doing so, one might also lose information about the bidirectional nature of the interaction, as some caregivers seemed to violate less often because their children were less responsive.

4.5 Conclusion

Consistent with previous research, the current study highlights the bidirectional nature of parent-child interactions. We found that both typically and atypically developing children responded differently to caregiver interruptions of communication than to reciprocal communicative interactions. Although children’s differences in responding to caregiver violations, as compared to bids, of communication were subtle, we anticipated less robust
responses to the more naturalistic violations of communication in our study, compared to less
natural interruptions of communication that previous research has examined. Most previous
research involved 15-second interruptions of communication with an experimenter. In the current
study, children responded to much shorter, naturalistic violations of communication, and may not
have had the time to respond. However, all children generally responded to both bids and
violations by either accepting, or being aware, but not responding to the communicative act. This
emphasizes that all groups of children were more likely to respond in a manner that did not
directly cut-off the communicative interaction, for example, by rejecting the parent’s
communication.

In terms of violations, versus bids, for communication, descriptively, in both contexts,
typically developing children increased their use of specific communicative behaviors when
responding to violations, as did the atypically developing children. When faced with the pressure
to repair the communicative interaction, children often increased their frequency of
communicative behaviors. In general, children with ASD had more difficulties communicating
with their caregivers than the other two groups; they experienced fewer opportunities to
communicate, and accepted communication less frequently. When they did respond, they were
more likely to use an instrumental behavior than a communicative behavior. Finally, children
with Down syndrome responded with more high-level behaviors to violations of communication
in the requesting context than in the social interacting context. In the past, navigating requesting
contexts has been shown to be particularly difficult for children with Down syndrome. This
study uncovers the possibility that when pressed to communicate in a requesting context,
children with Down syndrome display a more sophisticated communicative repertoire than has
been described in the scientific literature to date and warrants further investigation.
References


Appendix

Manual for coding caregiver bids, violations, and children’s responses

A.) Purpose. The purpose of this coding scheme is to describe caregiver bids for the child’s participation in either a requesting or turn-taking interaction, as well as to describe caregiver violations of communication in a requesting or turn-taking interaction. Additionally, we will be looking at children’s responses to caregiver bids and violations in both turn-taking and requesting contexts.

This coding scheme draws primarily from two previous studies; Ross and Lollis (1987) which examines the communicative and emotional reactions of typically-developing children to a violation in a turn-taking game with an experimenter and Adamson et al. (2001) which focuses on child responsiveness to caregiver bids. Additionally, five codes – point/point-extend [po], palm [pal], palm-extend [pal-ex], hold up [hu], and hold out [ho] are adopted from Özçalışkan and Goldin-Meadow’s gesture coding scheme (2005). The codes of literal [LI] versus conventional [CO] caregiver communication, as well as the child code of head shake yes/no [hs-yes], [hs-no] are derived from earlier coding schemes developed by Adamson and Bakeman (1982; 1983).

B.) Overview.

The following figures are designed to aid coders in conceptualizing the flow of the coding scheme.

![Flowchart](image_url)

*Figure 1. Flowchart depicting the relationship between child codes.*
Figure 2. Flowchart depicting the relationship between child codes.

Lexical chain coding of children’s specific behaviors to caregiver bids/violations
Gesture
(point (yes/no))
(palm (yes/no))
palm extend (yes/no)
hold up (yes/no)
hold out (yes/no)
head shake yes (yes/no)
head shake no (yes/no)

Object manipulation
- Grab
- Touch/hold
- Push/throw away
- Use partner as a tool

Gaze
- Eye contact
- Alternate gaze

Turns
- Takes own turn
- Takes adult turn
Caregiver Codes.
*Denotes codes that are mutually exclusive

1. [CB] Caregiver Bid
   Form*:
   a. [LI] Literal
   b. [CO] Conventional
   c. [BO] Both

2. [CV] Caregiver Violation
   Form of violation*:
   a. [LI] Literal
   b. [CO] Conventional
   c. [BO] Both

Child codes.

1. Child response*
   a. [un] unaware (oblivious)
   b. [aw] aware, but not responding to bid/violation
   c. [ac] accept
   d. [re] reject

2. Specific behaviors
   • Vocal behaviors
     a. [ve] verbalization
        i. complex
        ii. basic
     b. [vo] vocalization
   • Gestures
     a. [po] point
     b. [pal] palm
     c. [pal-ex] palm extend (gloss: give it to me)
     d. [hu] hold up
     e. [ho] hold out (gloss: take [the object])
     f. [hs-yes] head shake yes
     g. [hs-no] head shake no
   • Object manipulation
     a. [gr] grab
     b. [to] touch/hold
     c. [pu] push away/ throw
     d. [us] use partner as a tool
C. Definitions.

DESCRIPTION OF THE SCENES

“Take Turns” scene:

Games can be characterized as “the mutual involvement of two players who develop and repeat game roles and alternate turns as they play” (Ross & Lollis, 1987, p. 241). This study will look at archival video recordings of Adamson & Bakeman’s Communication Play Protocol (CPP) of infants aged 18 and 30 months interacting with their primary caregiver. The CPP is designed to facilitate parent-child communication during six 5-minute long scenes in which the child plays the role of the star of the interaction and the parent plays the role of the supporting actor (Adamson & Bakeman, 1998). Games will occur spontaneously between the parent and child during a five-minute “Take Turns” scene in which a researcher provides the dyad with toys that lend themselves to turn-taking interactions, such as a ball, a busy box, or a stackable ring toy. In this scene, the parent receives a cue card stating that the plot of the scene is to “engage in a back-and-forth game of turn-taking” (Adamson & Bakeman, 1998). The card also suggests that the parent tease the child by pausing before taking some of his or her (the parent’s) turns.

“I Want scene”:

For the purpose of this study, coders will also watch the five-minute “I Want” scene, which is designed to facilitate child requesting. In this scene, the researcher places three toys on a shelf that is above the child’s reach but is easily accessible to the caregiver. Two toys are provided by the researcher, and the third is one of the child’s preferred toys from home. The caregiver receives a cue card at the beginning of the scene which instructs the parent to help the child to get the toy she wants, “but only after you pretend to misunderstand her desires” (Adamson & Bakeman, 1998). The cue card further suggests that the parent agree to help the child, but then pretend to be puzzled about which toy the child wants and make mistakes, offering the child the wrong toy. Finally, the cue card suggests that the parent retrieve the correct toy.

We are interested in coding “requesting episodes” in which the child and the caregiver are jointly focused on requesting toys on the playroom shelf. A requesting episode is considered
to have begun when the caregiver either bids for the child’s attention to the shelf/toys on the shelf, or the caregiver violates the child’s request. A requesting episode is considered to have ended when the caregiver gives the child the toy that the child has requested. The number of requesting episodes may vary considerably by from scene to scene; some scenes may contain no requesting episodes, whereas others may contain several that last the duration of the scene.

Please frame your coding around the caregiver’s initial communicative act. For example, the first part of coding will be to decide if the caregiver has committed an anticipated communicative act, such as a bid or a violation of communication, which is accomplished in the first round of coding. The second part of the coder’s task is to characterize the child’s response to either of these two forms of communication, which is accomplished in the second round of coding. As the child’s response is contingent on the caregiver’s initial communication, the coder must describe the caregiver communication and then describe the child response.

CAREGIVER CODES

1. Caregiver Bids [CB]

In the “Take Turns” scene, a caregiver bid for turn-taking [CB] is an attempt by the caregiver to initiate a turn-taking game. Additionally, a caregiver bid may be coded when the caregiver attempts to sustain and/or elaborate an ongoing communicative interaction. For example, if the child rolled the caregiver the ball and the caregiver rolled, bounced, or threw it back, this would be considered a caregiver bid to sustain the turn-taking interaction [CB].

In the “I Want” scene, the caregiver may bid for the child to attend to the shelf or to attend to the toys on the shelf. Some examples of caregiver bids to the shelf/toys on the shelf include asking the child which toy he wants while he is playing with the puzzle, asking “Do you want the ___?” If the child is looking at the shelf and has not yet requested, the caregiver may ask “What do you want?” or “Which one do you want?” These would also be considered caregiver bids for the child to attend to the shelf.

At times it may be difficult to decipher when one caregiver bid ends and another caregiver bid begins. In general, a bid is considered to be distinct if it fits at least one of the following three criteria: it stands alone in time (i.e., it is separated by 3 seconds from the previous bid), it takes on a new form, or it draws the child’s attention to a new focus. There may be occasional exceptions to these three general rules; for example, if there is only 2 seconds between caregiver bids but the coder feels that this pause was meaningful, the coder may make an exception and code two sets of caregiver bids and child responses. When in doubt, use the transcripts of the play session as a guide. Each line on the transcript constitutes a distinctive utterance.

If a caregiver bid [CB] is selected, INTERACT will prompt the coder to select the form of the caregiver bid. The coder must select the form of the caregiver bid before coding the child’s response to the caregiver bid [CB] for turn-taking or requesting.

Form of the caregiver bid: *

* Denotes mutually exclusive codes.

Caregiver bids are classified into three different forms. These forms include literal [LI], conventional [CO], or both [BO]. A caregiver bid is considered literal [LI] if it highlights some
part of the environment to make it more perceptually salient. Examples of literal forms of
caregiver bids may include tapping on a busy box noisily to indicate that the child take a turn,
moving the child directly in front of the ball tower or moving the shape sorter directly in front of
the child to get the child’s attention, or pulling a toy down from the shelf and shaking it near the
child’s face. When deciding if a caregiver bid has a literal [LI] aspect, the coder may ask
him/herself, would the child be able to “get the message” that the parent is trying to convey
without any understanding of conventional forms of communication within our culture, such as
language use, pointing, or other conventional gestures (i.e., the caregiver opens her palms
upwards and shrugs her shoulders to indicate, “I don’t know”). Positioning or repositioning the
child in front of a toy in order to make it more perceptually salient to the child also counts as a
literal aspect of the bid/violation. A caregiver bid may be classified as conventional [CO] if only
conventional forms of communication, such as language or pointing, are used to direct the
child’s attention. For example, a caregiver stating “Charlie, let’s take turns with the ball” without
making any part of the environment more perceptually salient would be considered a
conventional [CO] bid. In contrast, the caregiver stating “Charlie, let’s take turns with the ball”
and immediately shaking the ball in front of the child’s face would be both literal and
conventional [BO]. In order for a bid to be classified as both literal and conventional [BO], the
literal and conventional aspects of the bid must occur within three seconds of one another.

2. Caregiver Violations [MV]

Form of the caregiver violation:*

Caregiver violation can take on one of the same three mutually exclusive forms as a
caregiver bid. Coders must characterize the form of the violation as either literal [LI],
conventional [CO], or both [BO].

CHILD CODES

1. Child response*

- Mutually exclusive codes. There are four mutually exclusive codes: unaware [un],
  aware but not responding [aw], aware and accepting [ac], and aware and rejecting [re].
- Please see Figure 3 at the end of the description of these codes for a hierarchical
  representation of how to choose between these four codes.

The coder’s first task will be to determine if the child was either unaware [un], or aware,
of the bid or violation. A child will be coded unaware [un] when the child seems completely
oblivious to the adult’s bid or violation. If the child was aware of the caregiver bid or violation,
he showed acknowledgement that communication occurred (i.e. a shift of gaze or turning his
head when mom speaks.) The child does not have to be actively engaged in the situation to be
considered aware [aw] to the caregiver communication. For example, a caregiver could saying
“my turn” and taking her turn with the shape sorter while the child sits and watches her would be
considered an aware response. If in doubt if the child was aware or unaware of the caregiver
communication, code conservatively and choose the unaware code.
If the child was aware of the caregiver’s communication, the coder must decide if the child was aware, **but not responding** to the caregiver’s communication [aw], or if the child responded to the communication by accepting [ac] or rejecting [re] the caregiver communication. If the child ACTIVELY responds to the caregiver bid or violation, he may either accept [ac] or reject [re] the violation. Acceptance and rejection of a caregiver violation must be very CLEAR and STRONG. Also, if it is difficult to tell whether the child has accepted or rejected the caregiver bid, pay close attention to the context surrounding the bid/violation. Has the child seemed to be wary of the caregiver action up until the bid, or has he been anticipating the caregiver’s question? Even so much as a CLEARLY negative vocalization in response to a caregiver’s question is enough to code the child’s response as rejecting the bid. Keep in mind that we only want to characterize child responses when we can ascribe intentionality to the child’s response. That is to say, we want to only characterize child responses as accepting or rejecting when we are certain that the child **meant** to either accept or reject the caregiver bid. For example, we want only to code accept when the child is explicitly doing what the caregiver requested of him or her. We want to only code reject when we are certain that the child is intentionally refusing the caregiver’s bid or violation.

When the child accepts the caregiver bid or violation [ac], he usually does the action that the caregiver has requested of him. For example, if the caregiver says “it’s your turn” and the child takes his turn, then he has clearly accepted the caregiver bid for turn-taking. Another similar example would be if the caregiver asks the child “what do you want?” while indicating the shelf and the child points to a specific toy on the shelf. On rare occasions, the caregiver may offer the child a toy and the child takes the toy but does not do the action that the caregiver requests because he does not have time before her next utterance. For example, if the caregiver hands the child the ball and says “it’s your turn!” and the child takes the ball, but does not get a chance to throw it before the caregiver says “throw”, we would still consider this as accepting the caregiver bid because he took the toy that was offered to him. In the instance that there is a short amount of time in which the child responded, but he did respond, we can count this as either an acceptance or rejection of the caregiver’s communication (either the bid or the violation). Again, these instances may be rare.
2. Definitions of specific behaviors

After the coder has selected if the child either accepted [ac] or rejected [re] the caregiver bid/violation, he will be prompted to select which behaviors the child exhibited during his response.

1.) Vocal*

- Mutually exclusive codes

[vo] – vocalization. A vocalization refers to a sound that the child emits that does not have a conventional meaning; i.e., it is not a word. Examples of vocalizations include “bah,” “ahh,” “mmm” and noises such as these. Gestational noises such as burps, hiccups or yawns are not classified as vocalizations, and neither is crying (without any vocalizations, i.e., the child is silently crying). However, whining or a whining noise may be considered a vocalization, and as well as a scream that the coder feels was used in a communicative manner.

[ve] – verbalization. The verbalization code is used for any form of symbol use. Thus, a code of [ve] can be used for conventionally recognized words OR sign language.

- If the child used a verbalization to respond to the parent, the coder must select whether or not the child’s response was “complex” or “basic.” A “complex” response means that it is a well-formulated, well-articulated, and relatively grammatically complex verbalization, for example, “I don’t want that toy.” A “basic” verbalization is not well-formulated, well-articulated, or grammatically complex. A basic verbalization may consist of either one or two words or two-word that are not used in a syntactically complex manner, i.e., “me want,” or “ball.”

It is important to STICK AS CLOSELY AS POSSIBLE TO THE TRANSCRIPT when coding vocalizations/verbalizations. Make sure you are matching the child’s vocal/verbal response to the correct bid/violation (again, this requires paying close attention to the transcript).
Even if you heard no intelligible words but the child’s speech is transcribed as words on the transcript, count it as a verbalization. If the child’s speech was very unintelligible, stick with a basic verbalization as opposed to complex, even if the transcript says “I want that toy.” However, if “I want that toy” was clearly stated, it would be a complex verbalization. A main issue arises is when the child has a string of unintelligible utterances with one or two words in the mix. So, even if you heard no intelligible words, if the transcript states “xx toy xx”, count this as a verbalization.

2.) Gestures

- NOT mutually exclusive.

[\textit{po}] - point/point-extend. “Point” describes a gesture in which the child extends his or her index finger to indicate an object. “Point-extend” describes a gesture in which the child extends his or her index finger to indicate an object while simultaneously extending his or her arm. As these two deictic gestures are used for the same purpose, to indicate the object to the parent, we use the same code for both gestures. The gesture type category for this code is deictic point.

This code can be tricky because young children’s points sometimes are not a fully-extended index finger. However, if the index finger is even somewhat more extended than the other fingers, count this as a point, not palm or palm-extend. If the child distinctly switches between a point and palm or palm-extend, code both.

[\textit{pal}] – palm. In the palm gesture the child holds his palm flat in the direction of the object. The palm can be facing either upwards or downwards. Similar to the “point” code, we interpret this gesture as a deictic gesture to indicate the object to the parent. The gesture type category for this code is deictic palm.

[\textit{pal-ex}] – palm extend. Palm-extend describes a reach towards an object with the palm facing either upwards or downwards. We ascribe the child’s intentionality of the “palm-extend” gesture as a request. Most often, to distinguish between a “palm” code, which indicates that the child is indicating the object to the parent, versus a “palm-extend” code, which indicates that the child is requesting the object, there must be some emphatic aspect to the “palm-extend” gesture. For example, the child not only opens his palm upwards or downwards and extends it towards the object, but he also vocalizes emphatically to indicate that he wants the parent to give him the object. Another example is if the child emphatically reaches towards the toy, opening and closing his palm as if to say, “give it to me.” Again, we use “give” as a gloss for the meaning of this code, as the child desires the parent to give him the indicated object.

It is important to remember that we can ascribe intentional communication to all gestures. Therefore, if the child is reaching towards a toy so the caregiver sees that the child wants the toy, code palm-extend. However, if the child is reaching towards the toy just so he or she can touch it or grab it, it is NOT considered a communicative gesture (rather, it is an object-regulating gesture.) So, if the child’s reach ends in a touch/hold or grab and there was no separate, distinct palm-extend, DO NOT code palm-extend.

[\textit{hu}] – hold up/show, a gesture in which the child holds up an object in order to show the parent the object. The gesture type category for this code is deictic show.

[\textit{ho}] – hold out/take, a gesture in which the child holds out the object to the parent, in order for the parent to take the object from the child. The gloss for the meaning of this code is “take [the object].”
[hs – yes] – Distinct head shaking up and down in a conventionalized manner.
[hs – no] – Distinct head shaking from side to side in a conventionalized manner. Do not code abrupt head turns away from the partner that seem to indicate a refusal in a literal, non-conventional way.

Point, palm, palm extend, hold up, hold out, and head shake yes/no gestures are all COMMUNICATIVE gestures; that is, they are used to communicate some message to the communicative partner.

3.) Object Manipulation [ObMan]
- Mutually exclusive codes.
- These codes are used to indicate that the child has manipulated the object (or their caregiver as an object) in some way.
[to] – touches/holds the object. The child physically touches or holds an object relevant to the turn-taking or requesting interaction.
[gr] – grabs the object. The child grabs an object that is relevant to the turn-taking or requesting interaction. The distinction between touching/holding [to] an object and grabbing [gr] an object is that touching/holding the object [to] merely indicates that the child had contact with the object of the dyad’s focus. When a child grabs the object, he/she is touching the object; however, there is an added element of the child ACTIVELY attempting to possess an object that is REGULATED by the caregiver (i.e., the object is in the caregiver’s hands, or on the shelf where the child would not have access to it unless the caregiver is holding him/her). We should get the message that the child is intentionally trying to take hold of the object for his or her possession, as if to say to the caregiver, “it’s mine.” One common instance in which a coder might have to make the distinction between touch/hold [to] and grab [gr] is when a parent hands a child a toy from the shelf. If the hand-off of the object from the caregiver to child went rather smoothly, and the child merely took the object the caregiver offered and began to play with it, this would be coded as touch/hold [to]. However, if the child snatched the object from the caregiver as soon as it was offered, this would be coded as grab [gr]. A coder may get the feeling that the child is actively snatching or seizing the object from the parent when coding grab [gr].
[pu] – push away/throw the object. The child either pushes away the object or throws the object that the caregiver has offered to him/her, as a form of rejecting the object. However, if the child throws the object to the caregiver in the context of a turn-taking game (for example, if the caregiver and child are rolling or throwing the ball back-and-forth to one another) this would not be coded as push away/throw the object [pu], this would be coded as touch/hold the object [to]. The key to the push away/throw the object code is that the coder must feel that the child is doing this action as a form of rejection of the object.
[us] – uses the caregiver as a tool. This occurs when the child attempts to manipulate the caregiver’s body part to obtain some goal that the child cannot get on his or her own. For example, the child may bring the parent’s hand towards an object or place the parent’s hand on top of an object in order to perform an action that he or she is not capable of. Climbing up the parent’s body to reach an object is also a form of using the caregiver as a tool.
4.) Gaze*
   - Mutually exclusive codes
     [ec] – eye contact. The child looks at the caregiver’s eyes. Be conservative when coding eye contact. Always make sure that you can see the child’s eyes orienting towards the caregiver’s eyes. See if you can pause the tape on the exact moment when they share eye contact, and note that time. Make sure nothing is occluding the mom’s face, including a toy held close to her face, her hair, etc. Also, if the tape is extremely grainy and it is nearly impossible to see the child’s eyes, do not code eye contact.
     [al] – alternating gaze. The child may alternate gaze between the parent and the toy, or the parent and another object in the room; to be considered an alternating gaze, the child must look at least twice at the parent.

5.) Turns*
   - These codes are mutually exclusive, and ONLY OCCUR DURING THE TURNS SCENE.
     [ot] – own turn. For example, if the child places a shape in the shape sorter, the caregiver pauses with a shape in her hand above the shape sorter, and then the child picks up another toy and places it in the shape sorter, this would be considered repeating her own turn. This code is specific to the “Take Turns” scene. An unsuccessful attempt on the part of the child to take his own turn should also be coded as “own turn,” as it is really the intention behind the action that counts.
     [at] – take the adult’s turn. In the above scenario, imagine that the child pushes the parents hand down toward the shape sorter, causing the shape the parent was holding to fall into the sorter. This would be considered taking the adult’s turn, because the child performed the action that was specific to the adult in this case. This code is specific to the “Take Turns” scene. To code adult turn, we need to have the sense that the child has some understanding of the turn-taking game, and their role vs. the adult’s role in the game.

3. Child affect*
   - Mutually exclusive codes.
     The child may display one of four mutually exclusive affective reactions to the caregiver bid/violation. These reactions include positive affect [pos], negative affect [neg], both positive and negative affect [both], and neutral affect [nil].
     
     [neg] negative emotional reaction. Examples of negative emotional reactions include the child spending the majority of violation episode screaming or crying, a sad expression, whining, grimacing, or frustration on the part of the child. When in doubt if an expression was negative or neutral, opt for the more conservative code (in this case, neutral).
     
     [pos] positive emotional reaction. The child seems to be amused, as evidenced by a smile or a giggle. The coder would also mark positive affect if a child laughs, giggles, or screams in delight at the caregiver communication. Again, when in doubt if an expression was positive or neutral, opt for the more conservative code.
     
     [both] both positive and negative emotional reaction. This indicates a “mixed” emotional reaction, in which the child displayed some evidence of both a positive or negative reaction
during the caregiver communication. For example, in response to a caregiver violation in the “I Want” scene, the observer would code [both] if the child initially smiled at the caregiver to get her attention, but then screamed when the caregiver would not give her the correct toy.

[nil] No positive or negative child affect. This signifies that the child’s affect was neutral during the caregiver communication episode. If in doubt of slight positive or negative emotional reactions to the caregiver communication (i.e. a slight smile or frown that is not easily discernible), neutral [nil] is the most appropriate code to select.