CONVERSATIONS BETWEEN FRIENDS: AGE AND CONTEXT DIFFERENCES IN THE DEVELOPMENT OF NONVERBAL COMMUNICATION IN PREADOLESCENCE

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Adults communicate using a variety of nonverbal behaviors, but not all of these behaviors are commonly used by children. When do children transition to using nonverbal means to communicate more like adults? Though there is some evidence such change occurs during the preadolescent period, no single study has examined change in the use of nonverbal behaviors across this age range. Further, though the peer context is increasingly important to the developing preadolescent, conversations with friends have been largely overlooked as a context for children's developing nonverbal communication. This study aimed to address these gaps in the literature by providing a descriptive picture of children's use of three nonverbal behaviors, gesture, eye gaze, and facial expressions, during dyadic interaction with a friend. Particular emphasis was placed on the use of behaviors that are typical of adult conversation, such as abstract gestures and looking at a partner while the partner is speaking. Thirty-three children were observed interacting with a same-sex peer in two settings (planning an event and sharing a snack) longitudinally in 4th and 6th grade. The production of children's gesture, gaze, and facial expressions was recorded. Results indicated that use of the majority of communicative behaviors, particularly those behaviors that are common in adult interactions, increased across the preadolescent period. However, there were context effects, such that different patterns of developmental change emerged in planning and conversation settings. These findings suggest

that, though communication is sensitive to changing contexts, preadolescent children produce behaviors typical of adult interactions with increasing frequency by the end of this period. Much like other systems, then, the nonverbal system appears to change during preadolescence.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

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1.0 INTRODUCTION

Adults' communication is rich and nuanced, occurring simultaneously through multiple channels that are integrated into a communicative whole. For example, adults are adept and conveying messages through several behaviors concurrently, such as smiling, nodding, and providing direct gaze to communicate listening. Though there is a substantial body of literature pointing to the importance of nonverbal communication in adult interactions (e.g., Kendon, 1967; Kendon, 1997; McNeill, 1992; Mehrabian & Ferris, 1967; Mehrabian & Weiner, 1967), nonverbal behaviors have generally been understudied in childhood past the period in which language emerges. The period right before adolescence, the preadolescent period (roughly ages 10 to 12), has been particularly overlooked. The few studies that have investigated children's use of nonverbal communication suggest that at some point during the preadolescent period, children use nonverbal behaviors typical of adult interactions with more regular frequency (e.g., Levine & Sutton-Smith, 1973; McNeill, 1992). However, no data documenting the nature and timing of this change are currently available. There is also evidence that children begin to spend more time with peers than with caregivers during the preadolescent period (e.g., Larson & Richards, 1991; Savin-Williams & Berndt, 1990), suggesting that peers are preadolescent children's most salient interactive partners. However, the existing literature has generally focused the production of communication in the context of narratives presented to an adult partner (e.g., McNeill, 1992) or while engaging in problem solving (e.g., Goldin-Meadow, Wagner Cook, & Mitchell, 2009) and has not examined children's production of communication during peer interactions. In light of evidence that children communicate differently with an adult versus a peer partner (e.g., Aiello & Aiello, 1974; Ashear & Snortum, 1971; Burgess & McMurphy, 1982; Harris, 1968; Levine & Sutton-Smith, 1973), it is particularly important to extend the current literature to the peer context.

The overarching goal of this research is to describe preadolescent children's production of nonverbal communication during dyadic peer interactions. To this end, the following literature review describes three of the most thoroughly studied nonverbal behaviors in adult interactions (gestures, eye gaze, and facial expressions) as an end point for development. These behaviors are discussed with reference to what is known about their development in childhood with special attention paid to the preadolescent period. Following this review, I briefly review other documented transitions during the preadolescent period (e.g., Elkind, 1967; Piaget & Inhelder, 1977; Savin-Williams & Berndt, 1990).

1.1 NONVERBAL COMMUNICATION

1.1.1 Gesture

One of the most extensively studied components of nonverbal communication is gesture, the hand and arm movements made when people speak (McNeill, 1992). Though gestures are physical actions, they function as communicative acts (e.g., Alibali, Health, & Meyers, 2001; Beattie & Shovelton, 2000; Jacobs & Garnham, 2007). Their communicative functions include conveying meaning, depicting events, representing ideas, and specifying, clarifying, or supplementing the spoken message (Bavelas, Chovil, Lawrie, & Wade, 1992). In interactions, gestures can extend beyond communication by helping regulate attention and conveying understanding or interpretations of others' ideas (Goodwin & Goodwin, 1986). Several studies have documented that the gesture system is intrinsically linked with speech from an early age (Iverson & Goldin-Meadow, 2005; Iverson & Thelen, 1999; Kelly, Barr, Church, & Lynch, 2002; Özçalışkan & Goldin-Meadow, 2005), further solidifying its role as an integral part of the overarching communicative system. There are four types of gestures that are commonly observed in communicative interactions: deictics, iconics, metaphorics, and beats[1] (McNeill, 1992).

Deictic gestures convey spatial information and are typically used to indicate persons, places, objects, or directions. They usually accompany speech, but can also be used in place of speech (e.g., simply pointing in response to a question rather than providing a verbal response). In adulthood, deictic gestures consist primarily of pointing. Pointing can be concrete (e.g., pointing to an interesting sight to draw attention to it; pointing to indicate spatial information), or abstract (e.g., pointing to an empty chair in reference to a person who previously occupied it). Most adult points are abstract in nature (e.g., McNeill, 1992).

Though deictic gestures emerge early in life (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Crais, Douglas, & Campbell, 2004; Iverson, Capirci, & Caselli, 1994; Iverson & Thal, 1998), early deictics are quite simple and concrete. Examples of common forms of early deictics include pointing to a desired sippy cup or showing a favorite toy to a caregiver. In direct contrast to concrete pointing, which is typically among the first gestures to develop, abstract

[1] A final type of gesture, emblems, is not discussed as they are fundamentally different from the other four gesture types presented here (for further information, see McNeill, 1992).

pointing is one of the last gestures to emerge, appearing at roughly 5 years (McNeill, 1992). However, aside from the age of emergence of these gestures, little is known about the frequency of their use.

Iconic gestures give a pictorial representation of a referent, providing information about movement, shape, action, or some other feature expressed in speech. For example, if a communicator were verbally describing a person running, the description might be accompanied by an iconic gesture consisting of a downward facing hand that alternately moves extended index and middle fingers while pushing the hand forward, like moving legs.

Iconic gestures, much like deictic gestures, emerge early in life (Acredolo & Goodwyn, 1988; Iverson & Goldin-Meadow, 2005; Iverson & Thal, 1998; McNeill, 1992; Nicoladis, 2002). As with deictic gestures, early iconic gestures are quite different from their adult counterparts in that they are often used in the absence of speech (McNeill, 1992). However, as the vocal modality begins to dominate, these gestures become synchronized with speech and become increasingly complex (Iverson et al., 1994; McNeill, 1992).

The final two types of gesture, metaphorics and beats, are more complex than concrete deictics or iconics and exhibit similar developmental courses. Metaphoric gestures, so named because they serve as a metaphor for the spoken referent, are similar to iconics as they are pictorial but are more abstract in nature. Further, the movements and shape of the hand do not directly relate to the spoken message but rather a presentation of an abstract idea. A common manifestation of a metaphoric gesture is presenting an idea to the addressee as a bounded entity. For example, a communicator who extends her hands as if holding an object while talking about an abstract idea (such as an opinion) is gesturing metaphorically by presenting the idea in the "container" of the two hands.

Beats differ substantially from other gestures in several ways: (a) they do not conceptually tie to the spoken message and appear to have no meaning; (b) they tend to manifest in the same form, as rapid, rhythmic flicks of the hand; and (c) they tend to happen wherever the communicator's hands are, not in the typical gesture space.[2] Beats also set up important parts of the spoken message, highlighting them for the addressee. An example of a common use of beat gestures in conversation is marking the introduction of a new person in a story (saying "and then, my brother," flicking the hand with the introduction of the brother; McNeill, 1992). A subcategory of beats, interactive gestures, relates to elements of the interaction itself. Interactive beats can directly relate to the literal meaning of speech (e.g., a flick of the hand toward the other person while saying "you know") or they can also appear to have no link at all (e.g., referencing an idea proposed by another person by flicking the hand toward that person; Bavelas et al., 1992).

Metaphorics and beats appear later in childhood, typically emerging at around 5 years of age, and appear to reach adult production levels by around age 11 (McNeill, 1992). Thus, there is some suggestion that abstract forms of gesture (abstract points, metaphorics, and beats), forms used in adult conversation, are used by children in a similar fashion to adults by about age 11. It is important to note, however, that a limitation in the field of gesture development is the general lack of empirical work assessing gesture in middle childhood and the preadolescent period. Specifically, little is known about typical patterns of gesture production or the most commonly

[2] In adults, other types of gestures generally occur in a "shallow disc" in front of the communicator that is truncated on the bottom when seated. Beats, however, are not contained to this gesture space (McNeill, 1992, p. 86).

produced gesture types during this period. In addition, in most previous investigations, children's gesture production has been assessed while completing a task (e.g., Piagetian conservation or while solving math problems; e.g., Iverson, 1999; Goldin-Meadow et al., 2009). Therefore, how children produce gestures, particularly abstract gestures, in conversations with a same-aged peer remains unclear.

1.1.2 Eye gaze

Eye gaze (looking at another's face or eyes) and gaze aversion (the intentional deflection of another's gaze or the refusal to make eye contact) are fundamental components of interactions. Though typically outside of conscious awareness (e.g., Kleinke, 1986), eye gaze plays an integral role in facilitating and maintaining interactions by signaling interaction openness, providing turn-taking cues, gathering feedback, and regulating the flow of conversation (Argyle & Dean, 1965; Ellsworth & Ludwig, 1972; Kendon, 1967; Kleinke, 1986; McCarthy, Lee, Itakura, & Muir, 2006). Gaze can also communicate persuasion, deception, ingratiation, and threats, and it simultaneously provides a quick glimpse into another's social skills, credibility, competence, emotions, and even mental state (Kleinke, 1986; McCarthy et al., 2006). For the communicator, receiving gaze from the addressee is a critical component of face-to-face communication. Without gaze, it appears that the addressee is not listening (Argyle & Dean, 1965). In fact, in the face of distracted or unresponsive addressees, communicators tend to have great difficulty finishing thoughts and stories (Bavelas, Coates, & Johnson, 2002).

Despite its several functions, gaze adheres to a precise form in interactions. Most gazes occur while listening rather than speaking (Argyle & Dean, 1965). The average gaze length is between 3 and 10 seconds, with gazes longer than 10 seconds seeming unusual in dyadic social interactions (however, variables such as proximity can influence typical gaze length; Argyle & Dean, 1965). In general, bouts of longer gaze (up to the point of social norms) are seen as more favorable than shorter bouts (Argyle, Lefebvre, & Cook, 1974; Ellsworth & Ludwig, 1972). However, communicative partners must strive for a "gaze equilibrium;" too little, excessive, or context-inappropriate gaze can induce anxiety in communicative partners (Argyle & Dean, 1965; Ellsworth & Ludwig, 1972).

Kendon (1967) provided detailed descriptions of gaze patterns in dyadic interactions. In his study, previously unacquainted dyads were instructed to get to know one another over a 30 minute period. Though there was extreme variability among dyads in the amount of time that communicators spent looking at addressees (*range* = 28-70%), the following general patterns of gaze were observed. Communicators looked away from addressees as they began utterances lasting longer than 5 seconds. At the end of these utterances, communicators tended to look back at addressees and hold their gaze. This shift indicated to addressees that the floor had been relinquished to them. In general, communicators spent less than 50% of the turn looking at addressees, whereas addressees generally spent more than 50% of the turn looking at communicators. Communicators also tended to alternate between gazes at addressees and gazes elsewhere, with gazes elsewhere being longer than gazes at addressees. When communicators did gaze at addressees, these gazes were more likely to occur during silences than during speech. In contrast to the patterns of communicators' gazing, patterns exhibited by addressees were generally characterized by looks to communicators for long periods of time that were broken up by short glances elsewhere. Therefore, a common manifestation of gazing in adult conversation is looking while listening.

Despite the wealth of information about gazing in adult interactions, investigations of developing gazing patterns in children's interactions remain limited. The few existing studies have indicated that patterns of gaze in young children are different from those observed in typical adult interactions. In addition, children's gaze patterns vary when the interactive partner is an adult versus a peer. With adult partners, preschool-age children look proportionately longer at their communicative partner than do children in middle childhood, suggesting that gaze to adult partners *decreases* across childhood (Harris, 1968). By age 11, gaze patterns with adults begin to stabilize and reach adult norms (Ashear & Snortum, 1971). In contrast, gaze duration with a child partner tends to *increase* across development but also reaches adult levels at about age 11 (Levine & Sutton-Smith, 1973). However, aside from time spent gazing at a partner, relatively little is known about typical gazing patterns in children's interactions and how this might change over the preadolescent period. And although one of the hallmarks of adult gazing is looking at a partner while listening, no studies have investigated whether frequencies of gazing while listening changes across the preadolescent period.

1.1.3 Facial expressions

Facial expressions, which have been extensively studied over several decades, are highly communicative with and without speech (Chovil, 1991/1992). For example, degrees of certainty, understanding, agreement, beliefs, and emotions can all be communicated via facial expressions (Manusov & Trees, 2002). Facial expressions of emotion are the best known manifestations of facial expressions.

Individuals from a wide range of cultural backgrounds agree about the emotions that specific facial expressions represent (Ekman et al., 1987). For both children and adults, six facial expressions are universally associated with emotions and are recognized as displaying those emotions: happiness, sadness, anger, surprise, fear, and disgust (Ekman & Friesen, 1971; Ekman et al., 1987; Izard, 1994; Kohler et al., 2004). Facial expressions of emotion have prototypical forms, but there is considerable flexibility in how they can be expressed (Shaver, Schwartz, Kirson, and O'Connor, 1987). For example, Ekman (1993) has identified over 60 types of anger, none of which can be placed in any other emotional category. Making emotional facial expressions even more complex, a single display can show more than one emotion (Ekman et al., 1987). For example, a parent whose child has run into the street but has been safely returned to the curb might simultaneously express anger and relief when disciplining the child.

As with other nonverbal behaviors, facial expressions of emotion emerge quite early in life (Campos, Thein, & Owen, 2003; Jones, Collins, & Hong, 1991). For example, smiling has been documented to appear as early as early as 3 weeks (Sroufe & Waters, 1976). However, it is not until 5 years of age that children have voluntary control over their emotional facial expressions (Lewis, Sullivan, & Vasen, 1987).

Though displaying emotional expressions is a task that is mastered very early in life, children must learn the complex rules that outline facial expression use in conversation. For example, masking felt emotions or conveying an unfelt emotion are complex skills that are critical in interactions (e.g., Ekman, 1993; Kohler et al., 2004). Though children's understanding of the use of display rules such as masking increases from ages 6 to 10 years (Gnepp & Hess, 1986), it is not until 10 years of age that children appear to understand situations in which they would need to mask an emotional facial expression (Saarni, 1979). Therefore, although children display emotional facial expressions from a very early age, it is not until about 10 years that producing emotional facial expressions according to cultural display rules is mastered.

As is evident from the preceding discussion, the vast majority of investigations of facial expressions have focused on expressions of emotion (Chovil, 1991/1992) and their interpretation by viewers (e.g., Ekman & Friesen, 1971). However, this approach does not fully capture the ways in which facial expressions are utilized in conversation (Parkinson, 2005). To date, the only empirical study investigating conversational facial expressions did not specifically describe emotional expressions and their typical patterns in interaction (Chovil, 1991/1992). Further, there is no published work on typical patterns of facial expressions, either emotional or unemotional, in children's interactions. Therefore, two primary questions remain. When children are engaged in a conversation with a peer, do they typically produce emotional facial expressions, and if so, what facial expressions are commonly employed?

In summary, nonverbal behaviors are critical to interactions and play a central role in adults' communication. While there is some evidence that children begin to use nonverbal behaviors, specifically gestures, eye gaze, and facial expressions, in an adult-like manner sometime between the ages of 10-12 years (e.g., McNeill, 1992; Saarni, 1979), the existing literature is limited in two ways. First, though the literature on nonverbal communication in adults is quite rich, research on nonverbal communication in the preadolescent period, particularly in naturalistic, dyadic conversations, remains limited. Second, the individual behaviors described above are typically studied in isolation, yet this stands in contrast to how they actually occur in interactions: as a dynamic, integrated whole. How children combine verbal and nonverbal behaviors during the preadolescent period to communicate is therefore unclear. These limitations point to the need for a more comprehensive investigation of nonverbal communication in children between the ages of 10 and 12 years.

1.2 A TIME OF CHANGE: THE PREADOLESCENT PERIOD

The changes characteristic of the preadolescent period are not limited to the changes suggested above in nonverbal communication; it is well established that the preadolescent period is a time of transition in other domains. For example, preadolescent children are transitioning to increasingly abstract thought (e.g., Piaget & Inhelder, 1977), more self-conscious thinking (e.g., Elkind, 1967), and improving perspective-taking (e.g., Laursen & Pursell, 2009). Important changes also occur in the social domain, as preadolescent children begin to spend increasing amounts of time with peers (e.g., Brown & Dietz, 2009; Larson & Richards, 1991; Savin-Williams & Berndt, 1990) and place greater value on their friendships (Bukowski, Motzoi, & Meyer, 2009). Not only are preadolescent children spending more time with peers and valuing their friendships more, what they are doing while with their friends changes as well. By the end of preadolescence, children spend more time engaging in conversation when with friends than earlier in childhood, and these conversations more closely resemble the interactions of adults and older adolescents (e.g., Raffaelli & Duckett, 1989).

Thus, compared to the play activities that are dominant earlier in childhood (Larson & Richards, 1989; Raffaelli & Duckett, 1989), it is clear that the preadolescent period brings a shift from child-like to more adult-like conversations with peers. During preadolescence, therefore, children must learn the nuances of carrying on a conversation (e.g., de Villiers & de Villiers, 1978). In the preadolescent period, friendships and engaging in conversations with friends become increasingly salient contexts for the developing child.

1.3 THE PRESENT STUDY

Despite the importance of the peer context during preadolescence, no single study has documented preadolescent transitions in nonverbal communication by examining the use of multiple nonverbal behaviors in dyadic friendship interactions. The primary goal of this research, therefore, is to describe the development of nonverbal behaviors between ages 10 and 12 years and to further our understanding of the transition to more adult-like communication. The study was designed to address the following questions:

(1) How do preadolescent children produce gesture, gaze, and facial expressions during communicative interaction with a peer, and does this change developmentally?

(2) Are individual differences in rates of production consistent for the various communicative behaviors, and are any such individual differences stable over time?

(3) How do preadolescent children use multiple communicative behaviors simultaneously, and does this change developmentally?

(4) Is adult perception of preadolescent children's communicative ability (both overall ability and the appropriateness of nonverbal use) related to communication production?

2.0 METHOD

2.1 PARTICIPANTS

Participants were selected from a longitudinal, multi-site study of child development, the NICHD Study of Early Child Care (study details are available at http://secc.rti.org). Children who participated in this study were born between 1990 and 1991 and were recruited from birth and followed through age 15. Families were included in the study if (1) mothers were at least 18 years of age; (2) mothers spoke English; (3) the family had no plans to move away from the study area; (4) children had been single births (i.e., were not multiples); (5) the child had no obvious illness or disability at birth; and (6) the mother had no current history of substance abuse. The initial sample included 1,364 families at the first visit (at infant age 1 month); 24% were ethnic minorities and 89% of mothers had at least a high school degree.

One hundred twenty-three children participated in the study at one site, a major mid-Atlantic city in 4^{th} or 6^{th} grade. Every effort was made to select a demographically homogeneous sample (see below for exclusion criteria). The final sample for the present study included 33 children seen at 4^{th} and 6^{th} grades. In 4^{th} grade, the average age was 10 years 0 months (*range* = 9 years 3 months - 11 years 0 months); the average age in 6^{th} grade was 12 years 1 month (*range* = 11 years 7 months - 12 years 10 months). At each age, participants visited the laboratory with a close, same-aged friend. Friends were matched to study children on gender and age (+/- 2 years).

The children had to have known one another for a minimum of 6 weeks and see one another at least once a week. Friends were selected based on how well they matched these criteria. Siblings were not allowed to participate as friends. It was not required that the same friend be brought to the 4^{th} and 6^{th} grade laboratory visits. To reduce potential variability due to interactions with opposite-sex dyads, only same-sex dyads were included in the present study. Four children were excluded from the present study due to participating with an opposite-sex friend at at least one age point.

2.1.1 Demographic Variables

2.1.1.1 Child sex

Mothers reported child's sex at the one-month home visit. Of the 33 children included in the present study, 18 were female (55%) and 15 were male (45%).

2.1.1.2 Child ethnicity

Mothers reported child's ethnicity at the one-month home visit. Though ethnicity was not a selection criterion for the present study, 100% of the participants were Caucasian.

2.1.1.3 Average income-to-needs ratio

Family income-to-needs ratios were based on government poverty thresholds determined by family size and income (U.S. Department of Labor, 1994). A score less than or equal to 2.0 indicates poverty. Information regarding family size and total family income was collected throughout the study. Income-to-needs ratios at the 4^{th} or 6^{th} grade laboratory visit were used in selecting the sample such that no participants had a ratio below 2.0 (M = 5.17, *range* = 2.25 –

15.21). Thirty-four participants' families had ratios below 2.0 an were therefore excluded from the final sample (an additional 27 children were excluded due to missing data).

2.1.2 Measures

2.1.2.1 IQ

The study child's IQ was measured at 4^{th} grade using the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1991). The WASI consists of four subtests, each designed to assess a different aspect of cognitive functioning (verbal knowledge, nonverbal and verbal reasoning and visual information processing). Full Scale IQ scores, which incorporated scores from each scale, were included as an index of child IQ. Children were excluded if WASI scores fell below 90 (16 children, whose IQs ranged from 69 - 89, were excluded; 17 additional children were excluded due to missing data). In the sample for the present study, the average WASI score was 113 (scores ranged from 92-135).

2.1.3 Procedure

Laboratory sessions in 4^{th} and 6^{th} grade lasted approximately 2½ hours and included a friendship interaction (see Table 1 for example tasks) and the individual completion of questionnaires. The present study will focus on two dyadic peer interaction tasks, a planning task and a snack. For both tasks, children were seated at a table facing a two-way mirror behind which a video camera was positioned. Children were aware that they were being videotaped. Both interactions took place in the absence of an experimenter.

Table 1: Examples of observed friendship interaction tasks during laboratory sessions.

4th grade	6th grade
Free play	Game: Jenga
Game: Pick-up Sticks	Game: Pictionary
Plan a birthday party	Plan a vacation
Snack	Snack

2.1.3.1 Planning

In both 4th and 6th grade, children were instructed to plan an event, though the nature of the event changed with age. In 4th grade, the study child and friend planned a shared birthday party. They were instructed to select a date, time, and location for the party (see Appendix A for instructions). The children invited 9 friends, selected cake and ice cream flavors, games, and a desired present they could share. They were given an invitation to complete (see Appendix B) and 10 minutes to complete the task.

At the 6th grade laboratory visit, the study child and friend planned a vacation. They were instructed to choose a location, three friends to invite, the duration of the vacation, the mode of transportation, a packing list for all travelers, a budget, and four activities (see Appendix A for instructions). After completing these tasks, the children were instructed to write a message to their parents from their vacation, as though writing a postcard. They were given a planning sheet (see Appendix C) and seven minutes to complete the task.

2.1.3.2 Snack

The laboratory visit included a snack break, where the study child and friend were given a tray with cookies, crackers, napkins, and juice boxes. They were instructed to enjoy their snack and have a conversation and were given seven minutes to interact with one another (see Appendix A for instructions). The nature of the snack session allowed for natural communication, in which the children determined their topic of discourse.

2.1.4 Coding

All of the participants' verbal and nonverbal communication (specifically speech, gesture, eye gaze, and emotional facial expressions) in the planning and snack sessions was coded from the videotaped sessions (see Appendix D for coding manual). Due to the difference in planning session lengths, only the first seven minutes of the 10 minute Plan a Birthday Party session were coded. Prior to completion of any coding, coders were trained to 80% or greater mean percent agreement on all coding categories (see below for reliability procedure). The training sample was comprised of children not included in the final sample. Three experimenters (including the author) completed all coding for the present study. The author served as master coder and, along with a second experimenter, completed coding for all behaviors and rating scales. The third experimenter was trained only for speech transcription (see below). Aside from the author, coders were blind to all other study data.

2.1.4.1 Speech

All of the study child's verbal communication, divided into utterances, was transcribed verbatim in each session. Utterances were defined as a sequence of words (which were not necessarily bound by grammatical or sentence structure) marked by either: 1) preceding and following silence of at least 1 second; 2) change in conversational turn; or 3) change in intonation.

2.1.4.2 Gesture

Gestures were coded when they occurred throughout each session. Gestures were limited to the movements of the hands and arms, and did not include instances of object manipulation. Gesture coding criteria were adapted from McNeill (1992), and coders were trained according to this system. Gesture types (deictic, iconic, metaphoric, and beat) were identified and coded for onset and offset. Deictic gestures were further classified as either concrete (e.g., pointing to indicate something immediately present in the environment) or abstract (e.g., pointing in reference to an idea).

2.1.4.3 Eye gaze

The use of gaze in conversation was recorded for each session. Specifically, coders kept a continuous record of gazes to friends' faces versus gazing elsewhere, noting the onset and offset of looks to the friend's face. Coders also noted whether the friend was speaking at any time during the gaze.

2.1.4.4 Facial expressions

Coders also provided a transcription of emotional facial expressions throughout both sessions. Specifically, coders noted the presence of an emotional facial expression and then further classified the facial expression as either positive or negative. Following past research (e.g., Hubbard, 2001), coders in this study relied on their experience interacting with others to determine the nature of an emotional facial expression and were not formally trained in recognizing the movements of facial muscles to determine expressions. Positive facial expressions included emotional expressions such as happiness, joy, contentment, and laughter. Negative facial expressions included expressions such as sadness, anger, disgust, or fear.

2.1.4.5 Communicative ability ratings

Immediately upon completion of coding each context for each child, coders rated the study children's communication on two scales: (1) overall communicative ability; and (2) nonverbal communicative appropriateness (see Appendix D for rating scales and instructions). Overall communicative ability was rated on a 5-point scale, with 1 indicating an unskilled communicator and 5 representing a very skilled communicator. Nonverbal communicative appropriateness was rated on a 3 point scale, with 1 indicating very odd nonverbal use and 3 indicating appropriate nonverbal use. The goal of these ratings was to provide a global index of a child's ability to communicate and the appropriateness of that communication in conversation. Though coders were instructed to base their judgments on the communication used by the study child, they were not provided with specific behaviors on which to base ratings (i.e., coders were not instructed to pay close attention to speech, gesture, eye gaze, or facial expressions). Brief training took place to ensure the coders achieved reliability in their ratings; however, coders based their judgments on their personal experiences (e.g., Hubbard, 2001).

2.1.4.6 Reliability

Intercoder reliability was computed for a subset (20%) of the data. Reliability sessions were selected randomly, with the exception of balancing for age and sex (i.e., 50% of the reliability sample was from 4^{th} grade sessions; 50% were female). Mean percent agreement was used to calculate reliability for the identification of gestures, gazes, and facial expressions, and Cohen's kappa and mean percent agreement were used to calculate reliability for all categorical (i.e., type) decisions. All intercoder agreements fell within acceptable ranges (mean percent agreement above 80% for all variables; all kappa values ranged from "substantial agreement" to "almost perfect" agreement; e.g., Landis & Koch, 1977; Viera & Garrett, 2005). Intraclass correlations were used to calculate reliability for rating scales (see Table 2 for reliability values). Both correlations were significant (overall communicative ability p = .001, nonverbal communicative appropriateness p = .001). Disagreements were resolved through discussion; all data reflect consensus codes.

Table 2: Mean percent agreement and Cohen's kappa reliability statistics.

	Gesture ID	Gesture Type	Deictic Gesture Type	Gaze ID	Gaze Type	Facial Expression ID	Facial Expression Type
Mean % Agreement	90%	84%	93%	93%	82%	84%	96%
Kappa	-	.79	1.00	-	.64	-	.94

3.0 RESULTS

The overarching goal of the present study was to describe the development of nonverbal behaviors during the preadolescent period. There were four primary questions: (1) how do preadolescent children produce gesture, gaze, and facial expressions during communicative interaction with a peer, and does this change developmentally; (2) are individual differences in rates of production consistent for the various communicative behaviors, and are any such individual differences stable over time; (3) how do preadolescent children use multiple communicative behaviors simultaneously, and does this change developmentally; (4) is adult perception of preadolescent children's communicative ability (both overall ability and the appropriateness of nonverbal use) related to communication production? Following a description of data reduction procedures and presentation of preliminary analyses, data relevant to the four primary questions will be presented in turn.

3.1 DATA REDUCTION

Three steps were taken to prepare the data for analyses. First, due to slight variation in session length (*range* = 5 minutes, 11 seconds - 7 minutes, 15 seconds; duration of 83% of all sessions was 7 minutes, 0 seconds), frequency data (utterances, gesture, gaze, facial expressions) were converted to mean rate per minute (production frequency divided by session length) prior to data analyses. Second, median values were imputed for all instances of missing data.[3] Finally, data were plotted on histograms to examine whether variables were normally distributed; all plots followed Gaussian curves. Komolgorov-Smirnov tests confirmed that all variables were normally distributed.

3.2 PRELIMINARY ANALYSES

Prior to conducting analyses central to the study goals, three sets of preliminary analyses were completed. The first preliminary analysis examined potential gender differences in communication. Previous studies suggest that young adolescent girls are more likely to engage in talk and conversation with peers than boys (e.g., Raffaelli & Duckett, 1989). Therefore, the goal of the first preliminary analysis was to determine whether girls were generally more communicative than boys. Overall communication was assessed at each grade using utterance rate (4th grade: $M_{\text{male}} = 11.70$, $SD = 2.59$, $M_{\text{female}} = 13.38$, $SD = 3.92$; 6th grade: $M_{\text{male}} = 12.44$, $SD = 3.47$, $M_{\text{female}} = 13.40$, $SD = 3.64$). A 2 (Grade) x 2 (Gender) between subjects Repeated Measures ANOVA revealed no significant gender differences (Grade: $F(1,31) = 0.27$, $p = .61$; Gender: $F(1,31) = 1.76$, $p = .20$; Grade x Gender: $F(1,31) = 0.31$, $p = .58$). As a result, gender was not included in subsequent analyses (but see Appendix E).

Second, potential effects of context (i.e., planning versus snack) on communication usage (defined as utterance rate) were examined (see Table 3 for means and standard deviations).

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3 There were two children who did not participate in one of the contexts in 4th grade: one child did not participate in snack and one did not participate in planning. Imputed values were used for these instances; there were no other instances of missing data.

Figure 1 presents utterance rates in 4^{th} and 6^{th} grade as a function of context. As is evident in the figure, communication varied by context and age such that it was generally more frequent in planning than snack contexts; this difference was particularly evident at 4^{th} grade. In addition, communication tended to decrease from 4^{th} to 6^{th} grade in planning but increase in snack from 4^{th} to 6^{th} grade. A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA confirmed a significant main effect of Context, $F(1,32) = 97.49$, $p < .001$. However, this main effect was qualified by a significant Grade x Context interaction, $F(1,32) = 24.30$, $p < .001$ (the main effect of Grade did not reach significance, $F(1,32) = 0.22$, $p = .64$). To determine the source of the interaction, a post-hoc paired samples *t*-test compared rates in planning versus snack in 4^{th} grade. Significantly higher rates in planning than snack contexts in 4^{th} grade were revealed ($t(32) = 13.64$, $p < .001$). As rate of communication varied by grade and context, all subsequent primary analyses for nonverbal behaviors were conducted with grade and context as within-subjects factors.

Table 3: Mean rate per minute (and standard deviations) of utterances in 4th and 6th grade.

		Utterances
		Mean Rate *(SD)*
4th Grade	Planning	15.77 *(3.61)*
	Snack	9.48 *(3.45)*
6th Grade	Planning	14.32 *(4.63)*
	Snack	11.58 *(3.68)*
4th Grade Mean		12.63 *(3.28)*
6th Grade Mean		12.95 *(3.70)*
Planning Mean		15.05 *(4.19)*
Snack Mean		10.53 *(3.70)*
Grand Mean		**12.79 *(3.47)***

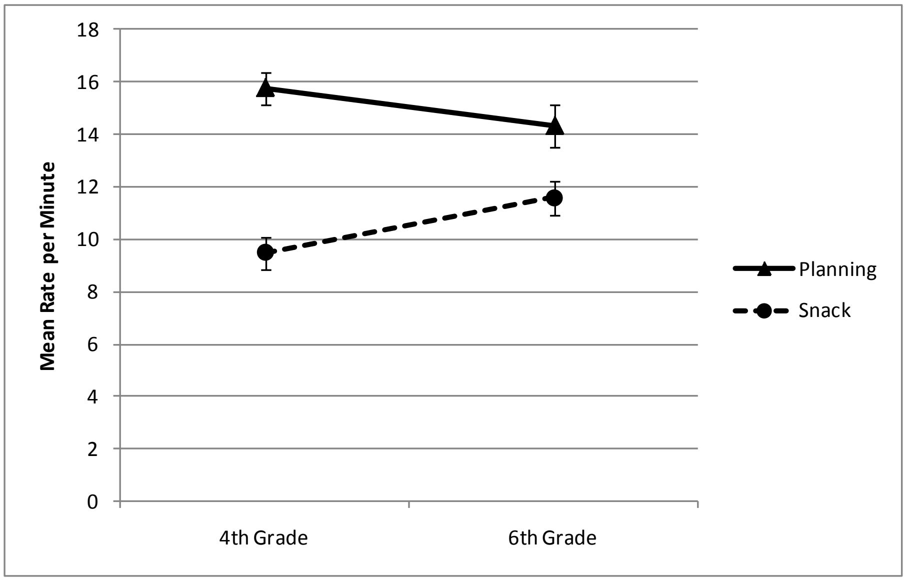

Figure 1: Mean production rates per minute of utterances in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

As nonverbal behaviors and language together are thought to form an integrated communicative system (e.g., Iverson, Hall, Nickel, & Wozniak, 2007; Iverson & Thelen, 1999; Kendon, 1967; Kendon, 1997; McNeill, 1992), the final preliminary analysis was completed to determine whether production of nonverbal communicative behaviors (gesture, gaze, and facial expressions) was related to production of language. Repeated Measures ANCOVAs were carried out on data for each behavior type (gesture, gaze, and facial expressions) separately for snack and planning contexts. Results of these tests were not systematic (see Appendix F); therefore, subsequent analyses of nonverbal communication were completed without accounting for change in utterance production.

3.3 SUBSTANTIVE ANALYSES

3.3.1 The production of gesture, gaze, and facial expressions during the preadolescent period

The first goal of the present study was to describe the use and development of gesture, gaze, and facial expressions during the preadolescent period. To capture the complexities of communication, several sets of analyses will be presented for each nonverbal behavior separately. First, overall patterns of production and developmental change will be described. This will be followed by presentation of data on production of types of behaviors within each category. These analyses were conducted with respect to context (planning or snack); where appropriate, follow-up analyses and descriptions of individual patterns will be presented.

3.3.1.1 How do preadolescent children use gesture to communicate during interactions?

The first set of analyses focused on overall production of gestures (see Table 4, right hand column for means and standard deviations). As is evident in Figure 2, both context and grade differences were apparent. Specifically, in 4^{th} grade, production rates were higher in planning than snack. However, following an increase in snack and a decrease in planning, these patterns were reversed in 6^{th} grade such that production rates during snack were higher than those for planning. A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA carried out on these data revealed a significant Grade x Context interaction, $F(1,32) = 15.66$, $p < .001$ (main effects of Grade ($F(1,32) = 0.004$, $p = .95$) and Context ($F(1,32) = 1.07$, $p = .31$) failed to reach significance). A paired-samples t-test verified that the difference between contexts at 6^{th} grade was significant, $t(32) = 3.30$, $p = .002$. This pattern was also upheld at the individual level, with

24 children producing higher gesture rates during the snack than planning session and nine children producing either equal rates in both contexts or higher rates during planning than snack, $\chi^2(1) = 6.82$, $p = .009$.

Table 4: Mean rate per minute *(and standard deviations)* of deictic, iconic, metaphoric, beat, and total gestures in 4th and 6th grade in planning and snack contexts.

		Deictics	Iconics	Metaphorics	Beats	**TOTAL GESTURE**
		Mean Rate *(SD)*	Mean Rate *(SD)*	Mean Rate *(SD)*	Mean Rate *(SD)*	**Mean Rate *(SD)***
4th Grade	Planning	1.34 *(1.53)*	0.51 *(.45)*	0.04 *(.10)*	0.55 *(.52)*	**2.42 *(1.97)***
	Snack	0.82 *(.89)*	0.50 *(.43)*	0.02 *(.06)*	0.40 *(.31)*	**1.73 *(1.15)***
6th Grade	Planning	0.67 *(.75)*	0.32 *(.35)*	0.03 *(.08)*	0.52 *(.47)*	**1.50 *(1.23)***
	Snack	1.12 *(.98)*	0.71 *(.72)*	0.04 *(.08)*	0.82 *(.91)*	**2.62 *(2.03)***
4th Grade Mean		1.08 *(1.27)*	0.51 *(.44)*	0.03 *(.08)*	0.47 *(.43)*	**2.08 *(1.41)***
6th Grade Mean		0.90 *(.90)*	0.52 *(.59)*	0.04 *(.08)*	0.67 *(.73)*	**2.06 *(1.37)***
Planning Mean		1.01 *(1.24)*	0.42 *(.41)*	0.04 *(.09)*	0.53 *(.50)*	**1.96 *(1.69)***
Snack Mean		0.97 *(.94)*	0.60 *(.60)*	0.03 *(.07)*	0.50 *(.70)*	**2.18 *(1.70)***
Grand Mean		**0.99 *(1.10)***	**0.51 *(.52)***	**0.03 *(.08)***	**0.57 *(.61)***	**2.07 *(1.38)***

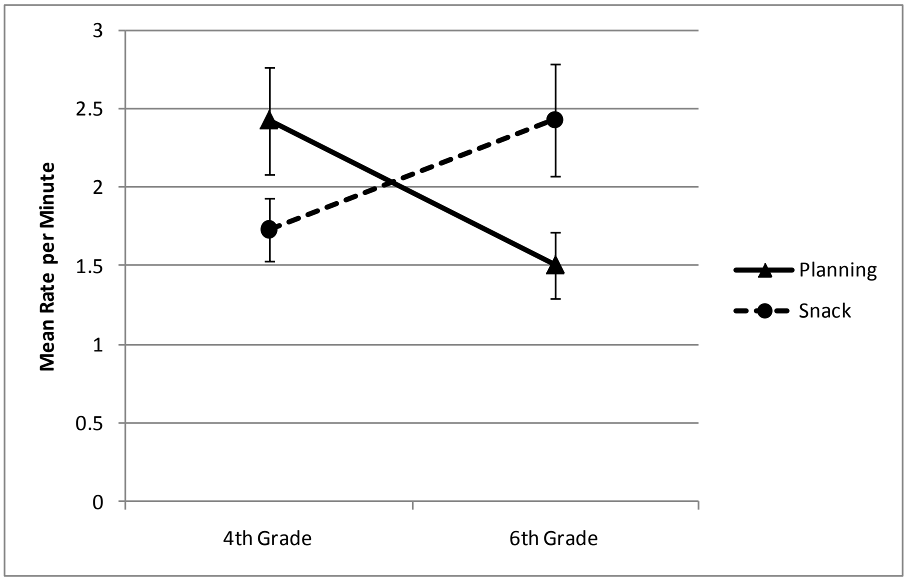

Figure 2: Mean rate per minute of total gesture in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

The next step was to assess production of the various gesture types. As is evident Table 4, production of gesture types varied by grade and context. Therefore, deictic, iconic, and beat gestures were investigated separately. Because metaphoric gestures were infrequent, they were not analyzed further.

Deictic Gestures. Production rates for deictic gestures are presented in Figure 3. As is evident in the figure, differences in production of deictic gestures emerged with respect to grade and context. In 4th grade, the use of deictic gestures was higher in the planning context and lower in the snack context (see Table 4 for means and standard deviations). However, after roughly a 40% increase in snack and 50% decrease in planning, rates of gesture production in 6th grade were higher for snack and lower for planning.

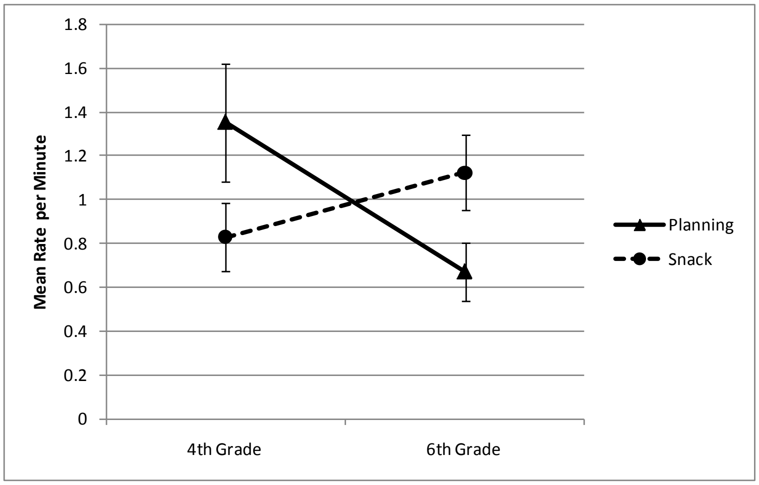

Figure 3: Mean rate per minute of total deictic gestures in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA carried out on these data revealed a significant Grade x Context interaction, $F(1,32) = 9.55$, $p = .004$ (main effects of Grade, $F(1,32) = 0.86$ $p = .36$, and Context, $F(1,32) = 0.05$, $p = .83$, were not significant). A paired samples *t*-test was conducted to assess whether production rates differed significantly by context at 6th grade. Production rates of deictic gestures in 6th grade were significantly higher for snack versus planning, $t(32) = 3.14$, $p = .004$. At the individual level, 25 children produced higher rates of deictic gestures in the snack versus planning context, and eight children produced either higher rates in planning than snack contexts or no differences between contexts. A chi-square analysis confirmed that more individuals produced higher rates of deictic gestures in the snack versus planning context at 6th grade, χ^2 (1) = 8.76, $p = .003$.

Next, the use of concrete (e.g., pointing to something in the room) and abstract (e.g., pointing to the door in reference to the experimenter who just left) deictic gestures was examined. Production rates of concrete and abstract deictic gestures in 4th and 6th grade in both contexts are presented in Table 5. As is evident in the table, concrete deictic gestures were produced more frequently than abstract deictic gestures. Consequently, data relative to the two types of deictic gestures will be presented separately.

Production rates of concrete deictic gestures followed a similar pattern to that described above for deictic gestures overall. As Figure 4 illustrates, production rates in 4th grade were higher for planning than snack. An increase in production rates in snack and a decrease in planning, however, led to the opposite pattern at 6th grade: production rates were higher for snack than for planning.

Table 5: Mean rate per minute *(and standard deviations)* for concrete, abstract, and total deictic gestures in 4th and 6th grade in planning and snack contexts.

		Concrete	Abstract	**TOTAL DEICTIC GESTURE**
		Mean Rate *(SD)*	Mean Rate *(SD)*	**Mean Rate *(SD)***
4th Grade	Planning	1.08 *(1.45)*	0.25 *(.29)*	**1.34 *(1.53)***
	Snack	0.78 *(.89)*	0.05 *(.12)*	**0.82 *(.89)***
6th Grade	Planning	0.62 *(.73)*	0.09 *(.23)*	**0.67 *(.75)***
	Snack	0.91 *(.84)*	0.21 *(.51)*	**1.12 *(.98)***
4th Grade Mean		0.93 *(1.20)*	0.15 *(.24)*	**1.08 *(1.27)***
6th Grade Mean		0.76 *(.80)*	0.15 *(.40)*	**0.90 *(.90)***
Planning Mean		0.85 *(1.16)*	0.17 *(.27)*	**1.01 *(1.24)***
Snack Mean		0.85 *(.86)*	0.13 *(.38)*	**0.97 *(.94)***
Grand Mean		**0.85 *(1.02)***	**0.15 *(.33)***	**0.99 *(1.10)***

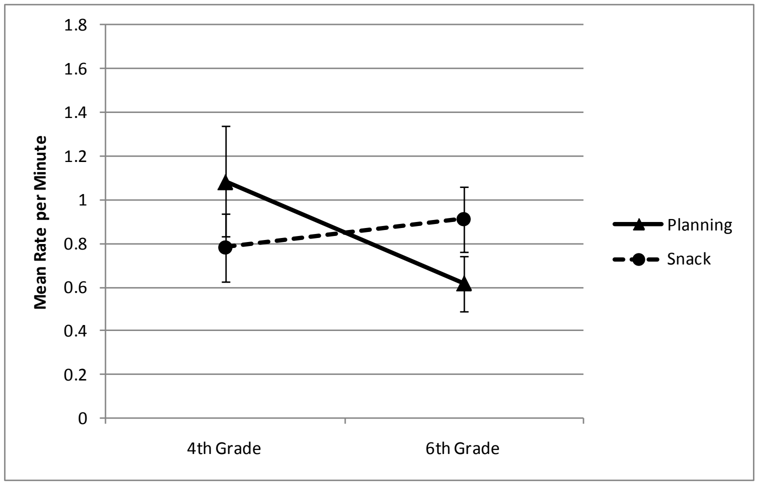

Figure 4: Mean rate per minute of concrete deictic gestures in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA was carried out on these data. Though main effects of Grade ($F(1,32) = 0.84$, $p = .37$) and Context ($F(1,32) = 0.00$, $p = .98$) were not statistically reliable, there was a significant Grade x Context interaction, $F(1,32) = 4.04$, $p = .05$. A paired samples *t*-test confirmed significantly higher production rates during snack than planning in 6th grade, $t(32) = 2.31$, $p = .03$. At the individual level, 22 children produced higher rates in snack than planning in 6th grade, and 11 either had higher rates in planning or produced similar rates in each context. A chi-square analysis indicated a trend toward significance, $\chi^2 = 3.67$, $p = .056$.

Although rates of abstract deictic gestures were lower than those for concrete deictic gestures, similar overall patterns emerged (see Figure 5). In 4th grade, rates were higher in planning than snack. In planning, rates decreased from 4th to 6th grade. In snack, rates increased by 1.33 standard deviations from 4th grade to 6th grade; by 6th grade, they were higher for snack than planning (see Table 5 for means and standard deviations). A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA carried out on these data confirmed a significant Grade x Context interaction, $F(1,32) = 8.81$, $p = .006$ (main effects for Grade, $F(1,32) = 0.003$, $p = .96$, and Context, $F(1,32) = 0.58$, $p = .45$, were not significant). To determine whether production rates differed significantly between contexts in 4th grade, a paired samples *t*-test was employed. Production rates in planning were significantly higher than snack in 4th grade, $t(32) = 4.45$, $p < .001$. At the individual level, nine children did not produce any abstract deictic gestures in either context at 4th grade. Of the remaining 24 children, 20 produced higher rates during the planning than snack context whereas four produced higher rates in snack than in planning or exhibited no context differences, $\chi^2 = 10.67$, $p = .001$.

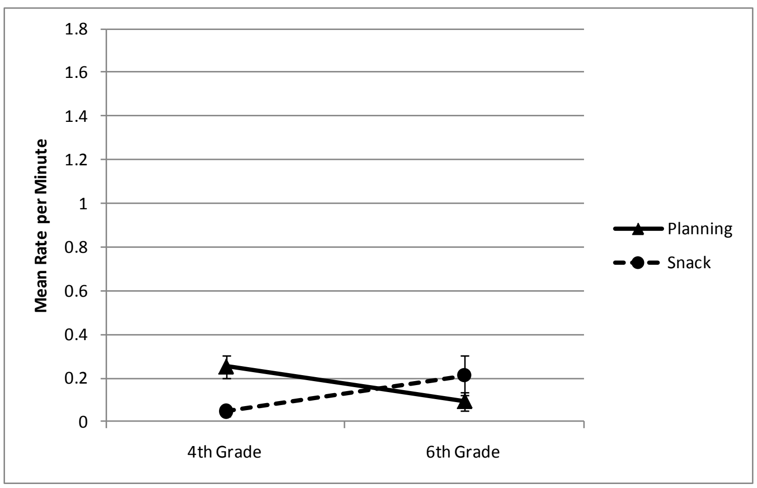

Figure 5: Mean rate per minute of abstract deictic gestures in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

Abstract deictic gestures were produced relatively infrequently at the group level, but they were also infrequent among individual children. This was apparent in both grades and in both contexts. Regarding grade, nine children did not produce abstract deictic gestures in 4th grade and 17 children did not produce these gestures in 6th grade. Regarding context, 9 children did not produce abstract deictic gestures in the planning context. In the snack context, 18 children produced no abstract deictic gestures. Therefore, though not all children produced abstract deictic gestures, production rates increased among those who did. The majority of children produced abstract deictic gestures in at least one context in one grade; only four children produced no abstract deictic gestures at either age in either context.

Iconic Gestures. The next set of analyses aimed to describe the use and development of iconic gestures (see Table 4 for means and standard deviations). Figure 6 presents production rates for iconic gestures at 4th and 6th grade in planning and snack contexts. As is evident in the figure, a different pattern emerged for iconic gestures than was evident for deictic gestures. Namely, use at 4th grade did not differ with respect to context. However, developmental patterns were similar to those seen in deictic gestures, with a clear increase in production rates in the snack context and a decline in the planning task from 4th grade to 6th grade.

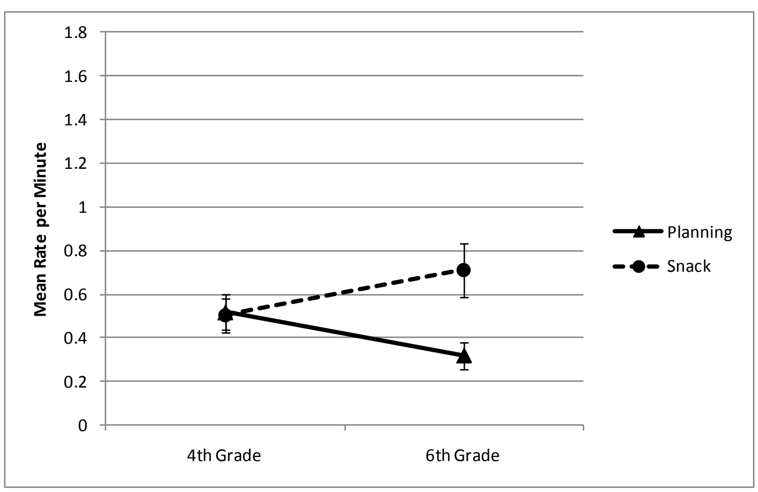

Figure 6: Mean rate per minute of iconic gestures in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA revealed a significant main effect of Context, $F(1,32) = 5.126$, $p = .03$, indicating higher production rates during snack than planning. However, this was qualified by a significant Grade x Context interaction, $F(1,32) = 10.28$, $p = .003$ (the main effect of Grade did not reach significance, $F(1,32) = 0.02$, $p = .89$). A paired-samples *t*-test revealed that production rates during 6^{th} grade snack were significantly higher than 6^{th} grade planning, $t(32) = 3.05$, $p = .005$. A chi-square analysis confirmed that this pattern was upheld at the individual level (24 children produced higher rates in snack than planning and nine children produced higher rates in planning than snack or no context differences at 6^{th} grade), $\chi 2(1) = 6.81$, $p = .001$.

Beat Gestures. The final set of gesture analyses focused on production of beat gestures. As Figure 7 illustrates, production rates in the planning context were relatively equivalent at 4^{th} grade and 6^{th} grade. Production rates increased by 1.35 standard deviations in the snack context from 4^{th} grade to 6^{th} grade (see Table 4 for means and standard deviations). Therefore, although rates were slightly lower in snack than planning in 4^{th} grade, by 6^{th} grade production rates in snack were nearly double those seen in planning.

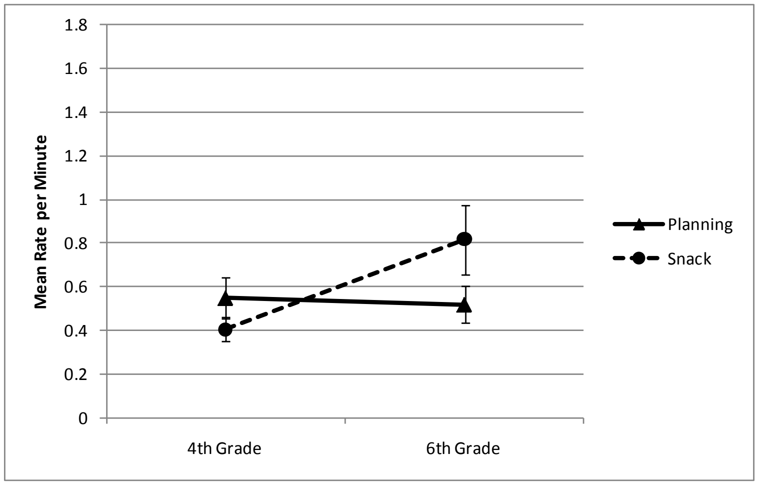

Figure 7: Mean rate per minute of beat gestures in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

These data were subjected to a 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA. The main effect of Context was not significant, $F(1,32) = 1.41$, $p = .244$, but the main effect of Grade approached significance, $F(1,32) = 3.54$, $p = .084$. However, the Grade x Context interaction was significant, $F(1,32) = 4.82$, $p = .04$. A paired samples *t*-test confirmed that rates were significantly higher in 6th grade snack than 6th grade planning, $t(32) = 2.18$, $p = .04$. At the individual level, 20 children produced more beats in snack than planning and 12 produced more in planning than snack (1 child had no beat gestures in either context). Although this generally followed the patterns seen in the larger group, these differences were not statistically reliable ($\chi^2(1) = 2.00$, $p = .16$).

3.3.1.2 How do preadolescent children gaze to a communicative partner during interactions?

Figure 8 presents the data on patterns of gazing to a friend's face in relation to grade and context. As is evident in the figure, rate of gaze varied with age and in planning versus snack settings (see

Table 6 for means and standard deviations). In general, gazing to partner occurred at higher rates in snack than planning contexts, but there was a developmental increase in gazing to partner in snack such that 6th grade gazing was higher than 4th grade gazing. In planning, overall gazing remained relatively stable from 4th to 6th grade. A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA carried out on these data revealed significant main effects of Grade, $F(1,32) = 8.38$, $p = .007$, and Context, $F(1,32) = 50.20$, $p < .001$. However, these main effects were qualified by a significant Grade x Context interaction, $F(1,32) = 8.96$, $p = .005$. A paired samples *t*-test carried out on these data confirmed that the developmental increase in rate of gazing to the friend's face from 4th grade to 6th grade in the snack context was the source of the interaction, $t(32) = 3.62$, $p = .001$. At the individual level, 25 children produced higher rates of gazing to a friend during 6th grade than 4th grade in the snack context (the remaining seven children produced either higher rates in planning or no differences), $\chi^2(1) = 10.13$, $p = .001$.

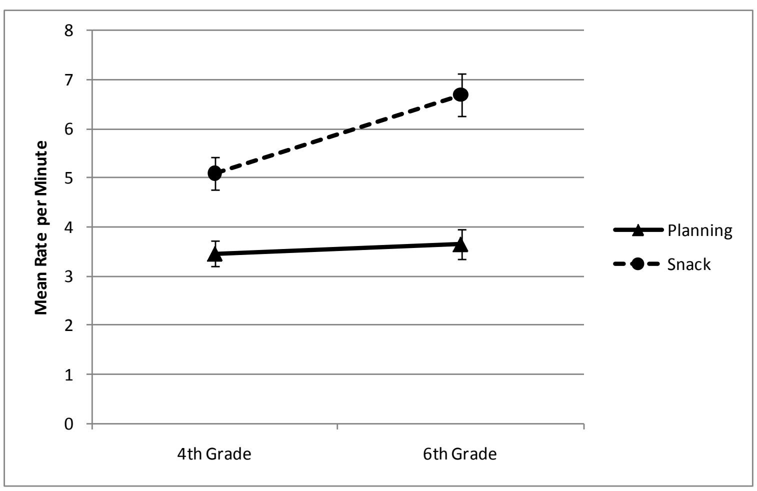

Figure 8: Mean rate per minute of gazing to a communicative partner in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

Table 6: Mean rate per minute *(and standard deviations)* for gazing in the absence and presence of partner speech in 4th and 6th grade in planning and snack contexts.

		Without Partner Speech	With Partner Speech	**TOTAL GAZE**
		Mean Rate *(SD)*	Mean Rate *(SD)*	**Mean Rate *(SD)***
4th Grade	Planning	1.24 *(.69)*	2.23 *(1.04)*	**3.46 *(1.46)***
	Snack	2.91 *(1.46)*	2.19 *(1.07)*	**5.10 *(1.86)***
6th Grade	Planning	1.71 *(.99)*	1.94 *(.98)*	**3.66 *(1.74)***
	Snack	3.00 *(1.21)*	3.69 *(1.87)*	**6.68 *(2.45)***
4th Grade Mean		2.08 *(1.41)*	2.21 *(1.05)*	**4.28 *(1.37)***
6th Grade Mean		2.36 *(1.27)*	2.82 *(1.72)*	**5.17 *(1.66)***
Planning Mean		1.48 *(.88)*	2.08 *(1.01)*	**3.56 *(1.30)***
Snack Mean		2.96 *(1.33)*	2.95 *(1.70)*	**5.89 *(1.77)***
Grand Mean		**2.22 *(1.34)***	**2.52 *(1.46)***	4.72 *(1.58)*

Because adults tend to look while listening to a partner speak, it was of particular interest to examine whether children's gazing was different in the *absence* versus *presence* of partner speech. As is evident in Table 6, children's patterns of gaze differed depending on whether the partner was speaking. Therefore, the next analyses explored the relative frequencies of gazing to a partner in the absence versus in the presence of partner speech.

Figure 9 shows patterns of gazing in the *absence* of partner speech. Clear context differences emerged, such that higher rates of gazing occurred during snack than planning (see

Table 6 for means and standard deviations). A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA confirmed these patterns, with a significant main effect of Context ($F(1,32) = 78.99$, $p < .001$). Main effects of Grade did not reach significance ($F(1,32) = 2.00$, $p = .17$), and the Grade x Context interaction approached significance ($F(1,32) = 1.77$, $p = .052$).

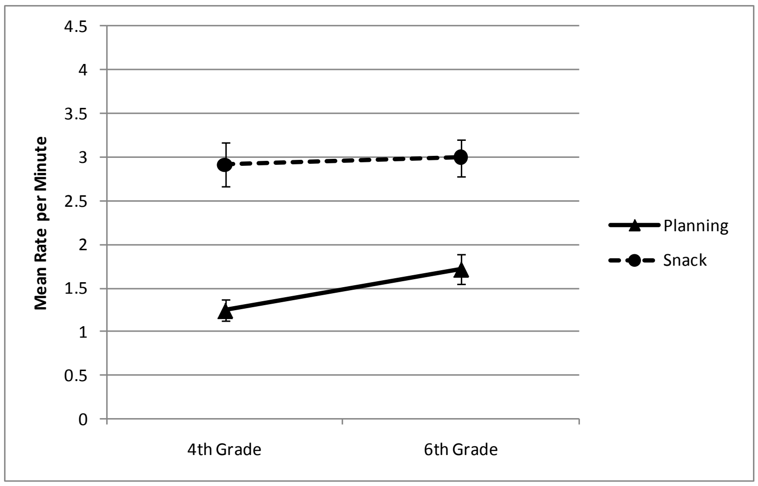

Figure 9: Mean rate per minute of gazing to a communicative partner in the absence of partner speech in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

Figure 10 presents data on rates of gaze in the *presence* of partner speech (see Table 6 for means and standard deviations). As is evident in the figure, gazing while partner speaks did not differ by context in 4th grade. There was a slight decrease in planning settings with age, but rates of gazing increased dramatically over time in the snack setting, nearly doubling from 4th grade to 6th grade (an increase of 1.40 standard deviations). As such, planning rates were higher in snack than planning in 6th grade.

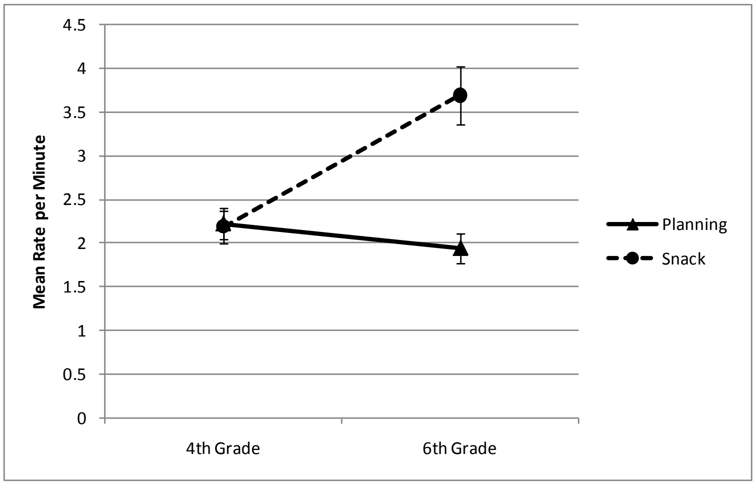

Figure 10: Mean rate per minute of gazing to a communicative partner while partner speaks in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA carried out on these data confirmed these patterns. The main effect for Grade was highly significant, $F(1,32) = 11.06$, $p = .002$, as was the main effect of Context, $F(1,32) = 11.84$, $p = .002$. However, these main effects were qualified by a significant Grade x Context interaction, $F(1,32) = 29.98$, $p < .001$. A paired samples *t*-test revealed that the increase in gazing while partner speaks from 4th to 6th grade in the snack context was significant, $t(32) = 5.12$, $p < .001$. This change was also apparent at the individual level: 29 children produced higher rates of gazing while partner speaks during the snack context in 6th grade versus 4th grade (the remaining four children either produced higher rates of gazing while partner speaks in 4th grade versus 6th grade or no grade difference), χ^2 (1) = 18.94, $p = .001$.

3.3.1.3 How do preadolescent children use facial expressions during interactions?

The next step was to describe the use of facial expressions in dyadic interactions during the preadolescent period in planning versus snack settings. Primary variables for this analysis were overall expressions of emotion and types of emotion (positive or negative). Table 7 presents means and standard deviations for production rates for positive and negative expressions used in each context at each grade. As is evident in the table, production rates for negative expressions were relatively low; they were therefore not included in subsequent analyses.

Production of positive facial expressions is depicted in Figure 11. As the figure indicates, there appeared to be a context difference in 4^{th} grade such that higher rates of positive expressions were seen in snack than planning. After a slight decrease in snack and an increase in planning, these context differences were less apparent by 6^{th} grade.

Table 7: Mean rate per minute *(and standard deviations)* of positive and negative expressions in 4th and 6th grade in planning and snack contexts.

		Positive Expressions	Negative Expressions	**TOTAL FACIAL EXPRESSIONS**
		Mean Rate *(SD)*	Mean Rate *(SD)*	**Mean Rate *(SD)***
4th Grade	Planning	2.86 *(1.41)*	0.42 *(.51)*	**3.29 *(1.61)***
	Snack	3.33 *(1.34)*	0.55 *(.52)*	**3.88 *(1.56)***
6th Grade	Planning	3.35 *(1.45)*	0.18 *(.25)*	**3.53 *(1.40)***
	Snack	3.24 *(1.12)*	0.53 *(.57)*	**3.77 *(1.23)***
4th Grade Mean		3.10 *(1.39)*	0.48 *(.51)*	**3.58 *(1.38)***
6th Grade Mean		3.30 *(1.29)*	0.36 *(.47)*	**3.65 *(1.06)***
Planning Mean		3.11 *(1.44)*	0.30 *(.41)*	**1.70 *(1.76)***
Snack Mean		3.29 *(1.23)*	0.54 *(.54)*	**1.91 *(1.67)***
Grand Mean		**3.20 *(1.34)***	**0.42 *(.49)***	3.62 *(1.22)*

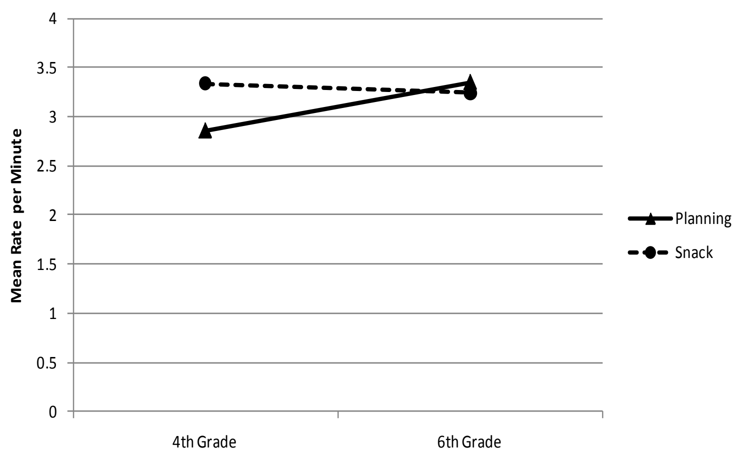

Figure 11: Mean rate per minute of positive facial expressions in 4th and 6th grade in planning and snack contexts. Error bars represent standard errors.

2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA was carried out on these data. Main effects of Grade (F(1,32) = .81, p = .37) and Context (F(1.32) = .78, p = .38) did not approach significance. A significant Grade x Context interaction confirmed that production rates varied with respect to grade and context, F(1,32) = 4.37, p = .05). A paired samples t-test revealed that the context differences in 4th grade were significant, t(32) = 2.03, p = .05. This pattern was upheld at the individual level, with 23 children exhibiting higher rates of positive affect in the snack versus planning context and 10 children exhibiting higher rates in planning versus snack or no differences, χ^2 (1) = 5.12, p = .02.

3.3.1.4 Summary

The first research question of this study focused on the use and development of three nonverbal behaviors (gesture, gaze, and facial expressions) during the preadolescent period. Production of many behaviors varied by context such that concrete and abstract deictic gestures, iconic gestures, beat gestures, and gazing during partner speech increased in the snack setting from 4th to 6th grade. In contrast, these behaviors remained stable or decreased slightly from 4th to 6th grade in planning. There were two notable exceptions: gazing in the absence of partner speech and positive expressions of emotion both tended to stay relatively stable or decrease slightly in a *snack* setting and increase or stay stable in *planning*.

3.3.2 Are individual differences in rates of production consistent for the various communicative behaviors, and are any such individual differences stable over time?

The second research question in this study had to do with the relative stability of the production of communicative behaviors, both concurrently and over time. Separate analyses were conducted in order to: (1) explore whether utterances, gesture, gaze, and facial expressions were correlated with each other concurrently (i.e., were individual behaviors produced at similar rates in each grade); and (2) examine whether production of individual behaviors was stable over time (e.g., were gesture production rates in 4th grade related to gesture production rates in 6th grade?). To obtain a global picture of the use of communicative behaviors, behaviors were collapsed across context for this set of analyses. Further, as both of these questions focused on overall communication, data from utterances, gesture, gaze, and facial expressions were included.

The first set of analyses examined potential concurrent associations between communicative behaviors in 4th and 6th grade respectively. Separate Pearson Product-Moment correlations were calculated between rates of production of individual communicative behaviors (utterances, total gesture, total gaze, and total facial expressions) in 4th grade and 6th grade.

Correlations between individual behaviors in 4th grade are depicted in Table 8. There were three positive and significant correlations, though most of these correlations were moderate in magnitude. Specifically, production of utterances was significantly correlated with production of gesture ($r(31) = 0.43$, $p = .012$) and production of facial expressions ($r(31) = 0.44$, $p = .011$), indicating that those children who produced higher utterance rates also used gestures and facial expressions at higher rates. Facial expressions were also correlated with gesture ($r(31) = 0.59$, $p < .001$), indicating that higher frequencies of facial expressions were associated with more gesturing. All remaining correlations were not significant.

Table 8: Pearson Product-Moment Correlations between communicative variables concurrently during 4th grade.

	Gesture	Gaze	Facial Expressions
Utterances	0.43*	0.04	0.44*
Gesture		0.23	0.59**
Gaze			0.30

* $p < .05$, ** $p < .01$

Correlations between individual communicative behaviors in 6th grade are depicted in Table 9. As the table indicates, there were two significant correlations. Utterances were again correlated with gesture ($r(31) = 0.58$, $p < .001$), indicating that, as in 4th grade, higher rates of utterances were associated with higher rates of gesturing. Further, facial expressions were moderately correlated with gaze ($r(31) = 0.35$, $p = .05$), also indicating that higher rates of facial expressions were associated with higher rates of gazing in 6th grade. No other correlations were significant in 6th grade.

Table 9: Pearson Product-Moment Correlations between communicative variables concurrently during 6th grade.

	Gesture	Gaze	Facial Expressions
Utterances	0.58**	0.21	0.28
Gesture		0.15	0.15
Gaze			0.35*

* $p < .05$, ** $p < .01$

The next set of analyses assessed the stability of individual behavior production over time. Pearson Product-Moment Correlations were computed between individual behaviors in 4th and 6th grade; these correlations are presented in Table 10. As Table 10 indicates, production of most communicative behaviors was generally stable over time. Specifically, production of utterances ($r(31) = 0.36$, $p = .04$), gesture ($r(31) = 0.47$, $p = .006$), and facial expressions ($r(31) = 0.35$, $p = .05$) were significantly correlated from 4th grade to 6th grade; the correlation for gaze was nearly significant ($r(31) = 0.33$, $p = .06$). Therefore, children produced individual behaviors at consistent rates over time.

Taken together, these analyses indicate that some (but not all) behaviors appeared to cohere concurrently. In 4th grade, utterances, gestures, and facial expressions tended to be produced at similar rates; in 6th grade utterances and gestures were again correlated, and production of gaze and facial expressions were also correlated. Further, individual differences in production rates were stable over time. The production of each behavior in 4th grade was at least moderately correlated with production of that same behavior in 6th grade, indicating that individual differences in these behaviors are stable over time.

Table 10: Pearson Product-Moment Correlations between communicative variables across sessions (4th and 6th grade).

		6th Grade			
		Utterances	Gesture	Gaze	Facial Expressions
4th Grade	Utterances	0.36*			
	Gesture		0.47**		
	Gaze			0.33^	
	Facial Expressions				0.35*

^ $p < .10$, * $p < .05$, ** $p < .01$

3.3.3 How do preadolescent children communicate using multiple behaviors simultaneously, and does this change developmentally?

The third question focused on preadolescent children's production of multiple communicative means simultaneously. To this end, "clusters" of co-occurring communicative behaviors were identified. Clusters were defined as instances in which two to four behaviors co-occurred in time and could include combinations of utterances, gestures, gaze, and/or facial expressions. Because the goal of this analysis was to provide an in-depth description of how behaviors occurred together, a new cluster was counted any time an individual behavior was added or dropped (provided that at least 2 behaviors still co-occurred).

There were 11 possible cluster types (see Table 11 for means and standard deviations). Inspection of the data revealed three cluster types that occurred infrequently and were produced by relatively few children: Gesture & Gaze; Gesture & Facial Expressions; Gesture, Gaze, & Facial Expressions (these are depicted in boldface font on the right side of Table 11). Therefore, these behaviors were not analyzed further.

Table 11: Mean rate per minute *(and standard deviations)* and number of children who produced each individual cluster type in 4th grade and 6th grade.

		Utterances & Gesture	Utterances & Gaze	Utterances & Facial Expressions	Gaze & Facial Expressions	Utterances, Gesture, & Gaze	Utterances, Gesture, & Facial Expressions	Utterances, Gaze, & Facial Expressions	Utterances, Gesture, Gaze, & Facial Expressions,	**Gesture & Gaze**	**Gesture & Facial Expressions**	**Gesture, Gaze, & Facial Expressions**
4th Grade	Mean *(SD)*	0.77 *(0.55)*	1.47 *(0.80)*	1.88 *(1.08)*	1.00 (.54)	0.38 *(0.30)*	0.32 *(0.36)*	1.02 *(0.57)*	0.25 *(0.22)*	**0.04 *(0.07)***	**0.07 *(0.12)***	**0.03 *(0.05)***
	# who produced	32	33	33	33	31	25	33	27	**11**	**15**	**12**
6th Grade	Mean *(SD)*	0.66 *(0.48)*	1.59 *(0.82)*	2.46 *(1.57)*	1.45 *(0.71)*	0.43 *(0.45)*	0.33 *(0.27)*	1.73 *(0.85)*	0.32 *(0.28)*	**0.05 *(0.13)***	**0.07 *(0.17)***	**0.03 *(0.05)***
	# who produced	33	33	33	33	27	30	33	31	**8**	**15**	**9**

The remaining clusters were classified into three categories: (1) clusters comprised of two behaviors (Utterances & Gesture; Utterances & Gaze; Utterances & Facial Expressions; and Gaze & Facial Expressions); (2) clusters comprised of three behaviors (Utterances, Gesture, & Gaze; Utterances, Gesture, & Facial Expressions; and Utterances, Gaze, & Facial Expressions); and (3) clusters comprised of four behaviors (all four behaviors were required for clusters with four behaviors: Utterances, Gesture, Gaze, & Facial Expressions). Mean production rates were then calculated for clusters of two behaviors and clusters of three behaviors (see Table 12 for means and standard deviations for clusters of two, three, and four behaviors by grade and context).

As is evident in Table 12, production rates differed for each cluster. Clusters of two behaviors were generally produced at higher rates than clusters of three behaviors, which were in turn produced at higher rates than clusters of four behaviors. Consequently, clusters of two, three, and four behaviors were analyzed separately.

Table 12: Mean rate per minute *(and standard deviations)* of clusters of two, three, and four communicative behaviors in 4th and 6th grade in planning and snack contexts.

		Clusters of Two Behaviors	Clusters of Three Behaviors	Clusters of Four Behaviors	**TOTAL CLUSTERS**
		Mean Rate *(SD)*	Mean Rate *(SD)*	Mean Rate *(SD)*	**Mean Rate *(SD)***
4th Grade	Planning	1.31 *(.53)*	0.63 *(.34)*	0.28 *(.27)*	**2.22 *(1.00)***
	Snack	1.25 *(.45)*	0.52 *(.29)*	0.22 *(.26)*	**1.98 *(.87)***
6th Grade	Planning	1.53 *(.65)*	0.69 *(.39)*	0.20 *(.24)*	**2.42 *(1.32)***
	Snack	1.55 *(.44)*	0.96 *(.54)*	0.43 *(.51)*	**2.95 *(1.11)***
4th Grade Mean		1.28 *(.43)*	0.57 *(.27)*	0.25 *(.22)*	**2.10 *(.94)***
6th Grade Mean		1.54 *(.46)*	0.83 *(.38)*	0.32 *(.28)*	**2.68 *(1.22)***
Planning Mean		1.42 *(.60)*	0.66 *(.37)*	0.24 *(.26)*	**2.32 *(1.17)***
Snack Mean		1.40 *(.47)*	0.74 *(.48)*	0.32 *(.42)*	**2.46 *(1.01)***
Grand Mean		**1.41 *(.54)***	**0.70 *(.43)***	**0.28 *(.35)***	**2.39 *(.74)***

Figure 12 depicts production rates for clusters of two behaviors in each grade and each context. As is evident in the figure, a clear developmental increase occurred from 4th to 6th grade that was apparent in both contexts. A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA revealed a significant main effect of Grade, $F(1,32) = 8.54$, $p = .006$, confirming that overall, rates in 6th grade were higher than in 4th grade. The main effect of Context ($F(1,32) = 0.07$, $p = .80$) and the Grade x Context interaction ($F(1,32) = 0.60$, $p = .44$) did not reach significance. Though 21 individuals adhered to the pattern seen in the larger group (higher rates for 6th grade overall than 4th grade overall; the remaining 12 children produced either equivalent rates or higher rates in 4th grade than 6th grade), this did not reach statistical significance, $\chi^2(1) = 2.45$, $p = .12$.

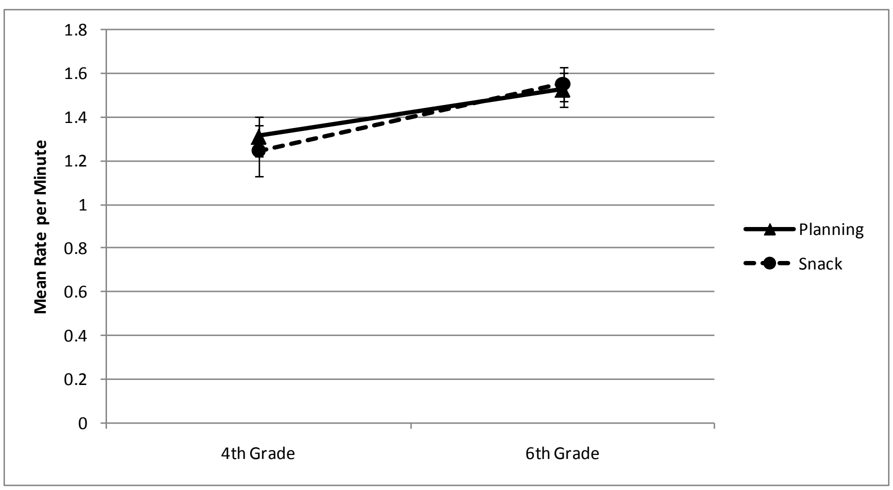

Figure 12: Mean rate per minute of clusters of two behaviors during 4th and 6th grades in planning and snack contexts. Error bars represent standard errors.

Mean production rates for clusters of three behaviors are presented in Figure 13. As is evident in Figure 13, production rates differed by grade and context. Specifically, production rates were relatively equivalent in both contexts in 4th grade. While production rates in the planning task remained relatively stable from 4th to 6th grade, there was an increase in production rates in the snack context at 6th grade.

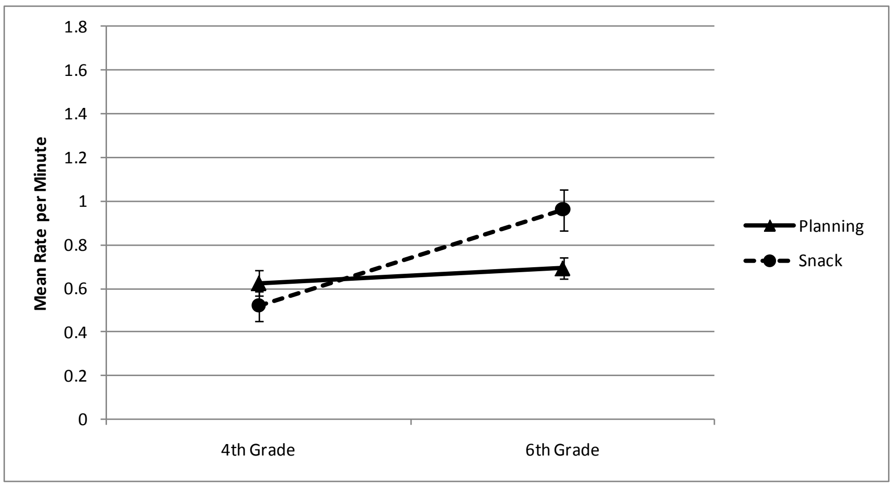

Figure 13: Mean rate per minute of clusters of three behaviors during 4th and 6th grades in planning and snack contexts. Error bars represent standard errors.

A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA was carried out on these data. Though the main effect of Grade was highly significant, $F(1,32) = 19.80$, $p < .001$, it was qualified by a significant Grade x Context interaction, $F(1,32) = 11.22$, $p = .002$ (the main effect of Context did not reach significance, $F(1,32) = 1.94$, $p = .17$). A paired samples *t*-test confirmed that rates of production of clusters of three behaviors in 6th grade were significantly higher in snack than in planning, $t(32) = 2.74$, $p = .01$. At the individual level, 26 children had higher rates of clusters of three behaviors in the snack than the planning context in

6th grade (the remaining seven exhibited either higher rates in planning than snack or no difference), $\chi^2(1) = 10.94$, $p = .001$.

The last type of cluster involved the simultaneous production of all four communicative behaviors (utterances, gesture, gaze, facial expressions). As Figure 14 illustrates, such clusters were produced relatively infrequently. However, production rates did vary by context and age. In 4th grade, rates were similar across contexts. However, following a developmental increase in snack and a decrease in planning, production in 6th grade snack was nearly double that of planning.

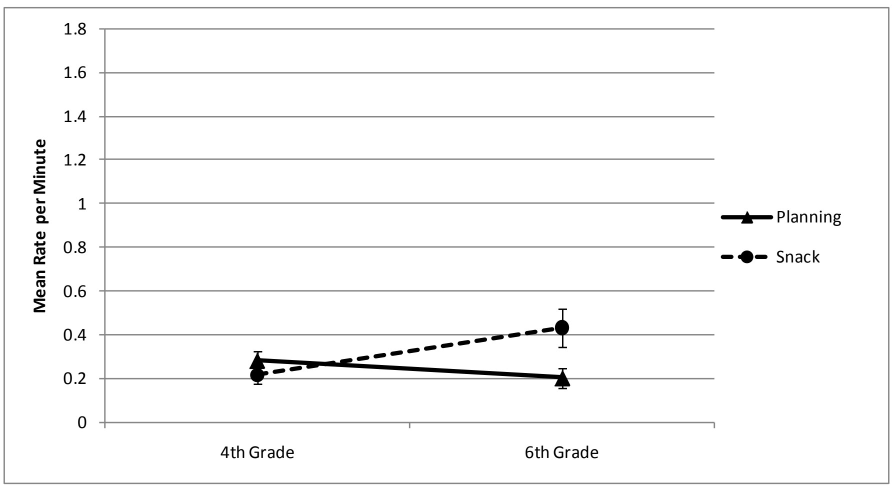

Figure 14: Mean rate per minute of clusters of four behaviors during 4th and 6th grades in planning and snack contexts. Error bars represent standard errors.

A 2 (Grade) x 2 (Context) within subjects Repeated Measures ANOVA confirmed these patterns. Though the main effects of Grade ($F(1,32) = 2.12$, $p = .16$) and Context ($F(1,32) = 3.13$, $p = .09$) did not reach significance, a significant Grade x Context interaction emerged, $F(1,32) = 5.28$, $p = .03$. A paired samples t-test confirmed significantly higher rates in snack versus planning at 6th grade, $t(32) = 2.31$, $p = .03$. At the individual level, 19 children exhibited higher rates in 6^{th} grade during snack and 12 children exhibited either equal rates or higher rates in planning than snack. However, this was not a statistically reliable difference ($\chi^2(1) = 1.58$, $p = .21$).

In summary, preadolescent children often produced multiple behaviors simultaneously. Clusters comprised of two behaviors were most common, but children also produced up to four behaviors simultaneously. Further, differences between contexts emerged. In snack, cluster production rates increased overall across preadolescence (an increase of 1.11 standard deviations for total clusters). In planning, production rates increased only for clusters of two behaviors; clusters of three and four behaviors remained stable from 4^{th} to 6^{th} grade.

3.3.4 Is adult perception of preadolescent children's communicative ability (both overall ability and the appropriateness of nonverbal use) related to communication production?

The fourth research question addressed in this study was whether use of communicative behaviors was related to adult impressions of preadolescent children's communicative competence. Because a clear change in production rates emerged for all variables from 4^{th} to 6^{th} grade in the snack context, this analysis focused on adult ratings of children's overall communicative ability and nonverbal appropriateness and child production of communicative behaviors in the snack context in 4^{th} and 6^{th} grade. Table 13 presents average ratings for the two scales at each time point.

Table 13: Mean ratings *(and standard deviations)* for overall communicative ability (maximum score = 5) and nonverbal appropriateness (maximum score = 3) in 4th and 6th grade in the snack context.

	Overall Communicative Ability	Nonverbal Appropriateness
4th Grade	4.58 *(.61)*	2.70 *(.47)*
6th Grade	4.42 *(.90)*	2.61 *(.61)*
Mean	**4.5 *(.77)***	**2.65 *(.54)***

Pearson Product-Moment correlations were computed between rates of production for individual behaviors (utterances, total gesture, total gaze, and total facial expressions) and clusters (average production rates of clusters containing two, three, and four behaviors) and rating scale scores (both Overall Communicative Ability and Nonverbal Communicative Appropriateness). These correlations are presented in Table 14.

As is apparent in the table, associations between child communicative behavior production and adult ratings differed at the two time points. In 4th grade, production rates were generally not significantly correlated with ratings of either type. In fact, only one significant correlation emerged: a negative correlation between nonverbal appropriateness and gesture use in 4th grade snack, $r(31) = -0.42$, $p = .02$. In other words, less frequent gesture use was associated with higher appropriateness ratings.

In 6th grade, nearly every communicative behavior, both single behaviors and clusters, was significantly correlated with ratings of communicative ability (with utterances, $r(31) = 0.45$, $p = .009$; with gaze, $r(31) = 0.53$, $p = .002$; with facial expressions, $r(31) = 0.49$, $p = .004$; with clusters of two behaviors, $r(31) = 0.42$, $p = 02$; with clusters of three behaviors, $r(31) = 0.47$, $p =$

.006; with clusters of four behaviors, $r(31) = 0.37$, $p = .03$). Therefore, both the use of individual behaviors and the use of multiple behaviors simultaneously were linked to higher ratings of overall ability to communicate.

Though none of the correlations between ratings on the nonverbal appropriateness scale and communicative behaviors were significant, there were several of reasonable magnitude. In particular, utterances ($r(31) = .31$, $p = .09$) and gaze ($r(31) = .26$, $p = .14$), approached significance, indicating that more frequent production of utterances and more frequent gazing to a partner tended to be associated with higher ratings of appropriateness.

Table 14: Correlations between communicative ratings and production of individual and clustered behaviors in 4th and 6th grade in the snack context.

		Utterances	Gesture	Gaze	Facial Expressions	Clusters of 2 Behaviors	Clusters of 3 Behaviors	Clusters of 4 Behaviors
4th Grade	Overall Communicative Ability	0.02	0.13	0.08	0.32	0.11	0.06	0.06
	Nonverbal Appropriateness	0.00	***-0.42*** *	0.06	-0.30	-0.14	0.05	-0.21
6th Grade	Overall Communicative Ability	***0.45*** **	0.16	***0.53*** **	***0.49*** **	***0.42*** *	***0.47*** **	***0.37****
	Nonverbal Appropriateness	0.31	0.09	0.26	0.18	0.21	0.23	0.22

$* p < .05$, $** p < .01$

In sum, there were some positive associations between preadolescent children's production of communicative behaviors and adult ratings of children's communicative ability and nonverbal appropriateness. However, the presence of these associations varied by grade. In 4th grade, only one significant correlation emerged on either scale (the production of gesture was negatively correlated with ratings of appropriateness). In contrast, nearly every variable was positively correlated with perceptions of communicative ability in 6th grade. Although not significant, there were positive relations between nonverbal appropriateness ratings in 6th grade and rate of utterances and gaze production.

4.0 DISCUSSION

The overarching goal of this study was to describe nonverbal communication and its development during preadolescence. That preadolescence is a period of transition in the cognitive (e.g., Elkind, 1967; Laursen & Pursell, 2009; Piaget & Inhelder, 1977) and social domains (e.g., Brown & Dietz, 2009; Bukowski et al., 2009; Larson & Richards, 1991; Raffaelli & Duckett, 1989; Savin-Williams & Berndt, 1990) is well established. However, we currently lack a description of whether and to what extent children's nonverbal communication changes during this period. The present study was designed to address this gap in our understanding.

The study had two major findings. First, there was evidence of developmental change in the use of nonverbal communication across the preadolescent period, particularly in aspects of communication that are commonly observed among adults. Second, nonverbal communication varied by context, such that varying patterns of developmental change were apparent in the two observational settings. These findings will be discussed in turn, followed by a brief discussion of individual differences in nonverbal communication and their stability over time. I conclude with suggestions for future research.

4.1 TRANSITION AND NONVERBAL COMMUNICATION DURING PREADOLESCENCE

One goal of the present study was to describe the use and development of nonverbal behaviors during preadolescence. Developmental change was particularly apparent in the snack setting; therefore, this section will focus on the findings from that context. Findings from the planning tasks will be considered in the next section.

Communication in the snack context changed in two primary ways. First, children's production of nonverbal communication, particularly nonverbal behaviors typical of adult communication, increased from 4th grade to 6th grade. Second, adults' perceptions of children's communication also appeared to shift. These findings will be considered individually.

4.1.1 Production of nonverbal communication during preadolescence

Production of nonverbal communication changed during preadolescence such that behaviors were generally produced at higher rates in 6th grade than in 4th grade. In particular, overall production rates for both gesture and gaze increased from 4th to 6th grade. However, facial expressions of positive emotions were produced at relatively similar rates at both ages. The comparable rates of positive facial expressions (and relatively infrequent negative expressions) seen in the present study may be a product of the observational setting, which involved asking children to bring friends to the lab and to engage in fun activities with them.

Of particular interest in the present study was whether preadolescent children used behaviors that are typical of adult communication when interacting with a peer and whether these behaviors changed over time. Three nonverbal behaviors that are characteristic of adult communication were investigated in this study: abstract gesture, gaze that accompanies partner speech, and the use of multiple communicative behaviors simultaneously (clusters).

4.1.1.1 Abstract Gesture

Abstract gestures (i.e., abstract points and beats) are commonly used in adult discourse and are typically produced in conjunction with speech that reflects abstract ideas (McNeill, 1992). There is limited literature documenting children's gesture production during preadolescence, but there is some indication that abstract gestures are used with regular frequency by age 11 (e.g., McNeill, 1992). However, previous studies have typically described children's abstract gesture production in the context of retelling a narrative to an adult (e.g., McNeill, 1992). It remains unclear whether children commonly use abstract gestures in dyadic, peer interactions. Therefore, in the present study, preadolescent children's gesture production during conversations with a peer was examined in order to obtain a more representative picture of gesture production in an unstructured, naturalistic context.

Findings indicated that abstract gestures were generally produced with greater frequency in 6th grade than 4th grade. This result adds to the existing literature in two ways: first, it supports the notion that abstract gestures become increasingly common by the end of preadolescence; and second, it extends previous work by providing evidence that children use these abstract means to communicate when interacting with a peer, not just an adult.

What might underlie this increase in abstract gesture? The body of research documenting intimate ties between gesture and thought (e.g., Goldin-Meadow, 2000; Goldin-Meadow, 2005; Goldin-Meadow, 2006; Kita, 2000; McNeill, 1992) suggests the possibility that the increased production of abstract gesture reflects advances in children's thinking. The most well-known description of transition in children's thinking at the end of preadolescence is that of Piaget (e.g., Piaget & Inhelder, 1977). According to Piaget, 10-year-olds think in different ways than do 12-year-olds; while thought for the 10-year-old is rooted in concrete terms, it is at roughly age 12 that children's thinking starts to become less rooted in concrete terms and shifts to being more flexible and abstract. Twelve-year olds, therefore, are better equipped to engage in hypothetical reasoning than 10-year-olds because they now consider what is *possible* rather than simply what *is*.

The increase in abstract gestures that emerged in the present study may reflect this transition toward increasingly abstract thought (see McNeill, 1992, for a similar argument). According to McNeill and colleagues (e.g., McNeill, 1992; McNeill, Cassell, & Levy, 1993), abstract deictic gestures involve abstract thinking in that the communicator often sets up a space as an imaginary representation of something that is not immediately present in the environment. A common manifestation of this in the present study was pointing at the door while saying "my lady," in reference to the experimenter who had been working with that child and who had just left through that door. In order to use an abstract point, children need to be able to approximate a space in reference to something that has no physical tie to that space; in other words, children must to be able to think abstractly about both their surroundings and about the content of their speech such that pointing to the door would mean "experimenter," not "door." That children who produced abstract deictic gestures used them with increasing frequency in 6^{th} grade (when they were on average 12 years old) than in 4^{th} grade (when they were on average 10 years old) is in line with the notion that increased production of abstract gestures reflects advances in abstract thought.

The increase in beat gestures seen in the present study may also reflect transitioning thought. According to McNeill (1992), "a beat, even though it is just a flick of the hand, is cognitively complex," in that it requires the understanding of what information in the spoken message is important and that it should be highlighted for an addressee (p. 321). One manifestation of a beat gesture is a subtle flick of the hand toward another person in reference to that person's ideas (e.g., Bavelas et al., 1992). A child in the present study used a beat gesture in this way by highlighting the word "museum" with a hand flick, referencing the fact that visiting a museum had originally been suggested by her friend. In this example, the gesture reflects thinking about the friend's idea, which is by definition an abstract (rather than concrete) thought.

There is another possible explanation for the observed increase in beat gestures in the present study. Bavelas and colleagues (e.g., Bavelas et al., 1992) have described ways in which beat gestures facilitate conversation itself. For example, a subtle hand flick accompanying the phrase "you know," indicates to the listener that what was just conveyed was important information and that the communicator is pausing to make sure the message was conveyed clearly. In highlighting the phrase "you know," this beat gesture serves the additional purpose of recruiting the addressee's participation directly in the conversation; this phrase and gesture combination typically elicits a response (such as "uh-huh" or a head nod). Indeed, children produced beat gestures in conjunction with the phrase "you know" in the present study.

Additional support for the view that these gestures can also play a role in facilitating conversation comes from the observation that beats occur more frequently in the presence of a partner than when alone. In Bavelas and colleagues' study (1992), for example, participants were asked to watch a video and provide a narrative. Participants either completed this task alone or in dyads. When two participants worked together to retell the narrative, significantly more beat gestures emerged than when a single participant completed the task. The fact that children's beat gestures increased from 4th to 6th grade in the present study may map on to this finding in adults, indicating that children are becoming more aware of the role played by these gestures in structuring the conversation.

Transitions in the social realm may also account for the observed increase in abstract gestures. Namely, as children are spending more time in the company of peers (e.g., Brown & Dietz, 2009; Larson & Richards, 1991; Savin-Williams & Berndt, 1990) and more time engaging in conversation while interacting with peers (Raffaelli & Duckett, 1989), it stands to reason that the increase in abstract gestures reflects children's desire to be more communicative with a social partner.

4.1.1.2 Gaze in the presence of partner speech

In adult communication, gaze typically accompanies partner speech (Kendon, 1967). However, few studies have documented children's gazing in peer interactions, particularly during preadolescence. One exception is the work of Levine & Sutton Smith (1973), who reported that children's gazing with peer partners declines in preadolescence. However, the precise nature of this difference is unclear because it is based on data from a group of children ranging in age from 10 to 12 years. We do not know whether changes occur *during* the preadolescent period, including whether 10-year-old children gaze to partners differently than do 12-year-old children.

In light of these limitations, the present study aimed to describe preadolescent children's use of gaze to a partner, particularly in the presence of partner speech. There was a developmental increase in gazing to partner, but this appeared to be due primarily to an increase in gazing in the presence of partner speech. There are two potential explanations for this finding.

The first is that this change may reflect children's increasing awareness of the needs of their communicative partner. In adults, it is well documented that the production of speech becomes disfluent in the absence of partner gaze. For example, when adults interact with a partner who does not supply adequate eye gaze, their narrative fluency drops measurably (e.g., Bavelas et al., 2002). The finding that children's gaze increased solely when partners were speaking may indicate an understanding that their feedback is important to partners. Indeed, there is some suggestion that by the end of the preadolescent period, children think about their contributions to the conversation, such as compromise and negotiation, and how these contributions facilitate the interaction (e.g., Laursen & Pursell, 2009).

Further support for this notion comes from research on the development of the understanding of emotional display rules. By the end of the preadolescent period, children are skilled at inhibiting the production of a felt emotion while simultaneously displaying a contrasting emotion (e.g., Saarni, 1979). Children engage in this masking of felt emotions to spare the feelings of the partner (e.g., Saarni, 1984), suggesting that they are aware that their communicative behaviors (in this case, facial expressions) can have an impact on their partner. Since, as noted above, gaze in the presence of partner speech appears to assist the partner, increased frequency of gaze in the presence of partner speech may be another manifestation of this understanding.

A second possibility is that children's increased gazing in the presence of partner speech is indicative of a shift in receptive communicative ability. Children may be looking while listening at increasing rates toward the end of preadolescence to glean information from multiple channels, both verbal and nonverbal. Work on children's processing of multimodal communication suggests that developmental changes occur in preadolescence. Prior to age 10, children appear to keep information conveyed in different modalities separate, but after age 10 they appear to integrate information across modalities (e.g., Church, Kelly, & Lynch, 2000;

DePaulo, Rosenthal, Eisenstat, Rogers, & Finkelstein, 1978; Friend & Bryant, 2000; Kelly & Church, 1998; McNeil, Alibali, & Evans, 2000; McNeill, Cassell, & McCullough, 1994).

For example, in Church and colleagues' study (2000), adult and child participants watched a video of a child explaining Piagetian conservation tasks. The videos for one condition depicted children presenting different information in speech versus gesture, e.g., saying the cup was "tall" while making a "thin" gesture with their hands. When asked verbally "Did the child indicate the width of the containers?" (p. 157), 9- and 10-year-old participants said no, but adult participants responded yes. When asked via gestural presentation (e.g., watching a video of an experimenter enacting different gestures), 9- and 10-year-old participants then responded yes, suggesting that they keep information conveyed in different modalities separate, whereas adults integrate across modalities. Other studies have provided evidence that it is not until roughly age 11 that children integrate communicative information across modalities as do adults (e.g., DePaulo et al., 1978; Friend & Bryant, 2000; McNeill et al., 1994). These findings suggest that children gaze more frequently at a communicative partner while the partner is speaking because of an increasing recognition of the multimodal nature of communication. More frequent gaze during partner speech would allow the child to obtain more information, information that is accessible only in the visual modality (i.e., other nonverbal behaviors such as facial expressions, gestures, body postures, etc.).

4.1.1.3 Communicating simultaneously via multiple channels.

Adults use multiple modalities to communicate, and their communication often involves the simultaneous coordination of communicative signals across modes. For example, it is not uncommon to observe an adult smile, wave, and look directly at another person while saying "hello," coordinating information across multiple modalities. Communication for adults, therefore, is dynamic and integrated. A substantial body of work has pointed to infancy as the period during which coordination emerges (e.g., Adamson & Bakeman, 1985; Bakeman & Adamson, 1984; Iverson et al., 2007; Moore & Dunham, 1995). Further, there is evidence that coordination itself shifts during infancy. Early in infancy the coordination of communicative behaviors typically involves vocal behaviors accompanied by positive facial expressions (e.g., Adamson & Bakeman, 1985; Yale, Messinger, Cobo-Lewis, & Delgado, 2003). However, as children begin to communicate using gestures and words, the coordination of behaviors appears to shift, such that gestures are more often coordinated with words (e.g., Parladé, 2007).

Whereas gestures are a central component of infants' communication (e.g., Acredolo & Goodwyn, 1988; Crais et al., 2004; Iverson & Goldin-Meadow, 2005), they transition to a more supplementary role after the onset of speech (e.g., McNeill, 1992). Adults infrequently produce gesture as a stand-alone means to communicate. A question that remains, therefore, is whether the coordination of behaviors continues to change past infancy. The present study is a first step in addressing this question. The finding that the clustering of communicative behaviors increased across preadolescence provides support for the notion that as communicative behaviors themselves develop, the overall communicative system and the coordination of communicative behaviors shifts. In other words, the developmental change observed in this study was evident in increases in both the production of individual behaviors and in the integration of multiple communicative behaviors.

There was also some indication that the behaviors central to coordination during preadolescence differ from those central to coordination at the end of infancy. As noted earlier, as gestures come to the forefront of communication toward the end of infancy, there is some evidence that facial expressions are less integral to coordination than gesture (e.g., Parladé, 2007). In the present study, however, the most commonly occurring clusters of two behaviors (which were more common than clusters of three or four behaviors) typically involved the coordination of utterances and facial expressions. In contrast to the patterns seen toward the end of infancy, clusters involving utterances and gesture were produced less frequently, especially in 6^{th} grade.

Prior work on facial expressions has generally not addressed the use of facial expressions in conversation (see Chovil, 1991/1992 for an exception), but the present study suggests that they are integral to communication in peer conversations. As there is a general lack of research assessing communication production as a whole, it is unclear why facial expressions resurge to a central role in communication. The findings of the present study suggest a need for a more systemic approach to later communication development, particularly with regard to the role of facial expressions.

4.1.2 Perceptions of preadolescent children's communication

Not only did production rates of individual and clustered behaviors change in the present study, but links between children's communication and how adults *perceived* that communication changed as well. Significant correlations between production of communicative behaviors and perceived ability were rare in 4^{th} grade. In contrast, production of individual behaviors (all except gestures) and clusters in 6^{th} grade were significantly correlated with adult impressions of communicative competence, suggesting that the perceived quality of children's communication changes from 4^{th} grade to 6^{th} grade. This may be due to the observed increase in the production of communicative behaviors typical of adults by 6^{th} grade.

Caution must be used in interpreting these results, however, as the basis for adults' ratings remains unclear. When raters were asked to evaluate the ability and appropriateness of the child's communication, they were not given explicit instructions as to what constituted "skilled" or "appropriate" use of behaviors (i.e., raters were not asked to focus on speech, gesture, gaze, or facial expressions), but rather were asked to base their evaluations on their own experience (Hubbard, 2001). Raters may therefore have based their judgments on factors other than the target child's communication. One possibility is that the presence of the peer may have influenced the rater's perceptions. If the peer appeared to be enjoying interacting with the study child, the rater's perceptions may have been positively influenced. Indeed, there was a general lack of variability in adult ratings, particularly in 4th grade. No child was rated as being "unskilled" for overall ability, and no child received a rating of "very odd" for appropriateness. In other words, the raters may have been prone to positive evaluations in the present study because the peer was acting as though the study child's communication was appropriate.

4.2 CONTEXT EFFECTS ON NONVERBAL COMMUNICATION

Children's communication varied between structured and unstructured contexts: engaging in a conversation elicited different communication than planning an event. For some behaviors (e.g., gaze), lower rates were apparent during planning an event than during a conversation; other behaviors were generally more frequently observed in planning (e.g., utterances and facial expressions). That differences emerged between contexts is in line with the existing literature; many studies have reported that different contexts yield different communication (e.g., Iverson, 1999; Iverson & Goldin-Meadow, 1997; Levine & Sutton-Smith, 1973). For example, Levine and Sutton-Smith (1973) found that children gazed more frequently to peers during conversation than during a construction task, in which children were asked to build something jointly out of blocks. In both the planning context in the present study and the construction task in Levine & Sutton-Smith's work, it would be expected that children's gaze would be split between partner and the physical objects involved in the task. The differences observed in communication in the two contexts employed here are likely a result of the nature of the tasks in which children were asked to engage.

A surprising finding was that patterns of developmental change in communicative behaviors differed across contexts. Though the majority of communicative behaviors increased in an unstructured, conversational setting (snack), similar increases were not apparent in the planning setting. Instead, in the planning task, most behaviors remained stable from 4th to 6th grade, but gestures appeared to decrease from 4th to 6th grade. Why might this be the case?

One possibility is that children were less engaged with the planning task in 6th grade, where they planned a kids' only vacation, than in 4th grade, where they planned a shared birthday party. However, the finding that children's positive facial expressions were higher in 6th grade than in 4th grade argues against this notion, suggesting that, on the contrary, children were likely more engaged when planning a vacation than when planning a birthday party.

A second possibility is that patterns of consistency and, in the case of gesture, decrease in production of communicative behaviors observed in the planning task are related to subtle differences between tasks. Although both the 4th grade and the 6th grade tasks involved planning, children were asked to plan different events with different materials at the two observations. These slight differences in task design and task demands may have created an environment of support for communication in 4th grade that was no longer present in 6th grade.

Asking children to plan a birthday party may allow them to draw on concrete themes grounded in specific personal experience. Birthday parties are typically highly scripted and predictable, and the planning sheet children were given in 4th grade likely mirrored their expectations for what a birthday party should entail (e.g., birthday parties would generally involve presents, cake, ice cream, games, and friends – all items that appeared on the planning sheet). Indeed, there is evidence that well-known scripts help children plan (e.g., Friedman & Scholnick, 1997; Gauvain, 2001; Hudson, Sosa, & Shapiro, 1997). As there is some suggestion that familiar scripts reduce cognitive load (e.g., Gauvain, 2001), the presence of a planning sheet that followed a familiar script may have freed resources for communication.

The presence of additional materials during 4th grade may have provided support for children's gesture in particular. When asked to plan a birthday party during 4th grade, children were given a large, laminated game sheet that spanned the space of the table in front of them. This game sheet served as a task "roadmap," pointing out the path they should take in planning their birthday party. As the game sheet itself was spatially oriented, it likely elicited pointing gestures; this may account for the high rates of gestures in 4th grade, particularly deictic (spatial) gestures. No similar device was used for planning a shared vacation. Thus, the nature of the planning task employed in 4th grade may have scaffolded and fostered children's communication.

In 6th grade, the nature of the event to be planned (a vacation) and the structure of the task may have may have resulted in reduced scaffolding of communication and increased task difficulty. Although children had probably been on vacations before, it is likely that few, if any, of them had actually planned a vacation on their own. Due to this lack of experience, the act of planning a vacation would require more creativity and abstract thought than planning a birthday party. Further, the fact that the vacation task was less scripted and more open-ended may have made the task more difficult. Both of these factors could have increased children's cognitive load, leaving fewer resources available for communication. That production of many communicative behaviors, including utterances, declined from 4^{th} to 6^{th} grade is consistent with this possibility.

However, the finding that gesture was produced at lower rates in the presumably more cognitively demanding task is counter-intuitive and stands in contrast to the existing literature. It has been argued extensively that gesture should be more frequent in difficult tasks compared to easier tasks, and that speakers may benefit from the use of those gestures (e.g., Goldin-Meadow, Nusbaum, Kelly, & Wagner, 2001; Iverson, 1999; McNeill, 1992). For example, children and adults remember more when gesturing during a cognitively demanding task than when they do not gesture (Goldin-Meadow et al., 2001). However, in the present study, children's gestures decreased as task demands increased. An explanation for this difference may lie in differences between the tasks employed in the existing literature versus in the present study. The tasks in the literature generally involve asking participants to engage in problem solving (such as Piagetian conservation tasks or solving math problems; e.g. Goldin-Meadow et al., 2001; Iverson, 1999), not to plan an event. These tasks likely support gesture use in a way that was not supported in the present study, as children are typically presented with physical objects to which they need to refer (such as glasses in a conservation task). Had gesture been scaffolded in 6^{th} grade in a similar fashion to 4^{th} grade, it is possible that this would have reduced cognitive load and in turn facilitated communication during planning.

These factors together suggest that the appearance of a decline in gesture and the stability in gaze and clusters of three and four behaviors from 4^{th} grade to 6^{th} grade may be more reflective of task differences rather than developmental decline. The findings of the present study extend the current literature, as evidence emerged that even subtle context differences can influence communication. There are also methodological implications inherent in these findings. Future studies of children's developing communication need to consider consistency in tasks and materials to index developmental change.

4.3 INDIVIDUAL DIFFERENCES AND STABILITY OVER TIME

Numerous studies have documented the fact that the production of communication is highly variable at the individual level (e.g., Acredolo & Goodwyn, 1988; Iverson, 1999; Kendon, 1967; Arnold, Semple, Beale, & Fletcher-Flinn, 2000). The findings of the present study are consistent with this view, as large ranges in the production of behaviors were apparent. For example, it was not uncommon for some children to rarely produce a behavior, such as a beat gesture, while others would produce beat gestures several times per minute. Moreover, correlations between 4^{th} grade and 6^{th} grade provided evidence that these individual differences were consistent over time.

The variability that emerged between individuals was mirrored within the production of different communicative behaviors concurrently. Specifically, there was evidence that some behaviors were produced at similar rates at one time point, particularly utterances and gestures. That there was evidence for stability between these two behaviors may be an indicator that preadolescent children are using speech and gesture as an integrated system. This finding is in line with both the infancy literature (e.g., Iverson et al., 1994; Iverson & Goldin-Meadow, 2005; Iverson & Thelen, 1999) and the adult literature (e.g., Kendon, 1997; McNeill, 1992), as there is evidence that gesture and speech are integrated in both populations. However, similar stability was not apparent between other behaviors (e.g., gesture and gaze).

In sum, though some behaviors appeared to cohere concurrently, there were large ranges in production rates of behaviors at the individual level. There was also evidence that this individual variability was consistent over time. The source of this variability is not well understood and is an important avenue for future research. One possibility is that child factors such as sociability or self-esteem contribute to these individual differences. It may be that children who are more social or self-confident are more likely to engage in eye contact, for example, than children who are less social or self-confident. Indeed, the adult literature supports this notion, as adults who have lower self-esteem engage in less frequent eye contact (e.g., Droney & Brooks, 1993; Kendon, 1967; Lagomarsino, Gallagher, Yankalunas, Brooks, O'Brien, 1998).

4.4 FUTURE DIRECTIONS

Since the present study is a first step toward describing preadolescent children's communication, there are several avenues open for future research. One is to investigate gender differences in nonverbal communication that may be present during preadolescence. Though a global index of communication revealed no gender differences in the present study, whether any such differences are present in more nuanced aspects of communication in preadolescence is unclear. For example, there is some evidence that adult females gaze more during conversations than adult males (e.g., Argyle & Cook, 1976, Ellsworth & Ludwig, 1972; Levine & Sutton-Smith, 1973); such differences may also be apparent in children. Indeed, studies have documented that female children gaze to partners more frequently than male children (e.g., Levine & Sutton-Smith, 1973). However, there is some evidence that context can interact with gender, as males tend to exhibit more gaze than females in certain settings. Specifically, males gaze more than females in threatening or uncomfortable situations (e.g., Henley, 1977), and males also gaze more than females while on dates (e.g., Adams & Kirkevold, 1978). Coupled with the findings of the present study that nonverbal use varied in different contexts, it is possible that male and female children use nonverbal behaviors differently in different settings. Additional research is warranted to examine potential gender differences in children's communication.

Second, the relatively small sample size in the present study may have obscured the ability to detect significant differences. That many of the correlations were marginal but did not reach significance points to the need to replicate this study with a larger sample size.

Third, many questions remain regarding the simultaneous use of multiple nonverbal behaviors. One such question involves the timing of different behaviors used together. For example, adults tend to look at their partners as they (the communicators) are completing utterances (Kendon, 1967). Do preadolescent children communicate in a similar way, and is this more apparent among 12-year-olds than 10-year-olds? Documenting this more specifically could strengthen the argument that children's gaze is transitioning during the preadolescent period.

Finally, the contexts in the present study were affiliative; children were engaged in cooperation with their friends and were enjoying themselves while conversing. Documenting how children use nonverbal communication in more acrimonious settings, such as conflict settings, may reveal different patterns of communication. Eye gaze, for example, can be used to signal threats or dominance (e.g., Argyle & Cook, 1976); it is therefore possible that, while engaged in conflict, children would be more prone to stare directly at their partner.

4.5 CONCLUSIONS

In sum, the findings of the present study suggest that during the preadolescent period, children make increasingly frequent use of communicative behaviors typical of adult interactions, indicating that it is indeed a transition period for nonverbal communication. That this transition was most apparent in an unstructured setting underscores the sensitivity of communication to variation in contexts. Future investigations of children's developing communication should be aware of this sensitivity, taking care to consider task demands and to employ comparable measures over time. These findings of this study therefore extend the current literature documenting change during preadolescence in cognitive and social systems to a new domain: communication.

APPENDIX A

INSTRUCTIONS TO PARTICIPANTS DURING LAB VISITS IN 4TH AND 6TH GRADE

A.1 4TH GRADE INSTRUCTIONS

A.1.1 Plan a Birthday Party

"You are now going to plan a birthday party. The party is for the both of you. We know that your birthdays are probably not on the same day, so some decisions will have to be made." If the children say they do share the same birth date, say, "Great, then this might be easier for you to do. To help you make your birthday plans, you can use this (places laminated game sheet on table). Let me explain everything before you start your plans. First decide on the date you will have the party, like the month and day, and then the time the party will begin and end. Next, talk over and decide where the party will take place; maybe someone's house or a special place. Then, decide on nine friends to invite, not including yourselves. Once you choose your friends, choose the kind of cake you want to eat and what flavor ice cream to have. Playing games at parties is fun, so choose three games for everyone to play. The very last decision to make is, what one birthday present do the both of you want and can share even if you don't live close by each other. Do you have any questions? It should take you about 10 minutes. I will open the door to tell you when you have just a few minutes left to finish. If you finish before I open the door, you can look up and wave, and I will come in. Remember, speak up—no whispering, stay in your seats, and start when I leave the room. Here is something for you to use to keep a record of what you are planning."

A.1.2 Snack

"Here is something for you to snack on. I have two different kinds of drinks, so you'll have to decide which one you want. Go ahead and have a nice conversation as you relax, but please don't whisper, I would still like to hear your voices. Enjoy your snack and I will be back in about seven minutes. Please stay in your seats."

A.2 6TH GRADE INSTRUCTIONS

A.2.1 Plan a Vacation

"You are going to plan a kids' only vacation. To help you make your vacation plans, you can use this (places planning sheet in front of children on table). Let me explain everything before you start your plans. First decide where you will go. Next talk over and decide which three friends, not including yourselves, you will take with you. Then decide how long you will be gone and how you will get to your vacation, like airplane, train or bus. Now think of the same five things that everyone can pack and how much money each can spend. The last two things to do are: decide on what four things you all can do together, and then write a short message to your parents about your vacation that you could put on a postcard. Do you have any questions? It should take you about seven minutes. I will open the door to tell you when you have just a few minutes left to finish. If you finish before I open the door, you should just continue to talk about your plans. Here are pencils for you to write your plans."

A.2.2 Snack

"Here is something for you to snack on. I have two drinks, one Nutri-Grain bar, a bag of potato chips, and some crackers. Go ahead and have a nice conversation as you relax, but please don't whisper, I would still like to hear your voices. Enjoy your snack and I will be back in about seven minutes." The RA looks up at the clock and says, "so that means about ____ o'clock. Please stay in your seats."

APPENDIX B

BIRTHDAY PARTY INVITATION

YOU'RE INVITED !!!

To a birthday party for

____________ & ____________

on

___________________ (date)

from

_________ (start time) to _________ (end time)

The party will be held at (place):

____

We have decided to invite these nine friends:

____________________	____________________	____________________
____________________	____________________	____________________
____________________	____________________	____________________

And we will be having

________________ cake and ___________ ice-cream!

We are going to be playing 3 fun games ~

________________,_________________ and _________________

The gift we would like to share is:

____

HOPE TO SEE YOU THERE !!!

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Chapter 61.4 Appendix D 6/12/00

APPENDIX C

PLAN A VACATION FORM

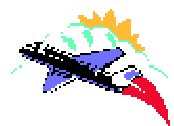
KIDS' WORLD VACATION PLANNERS

YOUR TRIP TO ______________________ HAS BEEN CONFIRMED!!!

YOU WILL BE TRAVELING WITH THESE 3 FRIENDS:

___________________ ___________________ ___________________

YOUR VACATION WILL LAST ________ DAYS.



YOU WILL BE TRAVELING BY (CIRCLE ONE):

A. CAR BUS TRAIN PLANE SHIP

OTHER:______________

DON'T FORGET TO MAKE YOUR PACKING LIST:

_____________ _____________ ____________ ____________

____

WHEN YOU GET THERE....

YOU CAN EACH SPEND $_____________ AND

YOU WILL ALL DO THESE 4 THINGS:

_______________ _______________ ______________

____

Write a short "postcard" to your parents about your trip:

APPENDIX D

CODING MANUAL

You will be coding communicative behaviors of a child (Study Child) who is partnered with a friend as they interact in two contexts. One context takes place during a snack break and the other context involves planning (either a birthday party or a vacation; code only the first 7 minutes of each context). Each video begins with an introduction, which will provide a label for the study child. Watch a brief amount of the video without coding to identify the study child, then restart the session and begin coding.

Using Windows Media Player and Excel, you will note the following behaviors in an Excel template. One spreadsheet should be used per participant with one tab for each context (see example). Please note: for the Planning tab, you must mark whether the participants are planning a vacation or a party (see example).

The coding sheet will also be a general record of events that occur in the session, including the start and stop times for each context. Code the start and stop times for each context at the top of the corresponding tab. Use the following guide for determining start times:

Snack: begin coding when tray hits table

Planning: begin coding when pencils hit table

Stop times should always be exactly 7 minutes after start times. For example, if the tray hits the table in the snack context at 1:42, you should then stop coding precisely at 8:42. If behaviors are active at either start or stop times, simply arbitrarily start or stop them at the specified context start and stop time.

If the children complete the task before 7 minutes are up, stop the context when the experimenter returns to the room (find the frame where the experimenter knocks on the door). The exact time of the experimenter's return should be recorded.

D.1 SPEECH

Transcribe all utterances produced by the study child. An utterance is defined as a sequence of words (which may not necessarily be bound by grammatical or sentence structure) marked by either: 1) preceding and following silence of at least 1 second; 2) change in conversational turn; or 3) change in intonation. Use a new row for each utterance.

When the speech is unintelligible or cannot be understood, denote with "XXX." If only part of the utterance is unintelligible, transcribe the portion of speech you can understand then include XXX where applicable.

- Example: "I want to go to XXX."

All other coding will be marked relative to utterances (see descriptions below for examples).

D.2 GESTURE

Gestures are the hand and arm movements made when people speak. To code gestures for the present study, we will focus on the movements of the arms and hands. Use the following procedure:

In order to enter your code, you will need the following information:

(1) Note the exact onset and offset of each gesture relative to the spoken utterance (all gesture coding should include the preparation, stroke, and retraction phases). Use **{** and **}** brackets to mark gesture occurrence. Example: If a deictic point occurs with the phrase "over there", the transcription would be marked with brackets as follows: "put the paper {over there}"; if the gesture occurs in the absence of speech, use a new row and write "**{ }**."

(2) In the same row as your brackets, identify gesture type (either **Deictic, Iconic**, **Metaphoric**, or **Beat** as follows).

D.2.1 Deictic gesture

Deictic gestures convey spatial information and are typically used to indicate persons, places, objects, or directions. Their most common manifestation is the pointing gesture. They typically accompany speech, but can also be used in place of speech (e.g., simply pointing in response to a question rather than providing a verbal response).

For deictic pointing gestures, distinguish between concrete and abstract:

(1) Concrete Point: e.g., pointing to a location or object to draw attention to it; pointing to indicate spatial information (e.g., to the right, to the left)

(2) Abstract Point: e.g., pointing to an empty chair in reference to a person who previously occupied it; pointing to a location to refer to the person who had been standing there

D.2.2 Iconic gestures

Iconic gestures give a visual representation of what is being said in speech, revealing the movement, shape, action, or some other feature related to speech. Examples of iconic gestures include: a downward facing hand that alternately moves extended index and middle fingers while pushing the hand forward, like moving legs, to represent a running character, or holding a fist by the shoulder, as if holding an umbrella.

D.2.3 Metaphoric gestures

Metaphoric gestures, so named because they serve as a metaphor for the spoken referent, are similar to iconics but are more abstract in nature. They typically represent abstract concepts, such as knowledge or language. The movements and shape of the hand do not directly relate to the spoken message like iconic gestures, but they are still easily interpreted. A common manifestation of a metaphoric gesture is presenting an idea to the addressee in a “box” or “container.” Examples include: extended hands as if holding an object while talking about an abstract idea, gesturing metaphorically by presenting the idea in a “container” held by the two hands, or cupping the hand while saying “can you tell me more about that,” gesturing metaphorically to represent the knowledge

D.2.4 Beat gestures

Beats tend to have a rhythmic quality. Beats also set up important parts of the spoken message, highlighting them for the addressee. These gestures differ drastically from others in many ways:

(1) they do not conceptually tie to the spoken message and appear to have no meaning

(2) they always take the same general shape and form, as rapid flicks of the hand

(3) they tend to happen wherever the communicator's hands are, such as on chair arm rests rather than in the space in front of the torso (typical gesture space)

Examples of beats include: a flick of the hand toward another person while saying "you know," or referencing an idea proposed by another person by flicking the hand toward that person

**NOTE: you will never code self-adapting behaviors (such as brushing hair out of the eyes, rubbing the nose, etc.) or emblematic gestures (gestures that are culturally determined, such as waving, the "peace sign", etc.)

D.3 EYE GAZE

You will code instances when the study child gazes at the face of his/her partner. When the study child gazes directly at the partner's face (imagine drawing a line from the study child's eyes to determine direction of gaze), note the onset of gaze within the transcription with "/". When study child looks away from the face, write "\" in the transcription. The / and \ codes should appear in the order of speech. Try to determine exact moment when child gazes at and away from friend.

For example, if a child's gaze begins and stops in the middle of the utterance, the transcription should appear as follows:

We /could go\ to Mexico

If a gaze occurs at the start of an utterance, write "/" immediately preceding the first word in the utterance. If the gaze occurs before the utterance begins, write "/"in a row above the utterance. Example:

Co-occurring gaze with utterance start:

/I think we should

Gaze beginning before utterance start:

/

I think we should

Use the same guidelines for offsets of gaze.

Note whether the partner is speaking at any point during the duration of the gaze. Advance the video frame-by-frame if you are uncertain about whether an overlap is occurring; if the friend speaks even for one frame of the study child's gaze, you should judge the gaze as occurring during partner speech

D.4 FACIAL EXPRESSIONS

You will rate facial expressions based on positive or negative affect. You will enter a code that corresponds to each type of facial expression and its start and stop embedded in utterance transcriptions (Column C). Use [and] to indicate affective displays. Example: child appears happy while saying “that’s funny”:

I think [that’s funny]

If affect occurs at the start of an utterance, write “[” immediately preceding the first word in the utterance. If the gaze occurs before the utterance begins, write “[”in a row above the utterance. Example:

Co-occurring affect with utterance start:

[let’s invite

Gaze beginning before utterance start:

[

let’s invite

Use the same guidelines for offsets of gaze.

Examples of Negative Affect: anger, sadness, disappointment, disgust, fear, etc.

Examples of Positive Affect: happiness, joy, contentment, laughter, smiling, etc.

**NOTE: some expressions, such as surprise, can be interpreted as either positive or negative. Use your best judgment to determine whether instances of these expressions are positive or negative, based on the overall facial expression

D.5 OVERALL COMMUNICATIVE ABILITY

D.5.1 Overall Communicative Ability

After coding the clip for speech, gesture, gaze, and facial expressions, rate overall communicativeness for each context (planning and snack) using the following scale, such that two scales be completed for each child.

Table 15: Overall communicative ability rating sheet for coders.

Unskilled	Slightly Unskilled	Neither Skilled nor Unskilled	Moderately Skilled	Skilled
1	2	3	4	5

D.5.2 Appropriateness of Nonverbal Communication

After coding a child's communication as described above, you will decide whether you think the study child's communication seems like typical nonverbal communication or nonverbal communication that is excessive or outside the realm of normal nonverbal communication. You will complete the following rating scale:

Table 16: Nonverbal appropriateness rating sheet for coders.

Very Odd Nonverbal Use	Slightly Inappropriate Nonverbal Use	Appropriate Nonverbal Use
1	2	3

APPENDIX E

GENDER ANALYSES

Repeated Measures ANOVA analyses were completed for the three global nonverbal categories (gesture, gaze, and facial expressions) with Grade and Context as within subjects factors and Gender as the between subjects factor. Though gender differences did emerge for these variables (see below), patterns were not systematic (see Table 17 for means, standard deviations, and ranges). Coupled with the lack of statistically significant gender differences for utterances, gender was not included in primary analyses.

E.1.1 Gesture

Females tended to gesture at higher rates than males, which was confirmed with a significant main effect of gender ($F(1,31) = 9.328$, $p = .005$).

E.1.2 Gaze

Though females tended to gaze more than males, males gazed more than females in the planning context in 6th grade (Grade x Context x Gender interaction: $F(1,31) = 4.68$, $p = .04$).

E.1.3 Facial expressions

Similar patterns emerged for facial expressions as were apparent with gaze. Namely, females tended to gaze more than males, but in 6th grade planning, males gazed more than females (Grade x Context x Gender interaction: $F(1,31) = 5.21$, $p = .03$).

Table 17: Mean rate per minute, *standard deviation*, and range of production of gesture, gaze, and facial expressions in 4th and 6th grade in planning and snack contexts by gender.

			Gesture		Gaze		Facial Expressions	
			Males	**Females**	**Males**	**Females**	**Males**	**Females**
4th Grade	**Planning**	**Mean Rate**	1.81	2.94	3.14	3.73	2.54	3.91
		SD	*(1.74)*	*(2.04)*	*(1.73)*	*(1.18)*	*(1.53)*	*(1.42)*
		Range	0.57-7.45	0.30-8.71	1.00-8.00	0.30-8.00	0.96-7.02	0.27-7.02
	Snack	**Mean Rate**	1.27	2.12	4.90	5.26	3.01	4.60
		SD	*(1.13)*	*(1.05)*	*(2.15)*	*(1.62)*	*(1.32)*	*(1.38)*
		Range	0.14-4.43	0.14-4.43	2.00-9.79	0.37-9.79	0.86-5.57	0.23-7.57
6th Grade	**Planning**	**Mean Rate**	0.94	1.97	3.72	3.61	3.83	3.28
		SD	*(.47)*	*(1.46)*	*(1.72)*	*(1.80)*	*(1.45)*	*(1.35)*
		Range	0.14-1.84	0.00-5.57	1.57-7.57	0.30-7.57	1.47-6.43	0.25-6.71
	Snack	**Mean Rate**	1.79	3.31	5.82	7.40	3.24	4.22
		SD	*(1.37)*	*(2.27)*	*(2.63)*	*(2.10)*	*(1.09)*	*(1.19)*
		Range	0.67-5.00	0.24-8.29	1.57-9.86	0.46-10.29	1.57-5.17	0.19-7.00

APPENDIX F

ANCOVA ANALYSES: UTTERANCES AS COVARIATE

The purpose of these analyses was to test whether change in speech production (defined as utterance slope from 4th grade to 6th grade) was linked to change in the production of nonverbal behaviors. Repeated Measures ANCOVAs were carried out on the three global nonverbal behaviors (gesture, gaze, and facial expressions), with utterance slope as the covariate, separately for planning and snack contexts. See Section 3.3 for means and standard deviations.

F.1 GESTURE

In the planning context, there was a decrease both in utterance and gesture production. Analyses revealed a significant main effect of Grade ($F(1,31) = 7.50$, $p = .01$), but the Grade x Utterance Slope interaction ($F(1,31) = .27$, $p = .61$) was not significant. Therefore, the decrease in gesture production rates from 4th grade to 6th grade was not dependent on the decrease in utterance production.

In the snack context, where both utterance and gesture rates increased, analyses revealed both a significant main effect of Grade ($F(1,31) = 8.07$, $p = .008$) and a significant Grade x

Utterance Slope interaction ($F(1,31) = 6.05$, $p = .02$), which suggests that the change in gesture was dependent on the change in utterances. To determine the source of the interaction, three groups of children were created based on utterance slope. Groups were defined by ordering children's slopes from lowest to highest, with three groups being arbitrarily created (11 children comprised each group): those with Low, Medium, and High degrees of change. Though children were divided arbitrarily into groups, all children in the Low group had negative rates of utterance change (indicating a decrease from 4th to 6th grade), whereas children whose rates were Medium or High exhibited positive change, or an increase, from 4th to 6th grade.[4]

Figure 15 shows rate of change from 4th grade to 6th grade for the Low, Medium, and High groups. As is evident in the figure, children whose utterance change was positive (Medium and High groups) increased in gesture production from 4th to 6th grade, whereas children whose utterance change was negative generally produced fewer gestures in 4th than 6th grade.

[4] There was one exception, as the slope for one child was 0 (this child was part of the Medium group).

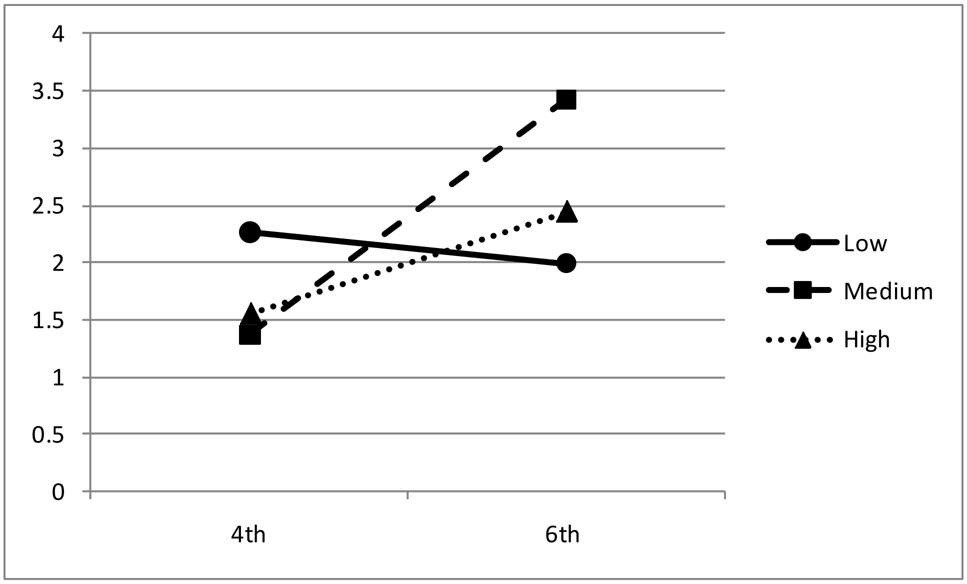


Figure 15: Gesture production during the snack context in 4th and 6th grades as a function of utterance slope group.

F.2 GAZE

In the planning context, neither the main effect of Grade nor the Grade x Utterance Slope interaction was significant (Grade: $F(1,31) = .13$, $p = .72$; Grade x Slope interaction: $F(1,31) = 3.05$, $p = .09$), indicating that the change in utterances did not influence change in gazing to partner from 4th to 6th grade. In the snack context, the main effect of Grade was highly significant ($F(1, 31) = 12.79$, $p = .001$), but the Grade x Utterance Slope interaction did not approach significance ($F(1, 31) = .27$, $p = .61$). Therefore, in the snack context, change in gaze was not linked to change in utterances.

F.3 FACIAL EXPRESSIONS

As facial expressions exhibited only slight change from 4^{th} to 6^{th} grade in both contexts, it is not surprising that analyses revealed no association with utterance change. In both contexts, the main effect of Grade (Planning: $F(1,31) = .37$, $p = .55$; Snack: $F(1, 31) = .20$, $p = .66$) and the Grade x Utterance Slope (Planning: $F(1,31) = .53$, $p = .47$; Snack: $F(1, 31) = .02$, $p = .89$) interaction were not significant.

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