

**LOOK AT MOMMY: ATTENTION-RELATED COMMUNICATION IN MOTHERS OF  
CHILDREN AT RISK FOR AUTISM**

by

**Karen P. Jakubowski**

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This thesis was presented

by

Karen P. Jakubowski

It was defended on

April 18, 2011

and approved by

Celia Brownell, PhD, University of Pittsburgh, Dept. of Psychology

Susan B. Campbell, PhD, University of Pittsburgh, Dept. of Psychology

Robert H. Wozniak, PhD, Bryn Mawr College, Dept. of Psychology

Thesis Advisor: Jana M. Iverson, PhD, University of Pittsburgh, Dept. of Psychology

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Attentional difficulties are evident in children with autism spectrum disorders (ASD; Landry & Bryson, 2004). Subtle atypicalities in attention are also apparent among later-born siblings of children with ASD (themselves at heightened biological risk for an ASD diagnosis; high-risk toddlers; HR), even those who are not eventually diagnosed with ASD (e.g., Merin et al., 2007). Mothers of children with ASD may modify child-directed communication to direct and maintain the child's attention (e.g., Adamson et al., 2001), and this pattern may generalize to communication with later-born HR infants. In light of this evidence, the present study explored patterns of child-directed communication in mothers of 18-month-old HR toddlers and mothers of same-age later-born toddlers with no family history of ASD (low-risk toddlers; LR), focusing particularly on the production of attention-related communication (i.e., communication focusing on capturing, directing, and maintaining children's attention and/or actions) and compared HR and LR toddlers' responses to maternal attention-related communication. Although both groups of mothers displayed relatively similar patterns of attention-related communication, mothers of HR toddlers produced significantly more utterances that involved attentionally salient words. Additionally, HR toddlers were less likely to respond to attention-related communication. In general, these findings suggest that having an older child with ASD may influence maternal behavior with later-born children, even when those children do not themselves necessarily

manifest obvious ASD symptomatology. They also highlight the need for further research on dyadic interactions between mothers and HR infants.

## TABLE OF CONTENTS

<b>PREFACE.....</b>	<b>XI</b>
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
<b>1.1 MATERNAL INPUT TO TYPICALLY DEVELOPING CHILDREN.....</b>	<b>2</b>
<b>1.2 MATERNAL INPUT TO DEVELOPMENTALLY DELAYED CHILDREN</b>	
.....	<b>3</b>
<b>1.3 MATERNAL INPUT TO CHILDREN WITH ASD .....</b>	<b>4</b>
<b>1.4 ASD: HIGH-RISK INFANT SIBLINGS.....</b>	<b>6</b>
<b>1.5 THE PRESENT STUDY .....</b>	<b>7</b>
<b>1.5.1 Prediction 1: Attention-related Communication .....</b>	<b>7</b>
<b>1.5.2 Prediction 2: Change Utterances.....</b>	<b>8</b>
<b>1.5.3 Exploratory Group Comparisons.....</b>	<b>9</b>
<b>2.0 METHODS .....</b>	<b>10</b>
<b>2.1 PARTICIPANTS .....</b>	<b>10</b>
<b>2.2 PROCEDURE .....</b>	<b>11</b>
<b>2.2.1 Coding .....</b>	<b>11</b>
<b>2.2.1.1 Utterance Composition.....</b>	<b>12</b>
<b>2.2.1.2 Speech Type.....</b>	<b>12</b>
<b>2.2.1.3 Utterance Function .....</b>	<b>13</b>

2.2.1.4	Attention-directing speech .....	13
2.2.1.5	Focus Type .....	14
2.2.1.6	Child Response .....	14
2.2.1.7	Reliability .....	16
<b>3.0</b>	<b>RESULTS .....</b>	<b>17</b>
<b>3.1</b>	<b>PRELIMINARY ANALYSES.....</b>	<b>17</b>
<b>3.2</b>	<b>OVERALL CHILD-DIRECTED COMMUNICATION.....</b>	<b>18</b>
3.2.1	Utterance Composition.....	18
3.2.2	Speech Type.....	19
<b>3.3</b>	<b>PREDICTION-DRIVEN ANALYSES .....</b>	<b>20</b>
3.3.1	Prediction 1.....	20
3.3.2	Prediction 2.....	25
<b>3.4</b>	<b>EXPLORATORY GROUP COMPARISONS.....</b>	<b>27</b>
3.4.1	Child responses to Call to Attention utterances.....	28
3.4.2	Child responses to Directive/demand utterances .....	29
<b>4.0</b>	<b>DISCUSSION .....</b>	<b>32</b>
<b>4.1</b>	<b>FUTURE DIRECTIONS.....</b>	<b>40</b>
<b>4.2</b>	<b>SUMMARY .....</b>	<b>41</b>
	<b>APPENDIX A .....</b>	<b>41</b>
	<b>APPENDIX B .....</b>	<b>47</b>
	<b>APPENDIX C .....</b>	<b>58</b>
	<b>APPENDIX D .....</b>	<b>60</b>
	<b>APPENDIX E .....</b>	<b>62</b>

<b>APPENDIX F .....</b>	<b>63</b>
<b>REFERENCES.....</b>	<b>64</b>

## LIST OF TABLES

Table 1. Maternal Attention-Related Communication Coding System .....	41
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## LIST OF FIGURES

Figure 1. Overall Utterance Composition.....	19
Figure 2. Speech Type .....	20
Figure 3. Attention- vs. Non-Attention-Directing Speech.....	22
Figure 4. Mixed Utterances.....	24
Figure 5. Attention-Directing Speech + G/A/B Utterances .....	25
Figure 6. Focus Type: Maintain vs. Change Utterances.....	26
Figure 7. Child Responses to Call to Attention Utterances .....	29
Figure 8. Child Responses to Directive/demand Utterances .....	30
Figure 9. Child Responses to Focus Type .....	31

## **PREFACE**

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## 1.0 INTRODUCTION

We live in a social world, and the world of infants is no different. Developing infants are assigned the incredible task of engaging with the social world in ways that help them meaningfully extract information about the people, objects, and events around them. One of the earliest and most salient social interactions that infants experience is that with their primary caregiver. Infants have countless interactions with their primary caregivers, many of which serve to capture, direct, or maintain their attention. For example, when playing with a set of blocks, a caregiver may attempt to initiate the activity by first capturing the infant's attention: "Let's play with your blocks!" or "Can you get your blocks?" She may attempt to further direct the infant's behavior by making statements such as "Give mommy a block" or "Put that one on top." The mother may maintain the child's engagement in the activity by saying "Look at the tower!" or "Look how tall it is!" All of these examples serve to demonstrate the levels of complexity in communication between a primary caregiver and infant, with an emphasis on the fundamental role that attention plays in such communication.

## 1.1 MATERNAL INPUT TO TYPICALLY DEVELOPING CHILDREN

Maternal communication has been well studied in mothers of both typically developing and developmentally delayed children. Previous research indicates that there is a relationship between maternal language and language development in infants, such that mothers simplify their speech in relation to the age and perceived communicative capabilities of the child (e.g., Newport, Gleitman, & Gleitman, 1977). Speech directed to infants who are in the initial stages of the language-learning process is characterized by short, syntactically simple utterances with frequent repetitions and exaggerated intonation; this manner of speech is often called “motherese” (Newport et al., 1977). In addition to simplifying their speech, mothers tend to follow the child’s current focus of attention and produce a series of utterances on the same topic (Gathercole & Hoff, 2007). Mothers’ verbal simplification and pattern of communicative adaptations (relative to their children’s language capabilities) has been suggested to facilitate language learning and comprehension in their children (e.g., Iverson, Capirci, Longobardi, & Caselli, 1999).

Although much of the literature on maternal input has focused on speech, caregivers also produce gestures with their speech. Iverson et al. (1999) investigated the nature and content of mothers’ gestures as they interacted with their typically developing children at 16 and 20 months of age. Mothers followed a consistent and unique pattern of producing a limited repertoire of concrete, informationally redundant gestures when speaking to their children, which they termed a “gestural motherese”. These gestures appeared to attract attention to important words and/or objects and to reinforce the meaning of a verbal message, thus providing children with an additional opportunity to recognize and process communicative information more effectively.

## **1.2 MATERNAL INPUT TO DEVELOPMENTALLY DELAYED CHILDREN**

The importance of nonverbal behaviors is even more evident when considering populations of children that are not typically developing. Schmidt and Lawson (2002) demonstrated that pointing gestures play a major role in caregiver attention-focusing for their very low birthweight, preterm children; they suggested that such nonverbal behaviors may provide additional information about the verbal component of the input. This pattern of verbal and gestural simplification is also apparent in the communicative interactions of mothers who have a child with Down syndrome (DS). Iverson, Longobardi, Spampinato, and Caselli (2006) reported that relative to mothers of TD children at roughly the same expressive language levels, mothers of children with DS exhibited an enhanced pattern of communicative modifications, such as holding the gesture throughout the entire duration of verbal utterances and producing more “showing” gestures, in which both the gesture and the referent are in physical contact. It is likely that showing gestures, which provide a concrete link between gesture and referent, may be more attentionally salient for young children with DS than pointing gestures, which are often distanced from their referents. In addition, there was a significant positive relationship between the extent of the child’s developmental delay and the frequency of gestures in maternal communication. A potential explanation for this result is that because DS involves difficulty in shifting attention (e.g., Krakow & Kopp, 1982; Landry & Chapieski, 1989), more extensive use of gesture may be an indicator of greater maternal efforts to direct and maintain the child’s attention.

### 1.3 MATERNAL INPUT TO CHILDREN WITH ASD

ASD is a developmental disorder characterized by attention deficits (e.g., Landry & Bryson, 2004). Children with ASD display difficulty in visually disengaging and shifting attention. Landry and Bryson (2004) compared the ability of children with ASD, children with DS, and TD children to disengage from a central visual stimulus and a competing peripheral stimulus. They found that children with ASD displayed difficulty disengaging from one of the two stimuli, in addition to showing difficulty in making rapid attentional shifts between competing stimuli. These results were upheld by Newell et al. (2007), who used a similar methodology and found that children with ASD displayed difficulties in disengaging attention, relative to mental-age matched TD children. The attentional deficiencies observed in children with ASD have been termed “sticky” attention by Ibanez et al. (2008). In light of these attentional difficulties, investigations into the nature of communicative control strategies employed by mothers of children with ASD are particularly important; they have provided useful information concerning the differences in control strategies across mothers of children with ASD, mothers of TD children, and mothers of children with mental retardation (MR).

Kasari, Sigman, Mundy, and Yirmiya (1988) suggested that caregivers of children with ASD were as responsive to their children as caregivers of children with MR and TD children, but the control strategies employed by caregivers of children with ASD were more similar to those employed by caregivers of children with MR. Furthermore, they found that caregivers of children with MR produced more points to objects, while caregivers of children with ASD spent more time physically maintaining their child’s focus on a task, such as offering objects to the child (Kasari et al., 1988). They concluded that caregivers of children with MR and caregivers of

children with ASD utilized more direct behaviors with their children, presumably as a way of maintaining their child's focus on joint tasks or activities, and that caregivers' responses to their children with ASD reflected an awareness of their child's joint attention deficiencies (Kasari et al., 1988). This maternal awareness is also indicated in the work of Leekam et al. (1998), in which mothers of children with ASD reported that their children were more successful at following gaze only when it was accompanied by both verbal and gestural cues; thus, providing children with ASD with both verbal and nonverbal content may help them to understand the intended message.

It is possible, at least in principle, that maternal awareness of the child's attentional focus is influenced by mothers' experience with and involvement in intervention services such as Applied Behavior Analysis (ABA). ABA is a behavioral treatment that involves careful assessment of how environmental events interact to influence an individual's behavior; this information is then used to create and implement interventions designed to change behaviors. Although there is an expanding body of treatments directed to children with ASD, ABA has the most empirical support and therefore is widely identified as the "treatment of choice" to address and improve a range of deficits for children with ASD, particularly social, communicative, and cognitive skills (Vismara & Rogers, 2010).

ABA techniques are based on operant learning paradigms, and thus they involve a rigorous, repetitive component. The best known of the behavioral approaches, and the most relevant to this discussion, is early intensive behavioral intervention (EIBI; "early" refers to its delivery before the age of 5 years; Vismara & Rogers, 2010). It involves breaking down complex skills and teaching them in many repeated trials, using concise and direct instructions for child responses (Vismara & Rogers, 2010). Given the intense nature of ABA intervention and its

pervasive utilization for children with ASD, mothers of children with ASD may be influenced by the structured, directive nature of the intervention, and ABA techniques they employ when communicating with their child with ASD may be present in their interactions with younger siblings of the child with ASD.

#### **1.4 ASD: HIGH-RISK INFANT SIBLINGS**

Recent research has indicated that later-born siblings of children who have been diagnosed with ASD are at heightened biological risk for the disorder (e.g., Zwaigenbaum et al., 2006). Subtle atypicalities in attention are also apparent among high-risk (HR) infants, even those who are not eventually diagnosed with ASD (e.g., Merin et al., 2007). Further evidence for these atypicalities has been provided by Ibanez et al. (2008), who used the Face-to-Face/Still-Face Protocol (FFSF) to compare the ability of HR infants and infants with no family history of ASD (low-risk; LR) to disengage visually from their parents' faces. They found that as a group, HR infants shifted their gaze to and from their parents' faces less frequently than LR infants and also had longer mean durations of gaze away from their parents' faces. Currently, there is no research examining whether mothers of HR infants may be sensitive to these possible attentional atypicalities and therefore adopt a style of communication characterized by a heavy focus on infants' attention.

## 1.5 THE PRESENT STUDY

The evidence reviewed above suggests that when mothers interact with a child who has attention difficulties, their communication is more likely to focus on capturing, directing, and maintaining the child's attention than that of mothers of TD children. In light of these considerations, the present study had three main goals: a) to describe communication produced by mothers of 18 month-old HR and of same-aged LR toddlers when interacting with their children; b) to examine attention-related communication in mothers of HR toddlers and compare it to that of mothers of LR toddlers; and c) to explore how HR and LR toddlers respond to maternal attention-related communication. In addition to providing descriptive information about the nature of communication in the two groups of mothers, the study will investigate two primary sets of predictions regarding maternal attention related communication in HR vs. LR mothers and a series of exploratory questions having to do with children's responses to such communication.

### 1.5.1 Prediction 1: Attention-related Communication

*Prediction 1: HR mothers will produce more attention-related communication than LR mothers.*

Since mothers of HR toddlers have a history of interacting with an older child with ASD-related attentional difficulties, presumably some experience working with their older child in the context of highly structured, directive interventions such as ABA, and heightened levels of concern about their later-born child's development (Ozonoff et al., 2009), it is expected that HR mothers will make more extensive use of attention-related communication than mothers of LR infants.

There are at least two ways in which maternal communication may direct children's attention. One is through explicit verbal means (e.g., attentionally salient words such as "Hey!" or "Look!"). A second way is through the use of gestures and other nonverbal cues (e.g., actions on objects or the child's body), which may be additional means for effectively directing and maintaining children's attention (e.g., Presmanes et al., 2006), particularly when combined with speech (e.g., "The ball is blue" + POINT to a picture) and especially with attention-related speech (e.g., "Hey" + POINT to an object). These considerations led to the following predictions:

- A. Relative to LR mothers, HR mothers will produce more utterances containing attention-directing speech.
- B. Relative to LR mothers, HR mothers will produce more utterances consisting of speech accompanied by highly salient nonverbal behaviors, specifically actions on objects and/or behaviors involving touching or manipulating the child's body.
- C. HR mothers will produce utterances that involve both attention-directing speech *and* a nonverbal component (gesture, action, or behavior) more frequently than LR mothers.

### **1.5.2 Prediction 2: Change Utterances**

*Prediction 2: HR mothers will produce more utterances that attempt to change the child's current attentional focus than LR mothers.*

Watson (1998) found that mothers of children with ASD produced significantly more "out-of-focus" utterances (defined as utterances that related to the immediate context but not to the child's current attentional focus) compared to mothers of TD children. Watson also reported

that children with ASD displayed variable patterns of interaction with toys – either focused on one toy in particular or on many different toys for brief periods of time – so out-of-focus utterances may have been an attempt by mothers to capture and direct the child’s attention. Therefore, in light of the subtle attentional deficits that have been reported for younger HR children (Merin et al., 2007), and if mothers of HR toddlers are more focused on their child’s attentional state, it is expected that HR mothers will produce more utterances that attempt to change the child’s attentional focus than LR mothers.

### **1.5.3 Exploratory Group Comparisons**

To date there are no published studies comparing the responses of HR and LR toddlers to maternal attention-directing communication. Therefore, a third goal of this study is to explore HR and LR toddlers’ responses to maternal attention-related communication, focusing specifically on the following questions:

- A. Are there differences in HR and LR toddlers’ responses to utterances that involve only attention-directing speech vs. to utterances that involve attention-directing speech accompanied by a gesture, action, or behavior?
- B. Do HR and LR toddlers differ in rate of responding to maternal utterances that attempt to change vs. maintain their attentional focus?

## 2.0 METHODS

### 2.1 PARTICIPANTS

The sample consisted of 22 mother-child dyads selected from larger samples of infants from three longitudinal studies. Eleven toddlers (6 males and 5 females) had an older TD sibling and no family history of ASD (i.e., no first- or second-degree relatives with an ASD diagnosis).

Eleven toddlers (6 males and 5 females) had an older sibling diagnosed with ASD. Diagnostic status of HR toddlers' older sibling with ASD was confirmed with the Autism Diagnostic Observation Schedule prior to study enrollment (ADOS; Lord et al., 2000). Mean age of ASD siblings at time of study enrollment of later-born HR toddlers was 5 years (range = 3-10 years). At study completion (36 months of age), none of the HR toddlers met diagnostic criteria for ASD. Average standard scores on the Mullen Scales of Early Learning for HR toddlers at the 36-month age point was 102.36 (range = 67-122).

All mothers and toddlers in the LR and HR samples were Caucasian and came from monolingual English-speaking homes. Toddlers in both groups were from full-term uncomplicated pregnancies. Mean maternal age did not differ significantly by group ( $M_{LR} = 32.5$ ,  $SD = 4.90$ ;  $M_{HR} = 32.6$ ,  $SD = 4.48$ ). All mothers had completed college or had some college, and approximately half of all mothers worked part-time or full-time.

## 2.2 PROCEDURE

Toddlers were observed at home at a time when the mother expected the child to be most alert and interactive. Toddlers in the LR group were observed biweekly from 2 to 19 months of age. Toddlers in the HR group were followed monthly from 5 to 14 months of age, with a follow-up at 18 months. Data were collected during 45-minute-long videotaped sessions that focused on mother-child interaction in naturalistic and toy play settings. The naturalistic setting consisted of unstructured interaction between the mother and child, such as daily routines or activities. During this time, mothers were encouraged to interact with their children as they normally would. The toy play setting consisted of semi-structured play between the mother and infant. During this segment of the observation, mothers were encouraged to engage their children in play and in social interaction with familiar toys. The present study utilizes data from the naturalistic and toy play segments at the 18-month session for both groups.

### 2.2.1 Coding

Coding focused on a 10-minute segment of dyadic interaction that occurred during naturalistic and toy play settings. All maternal communication produced during the segment was transcribed verbatim and separated into utterances. An *utterance* was defined as a sequence of words and/or gestures that are preceded and followed by a silence, a change in conversational turns, or a change in intonational patterns (e.g., Iverson et al., 1999). The composition, type, and function of maternal utterances were coded, along with the relationship between the utterance and the child's attentional focus and the child's response to the maternal utterance. The coding scheme is

presented in Appendix A with examples taken from the corpus for each category (see Appendix B for the complete coding manual and a coding decision tree).

### **2.2.1.1 Utterance Composition**

All utterances were classified into one of three categories on the basis of their composition. *Speech only* utterances consisted solely of verbal communication, with no accompanying gestures, actions, or behaviors. *Mixed* utterances consisted of speech accompanied by a gesture (pointing, showing, representational gestures; e.g., beckoning), an action (involving the use of an object in hand), or a behavior (physical action on the child's body). *Gesture/Action/Behavior only (G/A/B only)* utterances consisted of a gesture, action, or behavior with no accompanying speech.

### **2.2.1.2 Speech Type**

All utterances containing speech (i.e., all Speech Only and Mixed utterances) were next coded for the type of speech they involved. *Imperative* utterances involved the direct expression of a command using conventional imperative syntax (e.g. Adams & Ramey, 1980). *Questions* were syntactically marked by “wh” words (e.g., *where, when, what, who*) or by raised intonation of voice (Howlin et al, 1973). *Comments* concerned the objects and events currently present in the child's experience and universal statements related to objects currently present (Snow et al., 1976). Finally, utterances were coded as *Inaudible* if part of utterance was not comprehensible and the utterance function could not be determined. For utterances where there was visual evidence that the mother was speaking, but nothing could be heard due to competing noises in the home environment or audio difficulties, no speech was transcribed. Inaudible utterances

accounted for fewer than 5% of all utterances for both groups and thus were excluded from further analyses.

### **2.2.1.3 Utterance Function**

Next, utterances containing speech were grouped into one of the following five categories on the basis of their communicative function: Call to Attention, Directive/demand, Labeling, Suggestion, or Residual Language. *Call to Attention* utterances involved explicit attentional speech (e.g., Konstantareas et al., 1988). *Directive/demand* utterances involved the mother directing the child to speak or to respond motorically, as defined by Konstantareas et al. (1988). *Object Labeling* utterances involved explicit identification of an object by parent, by providing labels of whole objects, or of parts/characteristics of objects. *Suggestion* utterances involved either: 1) Use of a conditional verb; 2) the proposition of an activity or the proposition of an object for the child to take; 3) polite requests for objects; or 4) “polite” demands, defined as a demand made in a question format that did not involve a conditional word. Lastly, *Residual language* utterances were general statements made by parent to child with no response expected (e.g., “You are being silly today”; Konstantareas et al., 1988).

### **2.2.1.4 Attention-directing speech**

All Call to Attention and Directive/demand utterances were further classified as *attention-directing speech*. In addition, given the attention-directing nature of gestures, actions, and behaviors, Mixed + G/A/B utterances and G/A/B only utterances were also categorized as having attention-directing properties. All attention-directing utterances were further coded for Focus Type and Child Response. Utterances that did not have attention-directing properties (i.e., Object

Labeling, Suggestion, and Residual Language utterances consisting of speech only) were coded no further.

#### **2.2.1.5 Focus Type**

Attention-related utterances were next examined to determine whether they maintained or attempted to change a child's focus of attention. *Maintain* was coded when the child was actively attending to a source of stimulation and the maternal utterance related to the current focus of the child's attention. When focus was ambiguous, the "maintain" code was most conservative option. *Change* was coded when the child was actively attending to a particular object or stimulus and the utterance related to a completely different object or stimulus (e.g., child was playing with a puzzle and mother said "Get your shopping cart"), or if the utterance related to a different aspect of the stimulus the child was currently attending to (e.g., the child was playing with a red stacking ring; mother held out a blue ring to the child and said "Put this one on first").

#### **2.2.1.6 Child Response**

Lastly, attention-related utterances were coded for *child response*. This involved assessing the agreement between maternal attempts to direct the child's attention and the child's responses. Child responses to Calls to Attention and utterances that involved a gesture, action, or behavior were coded as *Look at Mother*, *Look at Target*, *No Response*, or *Uncodable*. *Look at Mother* was coded if the child responded to the maternal utterance by looking at the mother or in the mother's direction (e.g., mother said "Hey you!" and child looked at mother). Responses were coded as *Look at Target* if the child responded to the mother by looking at the focus of the utterance or by continuing to focus on the same object or event as the mother (e.g., mother said

“Look at the pig” and the child looked at the pig). For instances in which the mother was holding the toy she wanted the child to focus on, it was more conservative to code *Look at Target* than *Look at Mother*. *No response* was coded if the child ignored or failed to respond to the mother, the focus of the utterance, or the gesture, action, or behavior (e.g., mother said “Look at the flower” and the child ignored the mother). Responses were classified as *Uncodable* in the following two scenarios: 1) Simultaneous Bid-Response: Mother requested child’s action as the child was already performing that particular action (e.g., mother said “Get the ball” as the child was in the process of picking up the ball); or 2) Poor camera angle: the child’s gaze or action could not fully be seen, thus there was not enough evidence to determine how the child responded (e.g., mother said “Look at the car” and the child’s face was blocked, so it could not be determined if the child looked or not).

Child responses to Directive/Demand utterances were coded using the previously described four codes and two additional codes – *Appropriate motor response* or *No opportunity* – for a total of 6 possible codes. *Appropriate motor response* was coded if the child responded to the maternal utterance by performing the requested action or another action that is reasonably related to the focus of the utterance, no more than two seconds after the utterance (e.g., mother said “Get your ball” and child picked up a ball; mother said “Say duck” and the child responded by producing a sound). *No opportunity* was coded if the mother produced a Directive/Demand utterance and immediately responded to her request for action before the child had an opportunity to respond (e.g. mother said “Get your shopping cart” and grabbed it herself, before the child had an opportunity to get it). For purposes of statistical analyses, child responses were collapsed across the *Look at Mother*, *Look at Target*, and *Appropriate Motor Response* categories. All analyses described below involving child responses reflect the number of

responses (totaled across the three categories listed above) out of the number of possible child responses (i.e., the sum of responses and no responses). Data for Uncodable and No opportunity responses were not analyzed.

### **2.2.1.7 Reliability**

To assess inter-rater reliability, a second trained observer independently transcribed communication for six mother-child dyads (3 HR, 3 LR) and coded transcripts for five mother-child dyads (3 HR, 2 LR). Mean percent agreement for the identification and transcription of maternal utterances was 90% (range = .81-.93). Cohen's kappa (Cohen, 1960) statistics were calculated to assess agreement for identification of coded measures: Utterance Composition, Speech Type, Utterance Function, Focus Type, and Child Response. The mean kappas were as follows: Utterance Composition ( $\kappa = .96$ , range = .89-1.0), Speech Type ( $\kappa = .97$ , range = .89-1.0), Utterance Function ( $\kappa = .88$ , range = .77-1.0), Focus Type ( $\kappa = .99$ , range = .94-1.0), and Child response ( $\kappa = .94$ , range = .84-1.0). Inter-coder disagreements were resolved by watching segments of interest in the video clips and discussing the most appropriate consensus codes; these codes were incorporated in the data analysis.

### 3.0 RESULTS

The present study was designed to examine and compare communication in mothers of LR and HR toddlers, with a particular focus on mothers' production of attention-related communication and children's responses to this type of communication. Following presentation of preliminary analyses, I describe the nature of child-directed communication in LR and HR mothers. This is followed by data relevant to the two sets of primary predictions and the exploratory questions in turn.

#### 3.1 PRELIMINARY ANALYSES

Because there was some variation in the relative amounts of time coded during the naturalistic and toy play settings, a preliminary analysis was conducted to ensure that these did not vary systematically by group. Amounts of time coded in the two contexts were analyzed by averaging the length of the segments (in sec) selected from naturalistic ( $M_{LR} = 193.45$ ,  $SD = 250.68$ ;  $M_{HR} = 163.64$ ,  $SD = 280.26$ ) and toy play ( $M_{LR} = 403.00$ ,  $SD = 253.64$ ;  $M_{HR} = 436.36$ ,  $SD = 280.26$ ) respectively for LR and HR mothers. Independent samples  $t$  tests revealed no group differences in amounts of time coded in naturalistic,  $t(20) = .263$ ,  $ns$ , or toy play contexts,  $t(20) = -.293$ ,  $ns$ .

Preliminary analyses also revealed no differences in the numbers of utterances produced by LR and HR mothers during the 10-minute segment ( $M_{LR} = 155.2$ , range = 98-295;  $M_{HR} = 159.0$ , range 72-284;  $t(20) = -.163$ , *ns*). Thus, all variables to be reported below were calculated as rates per 10 minutes and averaged across mothers in each group.

Given the substantial individual variability in maternal production of the various communicative behaviors, data analyses were nonparametric and made use of Mann-Whitney or Wilcoxon matched-pairs signed-ranks tests as appropriate. Fishers Exact tests were also used to compare distributions for the LR and HR groups.

## **3.2 OVERALL CHILD-DIRECTED COMMUNICATION**

To provide a general picture of the nature of child-directed communication produced by LR and HR mothers, an initial set of analyses was conducted to examine Utterance Composition and Speech Type.

### **3.2.1 Utterance Composition**

Data on mean rates of Speech Only, Mixed, and G/A/B only utterances are presented in Figure 1. The majority of communication for both groups of mothers consisted of Speech Only utterances, followed by Mixed and G/A/B only utterances in that order. As is also apparent, LR and HR mothers produced similar rates of Speech Only ( $M_{LR} = 124.59$ ,  $SD = 35.44$ ;  $M_{HR} = 136.27$ ,  $SD = 56.21$ ), Mixed ( $M_{LR} = 28.74$ ,  $SD = 21.06$ ;  $M_{HR} = 18.91$ ,  $SD = .13.42$ ), and G/A/B only utterances

( $M_{LR} = 2.46$ ,  $SD = 3.01$ ;  $M_{HR} = 3.64$ ,  $SD = .3.26$ ). None of these comparisons was statistically reliable.

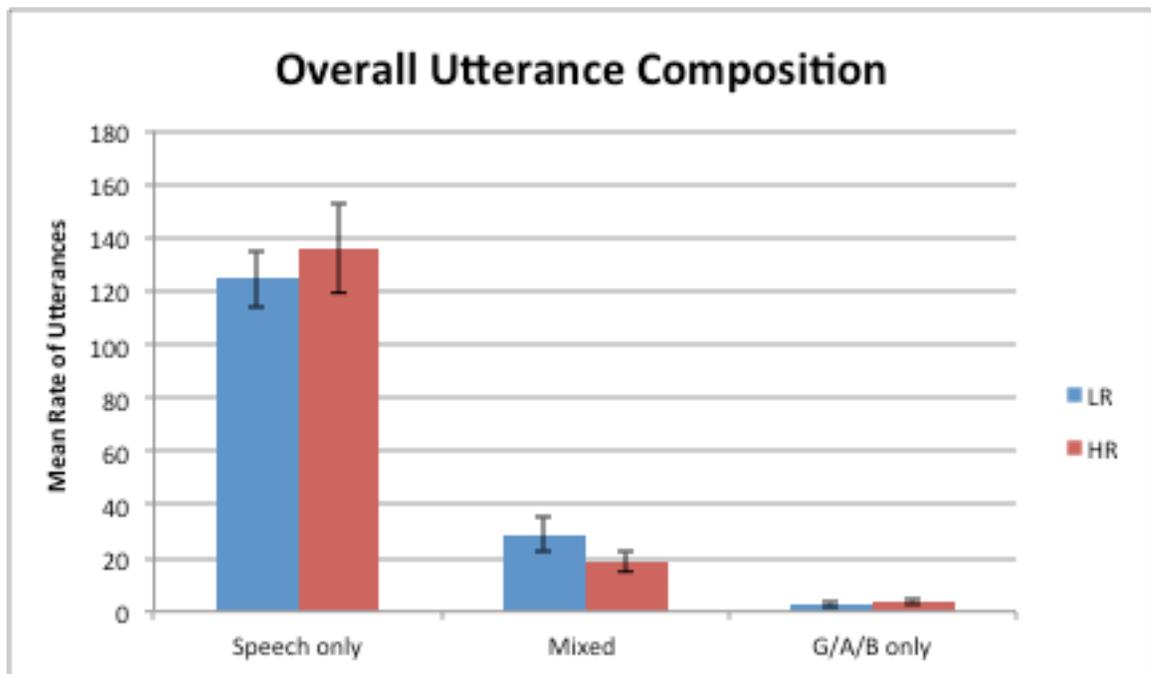


Figure 1. Overall Utterance Composition

### 3.2.2 Speech Type

Data on speech types are presented in Figure 2. The majority of communication for both groups of mothers consisted of Comments, followed by Questions and Imperatives in that order. In addition, rates of production of Imperatives ( $M_{LR} = 14.79$ ,  $SD = 12.48$ ;  $M_{HR} = 14.54$ ,  $SD = 9.48$ ), Questions ( $M_{LR} = 52.15$ ,  $SD = 17.47$ ;  $M_{HR} = 49.45$ ,  $SD = 14.71$ ), and Comments ( $M_{LR} = 85.65$ ,  $SD = 35.06$ ;  $M_{HR} = 90.36$ ,  $SD = 40.84$ ) were highly comparable for the two groups of mothers.

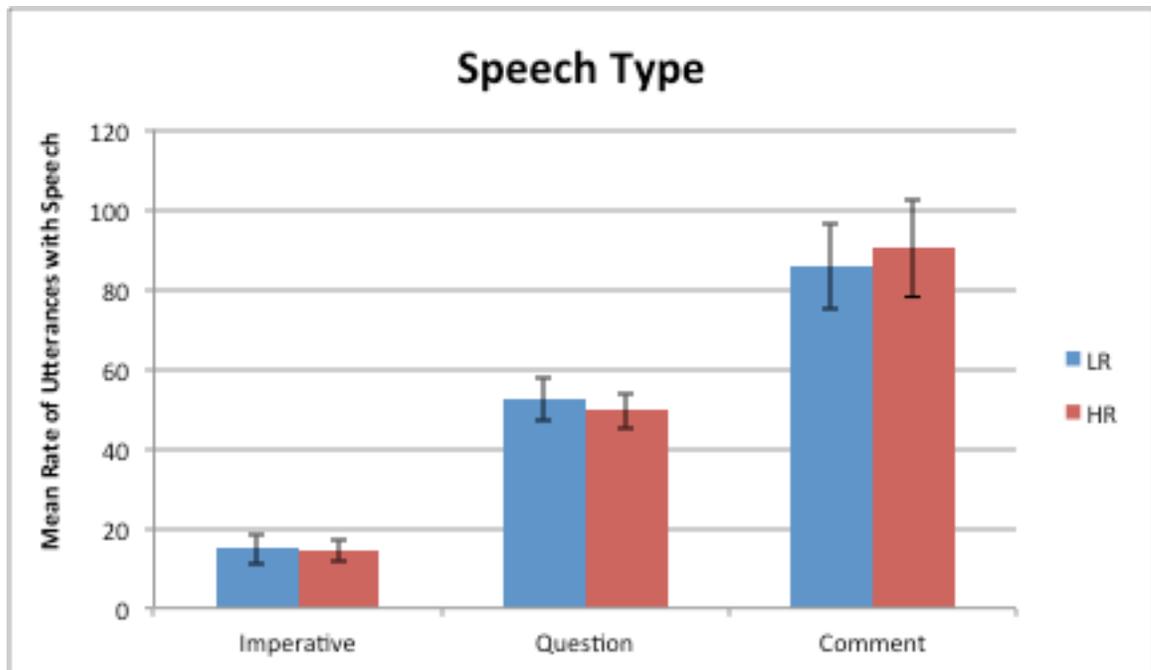


Figure 2. Speech Type

### 3.3 PREDICTION-DRIVEN ANALYSES

#### 3.3.1 Prediction 1

*Prediction 1: HR mothers will produce more attention-related communication than LR mothers.*

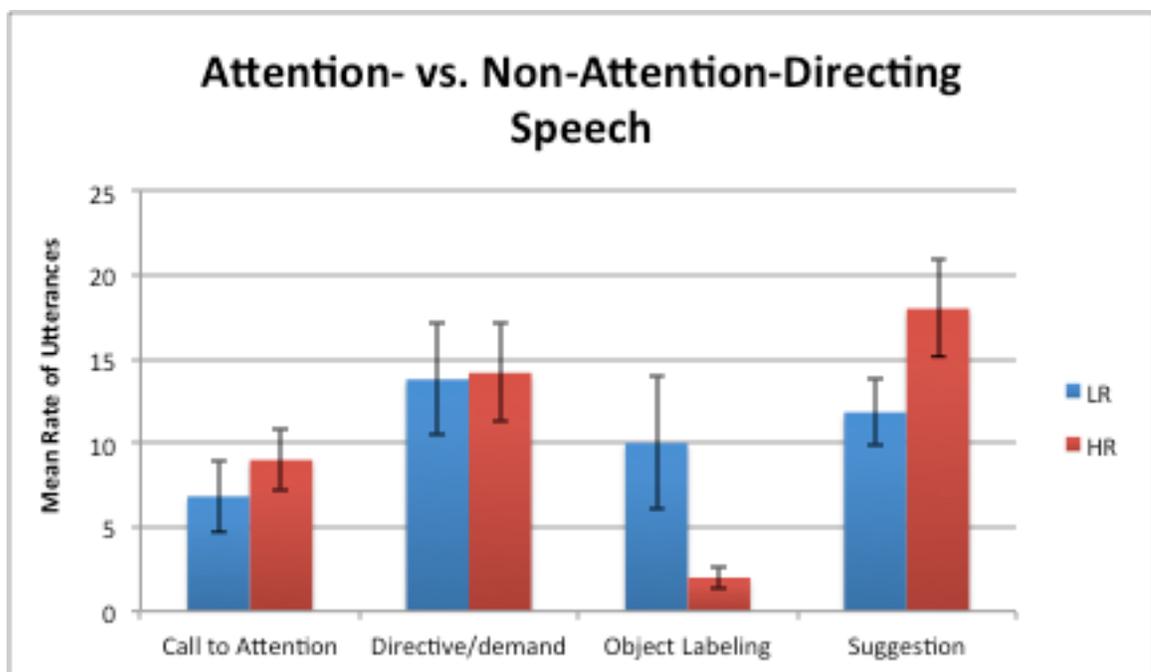
Three sets of analyses were conducted to address this prediction, as it was anticipated that group differences could manifest in at least three ways. First, HR mothers may produce more utterances containing attention-directing speech than LR mothers (Prediction 1A). The relevant data are presented in Figure 3. The data in the figure indicate that, counter to expectation, LR mothers and HR mothers produced relatively similar rates of both Directive/demand utterances ( $M_{LR} = 13.79$ ,  $SD = 10.98$ ,  $M_{HR} = 14.18$ ,  $SD = 9.63$ ,  $U = 54.5$ ,  $p = .693$ ) and Call to Attention

utterances ( $M_{LR} = 6.83$ ,  $SD = 7.06$ ,  $M_{HR} = 9.00$ ,  $SD = 6.03$ ,  $U = 45$ ,  $p = .307$ ). They also indicate that overall both groups of mothers produced Directive/demand utterances more frequently than Call to Attention utterances.

However, while average rates of production of Call to Attention utterances and Directive/demand utterances did not differ significantly between groups (employing Mann-Whitney  $U$  tests), inspection of the distributions for LR and HR mothers indicated substantial individual variability at the high end for Call to Attention utterances, especially among HR mothers. Thus, a Fishers Exact test was computed on the distributions of HR mothers that fell above versus at or below the median for the LR mothers (and vice versa). While 8 of 11 HR mothers produced Call to Attention utterances at a rate at or above the median for the LR group ( $Mdn = 6.00$ ), only 2 of 11 LR mothers produced Call to Attention utterances at a rate higher than the HR group median ( $Mdn = 10.00$ ),  $p = .03$ .

With regard to non-attention-directing speech, two group differences are apparent in the figure. LR mothers produced more Object Labeling utterances ( $M = 10.00$ ,  $SD = 13.20$ ) than did HR mothers ( $M = 2.00$ ,  $SD = 2.10$ ,  $U = 31$ ,  $p = .051$ ), a difference that just missed conventional levels of significance. Differences in production of Object Labeling utterances were further evaluated by comparing distributional patterns between groups. A Fishers Exact test was computed on the distributions of HR mothers that fell above versus at or below the median for the LR mothers (and vice versa). This analysis indicated that the difference described above was highly robust across individual mothers. For 9 of 11 LR mothers, rate of production of Object Labeling utterances fell at or above the median for the HR group ( $Mdn = 2.00$ ), while rates for only 2 HR mothers were greater than the LR group median ( $Mdn = 4.99$ ),  $p = .0019$ .

Finally, HR mothers tended to produce more Suggestion utterances ( $M = 18.00$ ,  $SD = 9.48$ ) than LR mothers ( $M = 11.83$ ,  $SD = 6.50$ ,  $U = 31$ ,  $p = .051$ ), a difference that just missed conventional levels of significance. A Fishers Exact test indicated that this difference was highly robust across individual mothers in the HR group. For 9 of 11 HR mothers, the rate of production of Suggestion utterances fell above the median for the LR group ( $Mdn = 10$ ), while rates for only 2 LR mothers were above that for the HR group median ( $Mdn = 18$ ),  $p = .0089$ .

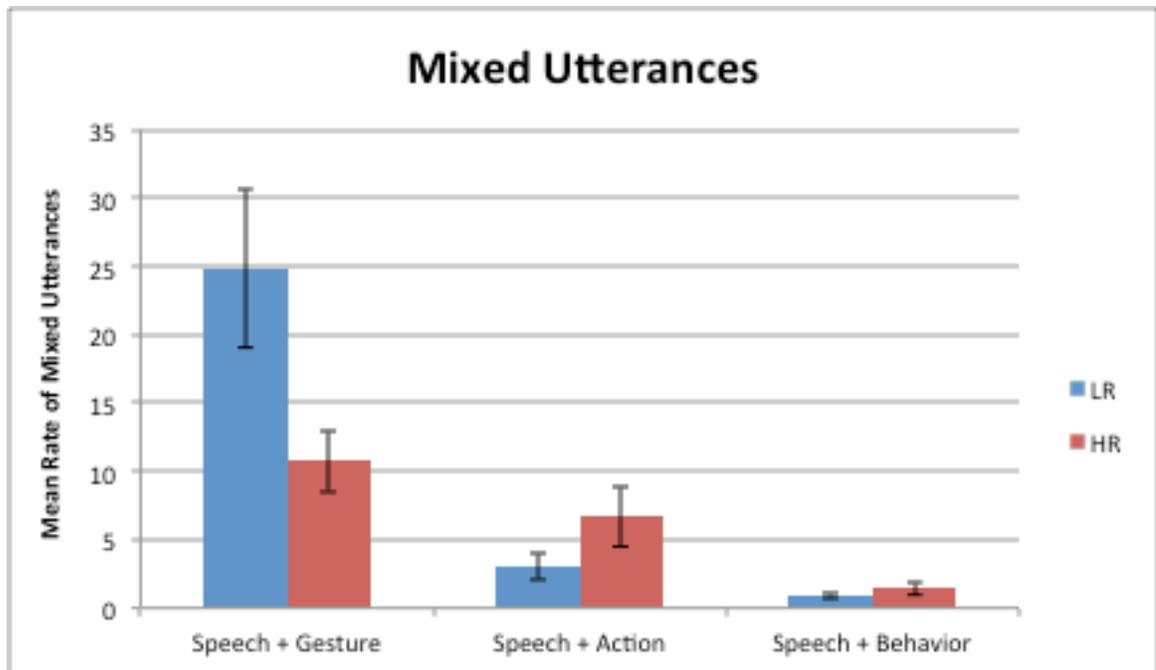


**Figure 3. Attention- vs. Non-Attention-Directing Speech**

A second possibility is that HR mothers may produce more Mixed utterances containing Actions and/or Behaviors than LR mothers (Prediction 1B). Data on the production of the three categories of Mixed utterances by LR and HR mothers respectively are presented in Figure 4. As is apparent, for both groups of mothers, a majority of Mixed utterances involved gestures, followed by actions and behaviors in that order. However, consistent with Prediction 1B, LR

and HR mothers differed in the relative rates of production of Mixed utterance types. Thus, LR mothers produced significantly more Mixed + Gesture utterances ( $M = 24.81$ ,  $SD = 19.09$ ) than did HR mothers ( $M = 10.72$ ,  $SD = 7.41$ ,  $U = 27$ ,  $p = .028$ ). A Fishers Exact test indicated that this difference was highly robust: for 11 of 11 LR mothers, the rate of production of Mixed + Gesture utterances fell above the median for the HR group ( $Mdn = 9.00$ ), while 3 of 11 HR mothers produced Mixed + Gesture utterances at a rate above that for the LR group median ( $Mdn = 16.95$ ),  $p = .001$ .

Although overall differences between LR mothers and HR mothers for Mixed + Action utterances were not statistically reliable ( $M_{LR} = 3.01$ ,  $SD = 3.09$ ,  $M_{HR} = 6.72$ ,  $SD = 7.42$ ,  $U = 40.5$ ,  $p = .187$ ), inspection of the group distributions indicated substantial individual variability at the high end among HR mothers. A Fishers Exact test conducted on these data revealed that for 8 of 11 HR mothers, the rate of production of Mixed + Action utterances fell above the median for the LR group ( $Mdn = 2.00$ ), while rates for only 3 of 11 LR mothers were equal or greater than the HR group median ( $Mdn = 5.00$ ), a difference that approached significance,  $p = .0861$ . Rates of Mixed + Behavior utterances did not differ between the two groups ( $M_{LR} = 0.90$ ,  $SD = .70$ ;  $M_{HR} = 1.45$ ,  $SD = 1.63$ ).



**Figure 4. Mixed Utterances**

A third and final possibility was that HR mothers would produce utterances involving combination of attention-directing speech *with* a gesture, action, or behavior more frequently than LR mothers (Prediction 1C). These data are presented in Figure 5. As is apparent, the data were not consistent with this prediction. LR mothers and HR mothers produced roughly comparable rates of both Call to Attention + G/A/B utterances ( $M_{LR} = 1.90$ ,  $SD = 2.30$ ,  $M_{HR} = 2.18$ ,  $SD = 2.18$ ,  $U = 56$ ,  $p = .759$ ) and Directive/demand + G/A/B utterances ( $M_{LR} = 2.56$ ,  $SD = 3.91$ ,  $M_{HR} = 2.73$ ,  $SD = 3.04$ ,  $U = 53.5$ ,  $p = .637$ ).

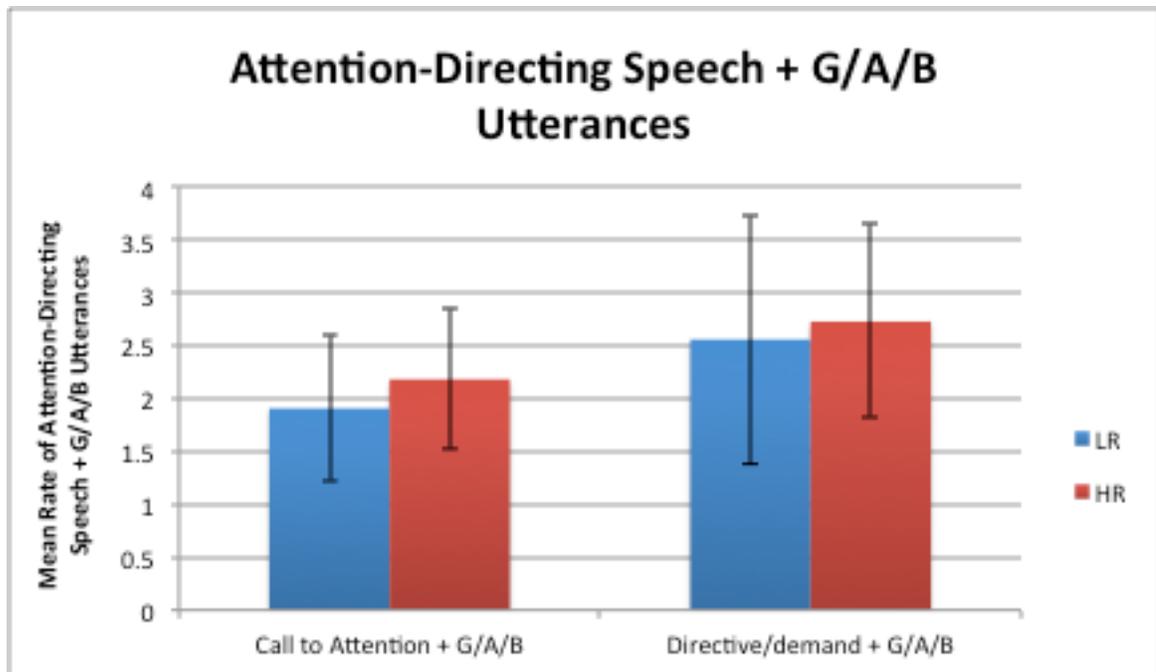
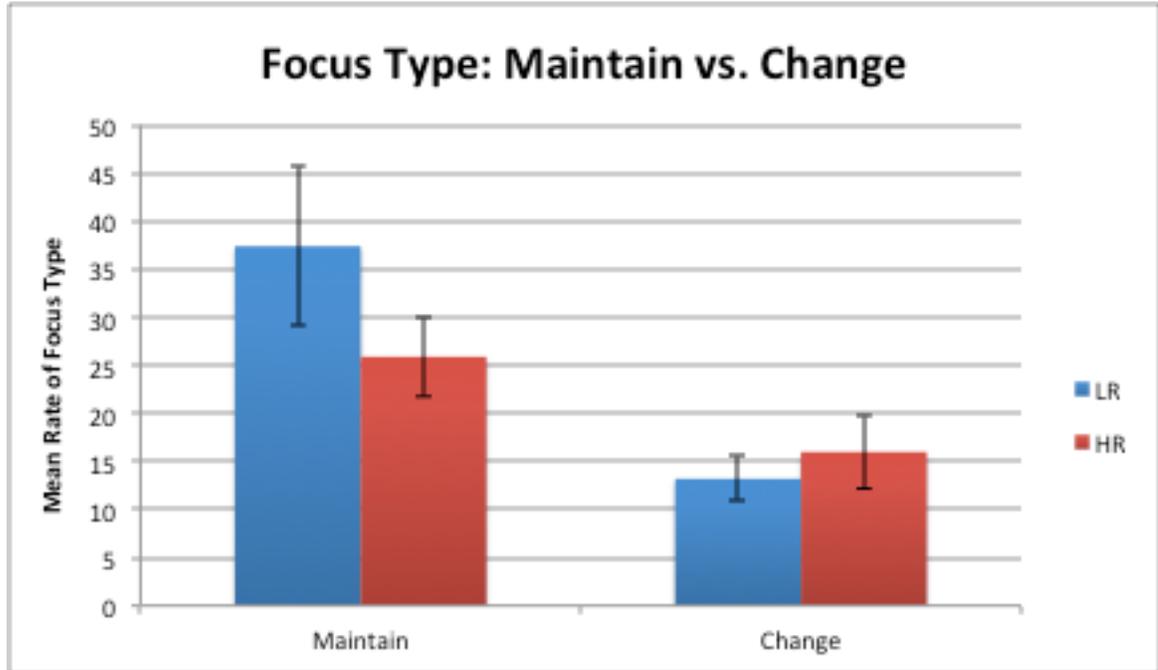


Figure 5. Attention-Directing Speech + G/A/B Utterances

### 3.3.2 Prediction 2

*Prediction 2: HR mothers will produce more utterances that attempt to change the child's current attentional focus than LR mothers.*

Data on production of utterances that maintained vs. changed the child's focus of attention are presented in Figure 6. As is evident, the majority of utterances produced by LR and HR mothers maintained the child's attention. Contrary to the prediction, LR mothers and HR mothers produced both Maintain ( $M_{LR} = 37.40$ ,  $SD = 27.54$ ;  $M_{HR} = 25.90$ ,  $SD = 13.74$ ) and Change utterances ( $M_{LR} = 13.21$ ,  $SD = 7.95$ ;  $M_{HR} = 16.00$ ,  $SD = 12.67$ ) at rates that did not differ statistically from one another.



**Figure 6. Focus Type: Maintain vs. Change Utterances**

In summary, the data presented above provide partial support for the predictions outlined above. With regard to the production of attention-directing speech (Prediction 1A), although average rates of production of attention-directing speech utterances were similar for both groups of mothers, HR mothers displayed substantial individual variability at the high end for the production of Call to Attention utterances relative to LR mothers. Analyses conducted on the production of attention-directing speech accompanied by a gesture, action, or behavior (Prediction 1B) indicated no significant group difference for the production Call to Attention + G/A/B utterances and Directive/demand + G/A/B utterances. With regard to the production of Mixed utterances (Prediction 1C), LR mothers produced Mixed + Gesture utterances significantly more frequently than HR mothers, while HR mothers tended to produce Mixed + Action utterances more frequently than LR mothers. Finally, the majority of utterances produced

by both LR mothers and HR mothers maintained their child's attentional focus (Prediction 2), and there were no significant group differences for the average rates of production of Maintain utterances or Change utterances.

### **3.4 EXPLORATORY GROUP COMPARISONS**

In this final section, I report analyses designed to examine two exploratory questions regarding LR and HR toddlers' responses to maternal attention-related communication. Questions focused on whether: a) there are differences in LR and HR toddlers' responses to utterances that involve only attention-directing speech vs. to utterances that involve attention-directing speech accompanied by a gesture, action, or behavior; and b) HR and LR toddlers differ in rate of responding to utterances that attempt to change vs. maintain their focus of attention.

The first set of analyses examined whether HR and LR toddlers differed in responding to utterances that involve only attention-directing speech vs. to utterances that involve attention-directing speech accompanied by a gesture, action, or behavior. Child responses to attention-directing speech utterances (i.e., Call to Attention utterances and Directive/demand utterances) and attention-directing speech + G/A/B utterances (i.e., Call to Attention + G/A/B utterances and Directive/demand + G/A/B utterances) were computed as proportions due to differences in base rates of maternal production of these utterances (see Figures 3 and 5). Four proportions were calculated for each child by dividing the number of child responses to each type of attention-related utterance (e.g., Call to Attention utterances, Call to Attention + G/A/B utterances, Directive/demand utterances, and Directive/demand + G/A/B utterances) by the total number of

attention-related utterances of the same type that elicited a codable response from the child. These were then averaged across children within each group.

### 3.4.1 Child responses to Call to Attention utterances

Figure 7 presents data on child responses to Call to Attention utterances and Call to Attention + G/A/B utterances. The data indicate that LR toddlers responded more frequently than HR toddlers to Call to Attention utterances ( $M_{LR} = .70$ ,  $SD = .35$ ;  $M_{HR} = .58$ ,  $SD = .32$ ), although the mean difference in proportion of responses by LR toddlers and HR toddlers was not statistically significant. However, the distributions of child responses to Call to Attention utterances differed by group. Proportions for 9 of 9 LR toddlers fell above the median for the HR group ( $Mdn = 0.43$ ), while 3 of 7 HR toddlers responded at a proportion higher than the LR median ( $Mdn = 0.75$ ),  $p = .0031$ , Fishers Exact test.

The data presented in Figure 7 also indicate that LR toddlers responded to a higher proportion of Call to Attention + G/A/B utterances than HR toddlers ( $M_{LR} = .92$ ,  $SD = .13$ ;  $M_{HR} = .63$ ,  $SD = .34$ ,  $U = 9$ ,  $p = .062$ ). A Fishers Exact test indicated that this difference held across individual toddlers in the two groups. For 7 of 7 LR toddlers, the proportion of responses to Call to Attention + G/A/B utterances fell above the median for the HR group ( $Mdn = .585$ ), while 2 of 6 HR toddlers responded at a proportion higher than the LR group median ( $Mdn = 1.0$ ),  $p = .021$ .

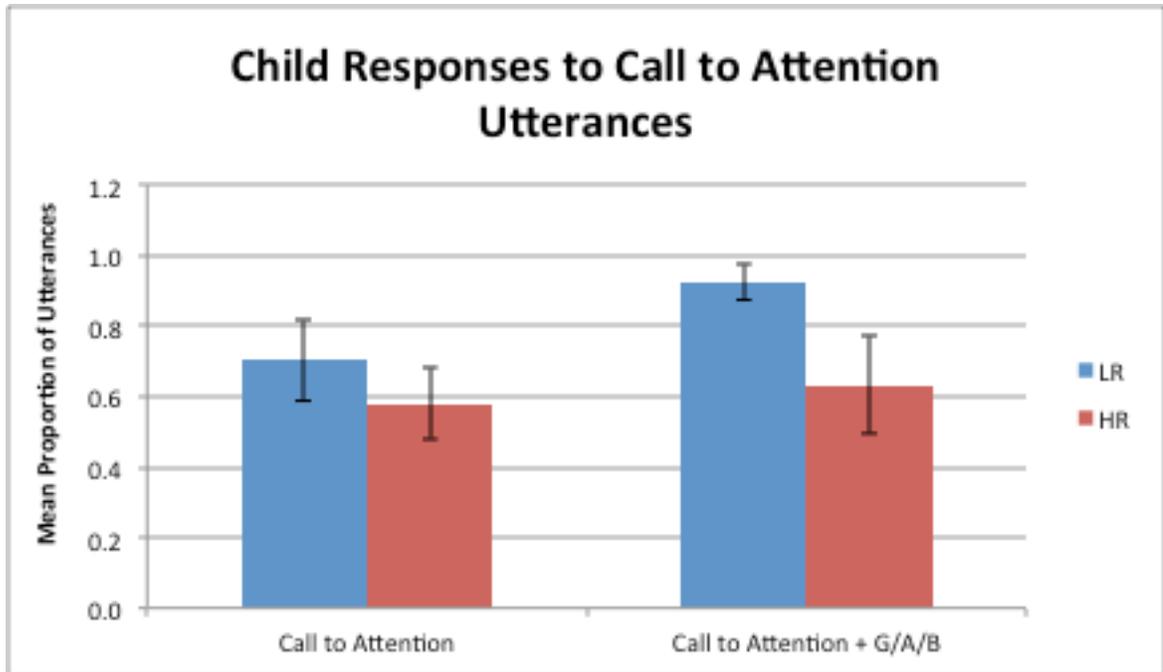
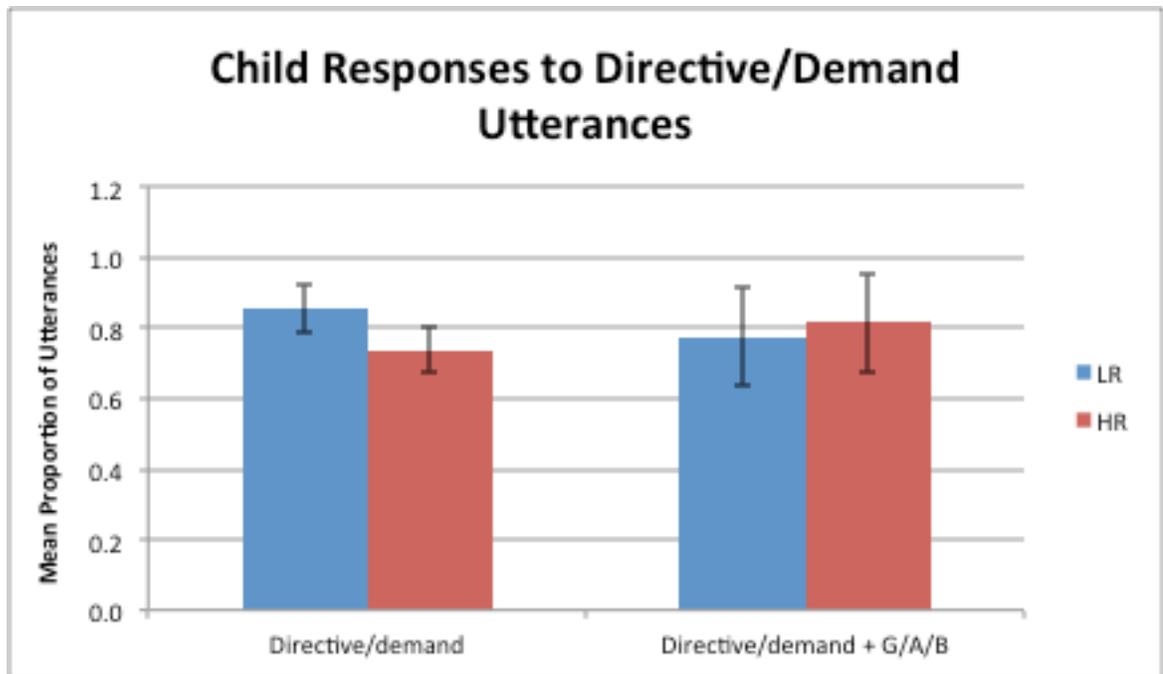


Figure 7. Child Responses to Call to Attention Utterances

### 3.4.2 Child responses to Directive/demand utterances

Figure 8 presents data on child responses to Directive/demand utterances and Directive/demand + G/A/B utterances. On average, LR toddlers responded more frequently to Directive/demand utterances than HR toddlers ( $M_{LR} = .85$ ,  $SD = .22$ ;  $M_{HR} = .74$ ,  $SD = .21$ ), although the difference was not statistically reliable. There was, however, a difference in the distributions of child responses to Directive/demand utterances. Proportions for 9 of 11 LR toddlers fell above the median for the HR group ( $Mdn = 0.8$ ), while 2 of 11 HR toddlers responded at a proportion higher than the LR median ( $Mdn = 1.0$ ),  $p = .0089$ , Fishers Exact test. Responding to Directive/demand + G/A/B utterances was relatively similar and did not differ reliably across the two groups ( $M_{LR} = .77$ ,  $SD = .37$ ;  $M_{HR} = .81$ ,  $SD = .38$ ).



**Figure 8. Child Responses to Directive/demand Utterances**

The second set of analyses focused on the question of whether HR toddlers as a group respond less frequently to Change utterances than to Maintain utterances relative to LR toddlers. Since the base rates of occurrence of these two types of maternal utterances differed (see Figure 6, child responses to Maintain utterances and Change utterances were calculated as proportions. This was done by dividing the number of child responses to focus type (e.g., Maintain utterances) by the total number of utterances that elicited a codable response from the child (i.e., the sum of Maintain utterances to which the child did or did not respond; uncodable and no opportunity responses were not included); these proportions were averaged across children within each group.

The data presented in Figure 9 indicate that LR and HR toddlers produced comparable proportions of responses to both Maintain ( $M_{LR} = .87, SD = .07; M_{HR} = .87, SD = .10$ ) and Change utterances ( $M_{LR} = .57, SD = .16; M_{HR} = .53, SD = .26$ ). Toddlers in both groups produced

significantly higher proportions of responses to respond to Maintain utterances (combined  $M = .87$ ,  $SD = .087$ ) than Change utterances (combined  $M = .55$ ,  $SD = .22$ ,  $Z = -.3845$   $p = .000$ ).

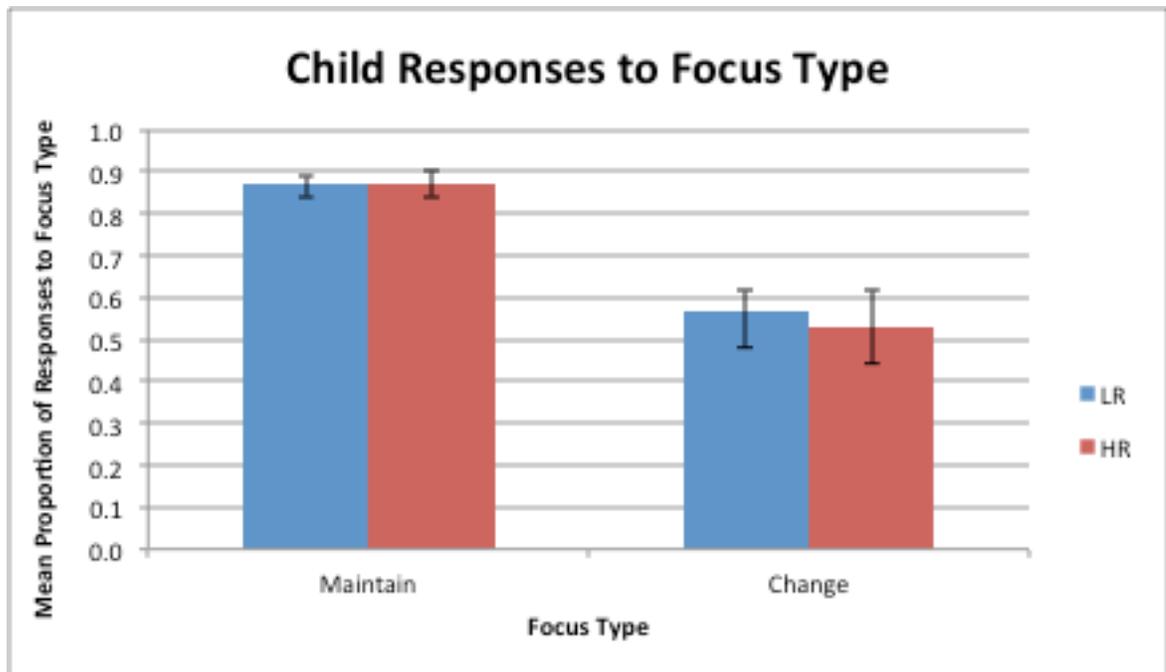


Figure 9. Child Responses to Focus Type

## 4.0 DISCUSSION

Previous research examining maternal communication to both typically developing children and children with developmental delays, as well as research examining mothers' interactions with their children with ASD, constitute the foundation for the present study. First, evidence suggests that mothers of young, language-learning children modify both their speech (e.g., Newport et al., 1977) and gestures (e.g., Iverson et al., 1999) to the perceived communicative capabilities of the child, by producing shorter utterances with exaggerated intonation and a limited set of concrete, informationally redundant gestures. These communicative modifications are even more pronounced in mothers of children with developmental delays (e.g., Iverson et al., 2006). Second, research has indicated that children with ASD display marked attentional deficits (e.g., Landry & Bryson, 2004; Newell et al., 2007), and mothers of children with ASD are sensitive to their child's communicative and attentional deficits (e.g., Kasari et al., 1988), and consequently modify their speech for their child, particularly through the utilization of physical actions on objects to capture and direct the child's attention (e.g., Adamson et al., 2001; MacArthur & Adamson, 1996).

In light of this evidence, this research was designed to explore attention-related communication in mothers of toddlers at risk for ASD in comparison to that of mothers of toddlers at low risk for ASD and to explore LR and HR toddlers' responses to maternal attention-

related communication. The present study investigated the overall nature of maternal communication, two primary sets of predictions, and a series of exploratory questions. Findings relevant to each of these will be discussed in turn.

*What is the nature of maternal communication?*

The first goal of this study was to explore overall maternal communication in mothers of LR toddlers and HR toddlers, focusing on the composition and types of speech in their verbal utterances. With regard to utterance composition, the majority of child-directed communication involved speech only utterances, followed by utterances that involved both speech *and* a gesture, action, or behavior (Mixed utterances) and utterances that involved only a gesture, action, or behavior (G/A/B only utterances). These findings are consistent with those of Iverson et al. (1999), who reported that the majority of utterances produced by mothers of TD children consisted of speech only, speech with gesture, and gesture only utterances, in that order. The consistency between the present study and Iverson et al. (2006) is important, suggesting that the communicative patterns displayed by mothers are stable features of child-directed communication.

The finding that comments were the speech type most widely employed by both groups of mothers is consistent with other studies in the maternal communication literature, and with recent work by Adamson et al. (2001), who found that comments constituted the majority of child-directed utterances produced by mothers of TD sons and mothers of sons with ASD.

*What is the nature of attention-related communication produced by mothers of HR and mothers of LR toddlers at 18 months of age?*

Two sets of predictions addressed the goal of examining the nature of attention-related communication in mothers of HR toddlers and mothers of LR toddlers. According to Prediction

1, HR mothers were expected to produce more attention-related communication than LR mothers, and it was anticipated that this difference could manifest in at least three ways.

First, findings were consistent with the expectation that HR mothers would produce more utterances containing attention-directing speech than LR mothers (Prediction 1A). Although average rates of production of attention-directing speech utterances were not statistically different between LR mothers and HR mothers, some HR mothers displayed substantial individual variability at the high end for Call to Attention utterances relative to some LR mothers, and this distributional difference was significant. It is possible that mothers of HR toddlers may be influenced by their experience using ABA techniques with their child with ASD, and thus the concise, directive nature of ABA techniques may have influenced some mothers to use more direct, attentionally salient speech spontaneously with their later-born child.

A second possibility exists, namely that mothers of HR toddlers are sensitive to some degree of developmental delay in their HR toddlers. Research indicates that HR infants who do not eventually receive an ASD diagnosis are at risk for numerous other developmental delays and atypicalities, such as delays in reaching developmental milestones, postural atypicalities and instability, and delays in language production and comprehension (e.g., Iverson & Wozniak, 2007). Evidence also suggests that mothers of HR infants report significantly more concerns about their HR children in ASD-related areas of development by the age of 12 months than mothers of typically developing, low-risk infants (Ozonoff et al., 2009). These concerns have been correlated with independent measures of development and ASD symptomatology, and have helped predict infants that have gone on to receive a diagnosis of ASD (Ozonoff et al., 2009). Therefore it is possible that mothers of HR toddlers have a heightened sense of awareness toward

their child's developmental progress, potentially their attentional capabilities, and structure their interactions to address perceived atypicalities.

An unanticipated finding of this study was that some LR mothers produced significantly more Object Labeling utterances, while some HR mothers tended to produce more Suggestion utterances. LR mothers' significantly increased production of Object Labeling utterances may be a means of facilitating language-learning in their children, and additionally may be related to their increased production of Mixed + Gesture utterances, which provide children direct object-referent information (Iverson et al., 1999). For mothers of HR toddlers, Suggestion utterances may be another form of attentional control, as the primary function of Suggestion utterances is to propose activities through the utilization of a question (e.g., "Should we get your puzzle?"). Suggestion utterances may provide mothers of HR toddlers who are more sensitive to their child's attentional difficulties (e.g., Ozonoff, 2009) with an additional means of directing their child's action, in a manner that differs from the imperative nature of Directive/demand utterances.

Second, the data provide partial support for Prediction 1B, that HR mothers would produce more utterances consisting of speech accompanied by highly salient nonverbal behaviors, namely actions on objects and/or behaviors involving touching or manipulating the child's body. While overall differences between LR mothers and HR mothers for Mixed + Action utterances were not statistically reliable, inspection of the group distributions indicated substantial individual variability at the high end among HR mothers. This is consistent with previous studies indicating that relative to mothers of TD children, mothers of children with ASD were more likely to supplement conventional acts (e.g., speech or pointing) with literal acts (i.e., attracting a child's attention by making a particular focus more salient perceptually; e.g.,

Adamson et al., 2001; MacArthur & Adamson, 1996). Because actions by nature involve placing an object in front of the child, in the child's hand, or within the child's view, they are likely a salient way to capture a child's attention (see also Watson, 1998). Thus, increased production of Mixed + Action utterances by some HR mothers in the present study may reflect a similar modification of communication among mothers of HR infants.

While HR mothers produced more Mixed + Action utterances, LR mothers produced significantly more Mixed + Gesture utterances than HR mothers. This finding is consistent with Iverson et al. (2006), who found that mothers of children with DS produced fewer utterances with gestures relative to mothers of TD children. For children with DS (or in the present study, HR toddlers), this may reflect mothers' sensitivity to the attentional difficulties of their child, who may need more concrete and attentionally salient communicative modification to capture and direct their attention (e.g., an action).

Although HR mothers produced Mixed + Behavior utterances at a rate twice as high as LR mothers, overall both groups produced Mixed + Behavior utterances at very low rates. It is possible that an observation longer than the 10 minutes used in the present study may provide more opportunities for Mixed + behavior utterances to occur, thereby facilitating comparison of their rates of production between LR mothers and HR mothers.

Finally, the data did not support Prediction 1C, that HR mothers would produce utterances that involve both attention-directing speech *and* a nonverbal component (gesture, action, or behavior) more frequently than LR mothers. We found that LR mothers and HR mothers produced Call to Attention + Gesture/Action/Behavior utterances and Directive/demand + Gesture/Action/Behavior utterances at roughly comparable rates.

Prediction 2 stated that HR mothers would produce more utterances that attempt to change the child's current attentional focus than LR mothers. Contrary to that prediction, there were no differences in production of Change utterances between the two groups of mothers. And like LR mothers, HR mothers produced more Maintain utterances than Change utterances.

It may be useful to consider this finding in light of Siller and Sigman's (2002) concept of caregiver synchronization, defined as instances in which the mother showed/pointed to or talked about objects to which the child was already attending. They found that caregivers of children with ASD synchronized their verbal and nonverbal behaviors with their children as much as caregivers of TD children and children with developmental delay, evidence that contradicts the widely held misconception that mothers of children with ASD are not as responsive to their children as mothers of TD children. The present results are consistent with this view. Furthermore, Siller and Sigman have suggested that caregiver synchronization facilitates later gains in language skills. Given that Maintain utterances can be viewed as measurable indicators of caregiver synchronization, this finding of underscores the potential importance of mothers' production of Maintain utterances for their child's later language ability.

*What is the nature of HR and LR toddlers' responses to maternal attention-related communication?*

To date there are no published studies comparing the responses of HR and LR toddlers to maternal attention-directing communication. Thus, two exploratory questions were posed to investigate the patterns of responses in HR toddlers and LR toddlers.

Overall, and across both HR and LR toddlers, the majority of all attention-directing speech only and attention-directing speech + G/A/B utterances produced received a response. This finding was consistent with data reported by Adamson et al. (2001), who found that TD

children and children with ASD were more likely to respond (as opposed to not respond) to their mothers' attention-related utterances. However, as suggested by Adamson et al. (2001) and demonstrated in the present study, there was substantial individual variation in the proportion of responses by LR toddlers and HR toddlers to attention-directing speech.

In the first set of analyses, we asked whether LR and HR toddlers would differ in their responses to utterances that involve only attention-directing speech vs. utterances that involve attention-directing speech accompanied by a gesture, action, or behavior. Analyses conducted on proportions of responses to Call to Attention utterances and to Call to Attention + G/A/B utterances revealed intriguing group differences. While overall differences between LR toddlers and HR toddlers for responding to Call to Attention utterances were not statistically reliable, inspection of the group distributions indicated substantial individual variability at the high end among some LR toddlers. In light of this finding, it is possible that the production of attentionally salient words, with no accompanying nonverbal behavior, may have been salient enough to elicit a response from LR toddlers, but not from some HR toddlers. LR toddlers were also significantly more likely to respond to Call to Attention + G/A/B utterances relative to HR toddlers. Thus, it appears that the accompaniment of a gesture, action, or behavior provides additional information for LR toddlers that allowed them to respond more frequently to maternal communication than HR toddlers. It is of particular interest that HR infants displayed similar proportions of responses to both Call to Attention and Call to Attention + G/A/B responses. The addition of a gesture, action, or behavior does not appear to serve to enhance the verbal message for HR toddlers and does not increase their likelihood of responding. It may be the case that the presence of a G/A/B actually detracts from the verbal message, and as a result the child focuses

on the G/A/B out of context from the speech and subsequently fails to respond to the verbal component.

Overall differences between LR toddlers and HR toddlers for responding to Directive/demand utterances were not statistically reliable, but inspection of the group distributions indicated substantial individual variability at the high end among some LR toddlers. Both groups produced a higher proportion of responses to Directive/demand + G/A/B utterances, relative to proportion of responses to Directive/demand utterances. Interestingly, HR toddlers responded as frequently as LR toddlers to Directive/demand + G/A/B utterances; this finding was surprising because the presence of a gesture, action, or behavior did not appear to increase HR toddlers' frequency of responding Call to Attention + G/A/B utterances.

In the second set of analyses we examined whether HR and LR toddlers differed in their rate of responding to maternal utterances that attempted to change vs. maintain their attentional focus. We found that LR toddlers and HR toddlers produced comparable proportions of responses to both Maintain and Change utterances, and that toddlers in both groups produced significantly higher proportions of responses to Maintain utterances than to Change utterances. These findings provide further support for the importance of caregiver synchronization, as it appears both HR toddlers and LR toddlers are more likely to recognize and respond to maternal communication if it follows their current attentional focus, as opposed to attempting to change the child's attentional focus to something new.

## 4.1 FUTURE DIRECTIONS

This study has revealed differences in communication between mothers of HR toddlers and mothers of LR toddlers, both in the overall nature of child-directed communication as well as in attention-related communication. Furthermore, this study has revealed differences in how HR toddlers and LR toddlers respond to maternal communication.

Given the potential influence of HR mothers' experiences with ABA techniques on their patterns of communication with their later-born HR infants, future studies are needed to investigate the impact of ABA and other intense intervention techniques on maternal communicative behaviors with younger siblings of children with ASD. Future studies may also examine maternal attention-related communication and child responses at earlier and later age points, to determine whether there is consistency across child development. Also, it may be valuable to incorporate measures such as the MacArthur-Bates Communicative Development Inventory (CDI; Fenson et al., 1993), a vocabulary checklist that asks parents to indicate words that their child only understands, as well as items that their child both says and understands. It is possible that certain aspects of maternal attention-related communication may be related to children's language levels, and may be able to predict vocabulary at later age points. This is particularly relevant in light of evidence that parents who provide verbal input related to their child's attentional focus enhance their child's language development (e.g., Tomasello & Farrar, 1986). Thus using the methods of the present study, it is of interest to explore, for example, whether the children of mothers who produce more Maintain utterances display more advanced levels of language.

Finally, future studies could look more closely at the extent of potential language delays and manifestation of early ASD symptomatology in the HR group in relation to maternal communication by using the CDI and/or the Modified Checklist for Autism in Toddlers (MCHAT; Robins et al., 2001) at 18 months. This information could provide a better overall picture of the language and/or ASD-related deficits in HR toddlers, and determine whether there may be a correlation between the extent of the child's language and/or ASD-related deficits and the extent to which mothers modify their child-directed communication, particularly the production of gestures, actions, and behaviors. Given the findings from Iverson et al. (2006) that mothers of children with DS who exhibited a larger developmental lag produced a higher proportion of utterances that contained both speech and gesture, it is possible that mothers of HR toddlers who exhibit language delays or some aspects of ASD-related symptomatology may display a pattern of attention-related communication that is distinct from both LR toddlers as well as other HR toddlers.

## **4.2 SUMMARY**

Overall, mothers of LR toddlers and mothers of HR toddlers displayed similar patterns of attention-related communication, and LR and HR toddlers displayed distinct patterns of responding to attention-related communication. There were two main differences between these groups. First, HR mothers produced a higher rate of Call to Attention utterances than LR mothers. Second, HR toddlers were generally less likely to respond to attention-related communication, including attention-directing speech that was accompanied by a gesture, action,

or behavior. Future studies should address the potential influence of HR mothers' experience with ABA techniques on their utilization of attention-related communication, and also explore the nature of maternal attention-related communication and child responses at multiple age points to determine if these variables change across development.

## APPENDIX A

**Table 1. Maternal Attention-Related Communication Coding System**

<b>CATEGORY</b> <i>Code</i>	<b>DEFINITION</b>	<b>EXAMPLE</b>
<b>UTTERANCE COMPOSITION</b> <i>Speech only</i>	Speech that is not accompanied by a gesture, action, or behavior.	“That dog is brown”
<i>Mixed + Gesture</i>	Speech that is accompanied by one of the following gesture types: pointing, showing, or representational gestures (i.e.: palm facing upwards for “give it to me,” beckoning, nodding head yes, shaking head no).	“That dog is brown” while pointing at a picture
<i>Mixed + Action</i>	Speech that is accompanied with an object in hand: 1) Mother hands child an object or holds out an object for the child to take (the child must gain possession in order to code as an action, otherwise it is coded as a show), 2) placing an object in front of the child (in the child’s line of eyesight), 3) turning an object so it faces the child.	1) “Here is your cup” while handing child a cup. 2) “Let’s do this puzzle” as mother pushes puzzle in front of the child. 3) Mother turns a puzzle around so it is facing the child
<i>Mixed + Behavior</i>	Speech that is accompanied with physical action on the	“Hey you” while tapping the child

	child's body: 1) tapping/nudging the child, 2) placing an object in the child's hand, 3) manipulating an object in the child's hand, 4) placing the child's hand on an object, 5) banging the floor with an open hand or an object to make a noise that grabs the child's attention, or banging two objects together (e.g., blocks) to make a sound.	on the arm. / "Put the piece here" while moving the child's hand to the correct location. / "Take this block" while placing a block in the child's hand.
<i>Gesture only</i>	Performance of a gesture (see above definition) without accompanying speech.	Mother points at a picture of a bear, without any speech
<i>Action only</i>	Performance of an action (see above definition) without accompanying speech.	Mother holds out a puzzle piece for the child to take
<i>Behavior only</i>	Performance of a behavior (see above definition) without accompanying speech.	Poking/tapping the child to get attention
<b>SPEECH TYPE</b> <i>Imperative</i>	Utterances that involve the direct expression of a command using conventional imperative syntax (e.g. Adams & Ramey, 1980)	"Go get your book" / "Come here" "Bring it to mom" / "Turn the page"
<i>Question</i>	Syntactically marked by "wh" words (e.g., <i>who</i> , <i>what</i> , <i>where</i> , <i>when</i> , <i>why</i> ) or by raised intonation of voice (Howlin et al., 1973)	"Where is your book?" "What should we play?"
<i>Comment</i>	Concerns the objects and events currently present in the child's experience and universal statements related to objects currently present (Snow et al., 1976)	"Your book is blue" / "Ducks say quack" / "You are funny"
<i>Inaudible</i>	Part of utterance is not comprehensible and the function of the utterance cannot be determined.	

<b>UTTERANCE FUNCTION</b> <i>Call to attention</i>	Explicit attentional speech used by parent (e.g. Konstantareas et al., 1988)	Look / Hey / Watch / Listen / You [alone] / See [must be 1 <sup>st</sup> word in utt] / name [alone] / There / There (name) / Here / Here (name)
<i>Directive/ demand</i>	Parent directs child to speak or to respond motorically (e.g. Konstantareas et al., 1988). <b>Note:</b> Directives/demands <u>do not</u> involve conditional words (e.g., could, would, can, should, etc.). If a conditional verb is present, always code as a suggestion.	“Bring mom your doll” “Say hello”
<i>Object Labeling</i>	Explicit identification of object by parent. Parent provides labels of objects, or parts/characteristics of objects. Labeling most often occurs in the following formats: 1) “This/that is ...” 2) “Here/there is ...” 3) “The (object) is (description)” 4) Using a single word to label an object  Labeling may also occur as a question: “That is a (object)?” / “Is that a (object)”	“This is an apple” “That is a book” “The ball is red” “Here are five dogs” “Book”  “That is a baby?” “Is that a duck?”
<i>Suggestion</i>	1. Involves use of a <u>conditional verb</u> (e.g., could, would, should)  2. The proposition of an activity or action [e.g. “Can we (activity)”, “Want to (activity),” “Let’s (activity)”] <b>or</b> the proposition of an object for the child to take [e.g. “Want (object)?”]  3. Polite requests for objects [e.g., “Can you get (object) /	1. “Should we read a book?”  2. “Can we cook it?” / “Can you say butter?” / “Want to play catch?” / “Want your doll?” / “Want pepper?”  3. “Can you get your bear?” / “Can

	<p>“Can mom see (object)” / “Let me see (object)” / “Can mom have (object)”]</p> <p>Suggestions may be in the following formats: “Should we/you ...”; “Would you ...” “Could we/you ...”; “Can we/you ...” “Want to ...”; “Want (object)”</p> <p><b>Note:</b> Suggestions are <b>not</b> requests for information (i.e., “What is that?” / “Where is your puzzle?” / “Who is in that picture?”)</p>	<p>mom see your doll?” / “Let me see your ball”</p>
<i>Residual language</i>	<p>General statements made by parent to child with no response expected (Konstantareas et al., 1988)</p>	<p>“You like to play catch” “You are being silly”</p>
<b>FOCUS TYPE</b> <i>Maintain</i>	<p>Coded when a child is <i>attending</i> to a source of stimulation and the mother’s utterance relates to the current focus of the child’s attention. When focus type is ambiguous, it is <i>most conservative</i> to code maintenance</p>	<p>Mother and child are playing with a puzzle; mother hands child another piece and says “Put it there”</p>
<i>Change</i>	<p>Coded when the child is attending to a particular stimulus and the maternal utterance is related to a different object or aspect of an object. Any time the mother attempts to redirect the child’s focus so that it is in line with her focus.</p> <p><i>Two common situations:</i></p> <ol style="list-style-type: none"> <li>1. Maternal utterance attempts to redirect child focus to a <i>completely different</i> object/person/location</li> <li>2. Maternal utterance attempts to redirect child focus to a different aspect of the same toy/object/event that the child is already attending to</li> </ol>	<ol style="list-style-type: none"> <li>1. Child looking at a book and mother says “Let’s play with this puzzle”</li> <li>2. Child is playing with a red stacking ring; mother holds out a blue ring and says “Put this one on</li> </ol>

		first.” Code a change, because the utterance involves a completely different aspect of the same toy
<b>CHILD RESPONSE</b> <i>Look at mother</i>	Child responds to maternal bid for attention by looking at mother (no more than 2 seconds after the bid)	Mother says “Hey you!” and child looks at mother.
<i>Look at target</i>	Child responds to mother by looking at the focus of the utterance, or continuing to focus on the same object/event/aspect of an object as the mother (no more than 2 seconds after the bid)	Mother says “Look at the pig” and child looks at the pig.
<i>Appropriate motor response</i>	Child responds to maternal bid by performing the requested action or another action that is <i>reasonably related</i> to the focus of the utterance (no more than 2 seconds after the bid).  If mother requests a verbal response from the child, code as an appropriate motor response if the child responds by immediately producing a sound, even if it does not sound like the requested word.	Mother says “Get your ball” and child brings a ball. Mother says “Show me how you tap dance” and child jumps up and down and waves her arms.  Mother says “Say duck” and child responds by producing a sound.
<i>No response</i>	Child <i>ignores</i> a maternal bid for attention or fails to look at the mother, the focus of the utterance, or the G/A/B.	Mother says “Look at the flower” and child ignores mother.
<i>No opportunity</i>	Maternal bid is immediately followed by mother responding to her own bid; the child has no opportunity to respond. Mother’s response to her bid must be <i>immediate</i> ; cannot be any time for the child to attempt to respond.	Mother says “Get your shopping cart” and grabs it herself, before child has an opportunity to get it

*Uncodable*

Code in response to the following situations:

1. Simultaneous Bid-Response: Mother bids child's action as child is already performing that particular action.

2. Poor camera angle: the child's gaze cannot be seen or the child's action cannot fully be seen → as a result there is not enough evidence to determine if the child's response

Mother says "Give me that block" as child is already picking up the block.

Mother says "Look at the car" and child's face is blocked, so it cannot be determined if child looked or not.

## APPENDIX B

### ATTENTION-RELATED COMMUNICATION CODING MANUAL

#### I. TRANSCRIPTION

- Transcribe **verbatim** all maternal communication directed to the **child** during the interaction. Only transcribe speech that is directed to the child! Do not transcribe any communication between the mother and the Team Leader or any other adult.
- Communication should be separated into **utterances**. An utterance is any sequence of words and/or gestures that is preceded and followed by a *silence*, a *change of conversational turns*, or a *change in intonational patterns*. An utterance may or may not be grammatically structured.
- Each line in the coding file represents a different utterance, with its related codes next to it and the time stamp at which the utterance occurred.
- Utterances or *portions of utterances* that cannot be distinctly understood should be represented by XXX. (e.g., “Where is the XXX?”; “Come on XXX”). If the entire utterance cannot be heard, **even if** there is evidence that the mother spoke, **do not** transcribe anything!
- It is always more conservative to code fewer words whenever uncertain
- Transcribe *all* meaningful **speech sounds**, including “uh oh,” “yeah,” “yay,” “ok,” “oops,” “oh/ah,” “mhm,” “hmm,” “vroom,” animal sounds (e.g., “quack” / “woof” / “ribbit” / “meow”), and singing sounds (e.g., do do do, da da da, etc).
  - **Do not** transcribe sounds like “pouring” (e.g., mother pretends to pour something into a cup), eating/drinking noises; “gasping”/ “surprise” noises, or anything that does not convey speech.
- Utterances that are said quickly in sequence, such as “one, two, three”; “quack, quack, quack”; “hop, hop, hop” (and those that are similar in nature) should be transcribed together

as the same utterance, until a distinct pause or breath can be heard. If sounds are produced so quickly that it is difficult to understand exactly what is being heard (such as a fast succession of “hop hop hop”), and the utterance does not direct attention or action, it is acceptable to transcribe as much of the utterances as can be heard, until another pause or conversational turn.

### **When and What to Code:**

1. *Mother is clearly on camera*
  - Transcribe and code all speech and visible gestures
2. *Mother is partially on camera* (e.g., you can see part of her body or part of her face)
  - Transcribe her speech and code all meaningful g/a/b's ***if and only if*** you see them clearly
3. *Mother is not on camera, but her voice can clearly be heard*
  - Transcribe her speech (but not G/A/Bs), and code only if you are able to provide evidence for your codes.  
*e.g.*, Mother is not on camera, but you hear her say “Come here” → If you have enough evidence to determine her location, transcribe her speech and code Speech Type and Utterance Function, and if possible code Child Responses to her speech.

When you cannot see the mother, you can ONLY code speech – never any G/A/Bs. When her location is ambiguous, you may code her speech, but not child responses – these will be *uncodable* (refer to Step 10 for further information).

The coding process involves 10 separate steps:

### **Steps 1-5 apply to ALL maternal utterances. Some utterances will not be coded past Step 5**

1. Transcription
2. Utterance Composition
3. *Description of maternal G/A/B*
4. Speech type
5. Utterance function

### **Steps 6-10 will apply only to a subset of utterances**

6. *Description of child attentional focus BEFORE maternal utterance*
7. *Description of child attentional focus AFTER maternal utterance*
8. Child focus
9. *Description of child response*
10. Child response

The italicized steps involve providing simple descriptions of maternal or child behaviors that will help you later determine the best possible **codes**. Steps that are not italicized require coding.

## II. UTTERANCE COMPOSITION

All utterances are coded as one of three types:

(1) **Speech Only**, (2) **Mixed**, or (3) **Gesture/Action/Behavior Only (G/A/B only)**

1. **SPEECH ONLY**: speech produced with no accompanying gesture, action or behavior.  
e.g., Mother says “Where is your book?”

2. **MIXED**: speech is accompanied by a **gesture**, **action**, or **behavior**. You must be able to clearly see the G/A/B in order to code a mixed utterance.

2.1 **MIXED + GESTURE** include three categories:

a) **Pointing**: clear articulation of the finger (most often index finger or thumb)

- e.g., Mother says “Go get your shopping cart” and points at cart; Mother says “Is that a doggy?” and points to a picture in a book.

*Note: At times, a book or other toy may block full view of the point. Code a point if you can see articulation of the finger, even if it is brief. If the book/toy is blocking full view of the mother’s hand, do not code any points, even if it is likely that they are occurring.*

*Points often occur in quick succession, particularly when mother and child are looking at a book. Code a new point every time the mother retracts her finger and extends it again, or when mother moves finger from one location to another (e.g., mother points at a picture of a dog, then moves finger to a picture of a cat*

b) **Showing**: holding up an object into the child’s line of sight

- e.g., Mother says “Here is your doll” and holds up the doll.

*Note: For cases where it is ambiguous if the mother is showing (performing a gesture) or performing an action, wait to see how the child responds. **If the child gains possession of the object code as an action.** If the child does not gain possession of the object, code as gesture.*

c) **Representational gestures**: may be one of the following types

1. Waving hello/bye-bye
2. Nodding yes/shaking head no
3. Holding out hand [palm(s) facing upwards] with the intent of child placing an object in it; mother must make the “give it to me” gesture **before** the child presents her with the object.
4. Beckoning, often accompanied with a request for the child to go to the mother; e.g., “Come here” or “Let’s go over here.”
5. Using an open hand to indicate an object (e.g., an “open hand” point)

*Do not code: clapping, gestures of emphasis (e.g., mother extending arms in surprise or questioning), or “target gestures” (e.g., mother making a target with her hands to catch a ball or toy)*

**2.2 MIXED + ACTION: speech** performed with objects in hand; there are 3 types:  
(*In order to code an action, the child **must gain possession** of the object*)

1) Mother **hands child an object** or **holds out an object** which the child takes (if the child does not gain possession of the object, code as a **show**).

*e.g., Mother says “Your turn” and holds out a puzzle piece which the child takes*

2) **Placing an object in front of the child** (in the child’s line of eyesight)

*e.g., Mother says “Wanna read?” and places a book in front of the child.*

*Note: it must be evident that the mother wants to provide an opportunity for the child to attend to the object. The object must be placed within the child’s **line of eyesight**, in front of OR on the side of the child. If the object is placed in a location where the child could not possibly see it (e.g., behind), do not code as an action*

3) **Turning an object so it faces the child.** Be conservative with this code – you must be certain that the mother is turning the object so the child can use it properly

*e.g., Mother and child are doing a puzzle, mother turns puzzle so it faces child*

*e.g., Mother turns a picture book the **first time only** so the child can look at it from the proper direction*

*Note: Often the mother and child play with a toy that has multiple pieces, such as stacking rings, a puzzle, or a shape sorter. Any time the mother gives the child a piece, holds up a piece for the child to take, or places a piece in front of the child, code **each separate instance** as an action.*

**Do Not Code the following as actions:**

1. Games of “**catch**” as actions – **throwing, rolling, bouncing, kicking** an object

2. Each instance of the mother “demonstrating” how to stack blocks, rings, etc.

3. Instances of mother turning a photo album so that child can see pictures horizontally or vertically, or turning a shape sorter to the specific shape of the object the child is holding.

**2.3 MIXED + BEHAVIOR:** involve action on the child’s body that *clearly redirect* the child’s attentional focus (*e.g., in order to code a Behavior, it must be evident that the mother is attempting to change the child’s attentional focus*). Only code the following instances:

1) **Tapping/nudging** the child’s body (*e.g., on the arm, leg, etc*). It is evident that the mother is using physical contact to redirect the child’s attentional focus.

*e.g., Child is looking at a toy, mother taps child on leg to get attention and says “You want to get your ball?”*

2) **Placing an object in child's hand; placing child's hand on an object**

*e.g.*, Mother places a block in the child's hand and says "Stack it"

*e.g.*, Mother takes child's hand, moves it above a particular place on a puzzle or shape sorter, and says "Put it here"

3) **Banging on the floor or an object** (often with an open hand), **banging two objects together**, or **snapping fingers** to make a noise that gets the child's attention.

*e.g.*, Child is standing next to mother, mother bangs on floor with an open hand and says "Sit down."

*e.g.*, Mother bangs two blocks together and says "Now stack 'em"

*Be aware of the following instances of physical contact – these occur frequently but should NEVER be coded as behaviors*

1. Mother taking an object out of the child's hand.

2. Instances of the mother trying to move the child to a new location (*e.g.*, pulling the child closer to her or on her lap, pulling a child's hand or arm while moving to get the child to follow her).

3. Wiping child's nose; playing with child's hair; tickling/hugging; fixing clothing.

4. Instances of mother turning on a toy that makes noise; although the toy is producing a sound, the mother is not the **direct source** of the sound.

**3. GESTURE/ACTION/BEHAVIOR ONLY (G/A/B):** a gesture, action, or behavior that is not accompanied by speech. (*Refer to previous examples of gestures, actions, behaviors*).

**To determine if an utterance is Mixed + G/A/B or G/A/B only:**

1. **Mixed + G/A/B**: code if ANY portion of the speech and G/A/B overlap. The speech and G/A/B may not occur together for the entire length of the utterance, but they key is that *some portion* of the speech and G/A/B occur together.

*e.g.*, Mother says "Here put it in the stove," and places a pot in front of the child.

The speech ends before the mother has completed the action of placing the pot in front of the child, but a portion of the speech and action overlap.

*e.g.*, Mother points at a picture of a cat in a book while saying "Look at the kitty."

2. **G/A/B Only**: code if the G/A/B is **isolated** from speech. No portion of the G/A/B can occur with speech. These types utterances will occur less frequently than Mixed + G/A/B utterances.

*e.g.*, Mother taps child on the shoulder; Mother points to a picture of a dog

*Note: if multiple G/A/Bs occur in one utterance, code in spreadsheet as "G/A" or "A/B" and describe the nature of each utterance under the "description of gesture" column. For example, if the mother taps the child's arm (behavior) to get the child's attention, then points at a toy, this would be coded as a "B/G." This applies to both **mixed + G/A/B** and **G/A/B only** utterances.*

### III. DESCRIBE MATERNAL G/A/B

Provide a brief description of the G/A/B (e.g., Mother points at ball, Mother taps child)

### IV. SPEECH TYPE

Next, code all utterances for the type of speech the mother uses. There are 4 categories:

- 1. Imperative:** Utterances that involve the direct expression of a command using conventional imperative syntax (e.g., “Get your book” / “Come here” / “Bring it to mom” / “Turn the page”)
- 2. Question:** Syntactically marked by “wh” words (e.g., *who*, *what*, *where*, *when*, *why*) or by raised intonation of voice (e.g., “Where is your book?” / “What should we play?”)
- 3. Comment:** Concerns the objects and events currently present in the child's experience and universal statements related to objects currently present (e.g., “Your book is blue” / “Ducks say quack” / “You are funny”)
- 4. Inaudible:** Part of utterance is not comprehensible and the function of the utterance cannot be determine. If you can only understand a portion of the utterance (e.g., Let's go XXX), transcribe as much as you can clearly hear, code speech type as inaudible, and no further coding is necessary.

### V. UTTERANCE FUNCTION

Next, utterances are coded for their function. There are 5 categories:

- 1. CALL TO ATTENTION:** Explicit attentional speech used by parent. Only code the following utterances as calls to attention:

“**Look**” [must be 1<sup>st</sup> or only word in utt.] / “**See**” [must be 1<sup>st</sup> or only word in utt]

“**Hey**” / “**Watch**” / “**Listen**” / “**you**” [alone] / “**name**” [alone]

“**There**” [must be 1<sup>st</sup> or only word in utt.] / “**Here**” [must be 1<sup>st</sup> or only word in utt.]

*Note: Do not code utterances as calls to attention if they begin with the child's name, but are actually asking the child a question or making a statement to the child; e.g., “Veronica do you want to go night night?” / “Aidan where are your blocks?”*

**2. OBJECT LABELING:** Explicit identification of an object that is clearly present in the room. The parent can provide labels of *whole objects* or *parts/characteristics of objects*. Do not code references to cartoon/book characters (e.g., “That is Pooh” / “That is Piglet”)

Labeling most often occurs in the following formats:

- 1) “This/that is ...” (e.g., “This is an apple” / “That is a book”)
- 2) “Here/there is ...” (e.g., “There are five dogs”)
- 3) “The (object) is (description).” (e.g., “The ball is red”)
- 4) Using a single word to label an object. (e.g., “ball”)
- 5) Labeling may also occur as a question: “That is a (object)?” / “Is that a (object)?” (e.g., “Is that a baby?” / “That is a duck?”)

**3. DIRECTIVE/DEMAND:** Parent directs child to:

- 1) Speak (e.g., “Say ball” / “Say fish” / “Say hello”)
- 2) Respond motorically (e.g., “Bring mom the ball” / “Turn it” / “Put it there”)

*Note:*

1. Do not code “look” as a directive/demand – always code as call to attention!
2. Do not code utterances as directives/demands if the **mother** is the focus of the utterance:  
e.g., “Should mom get the ball?” / “Should mom throw it?”
3. Context Matters: e.g. “Got the star?”
  - If child **does not** already have possession of the star, code as **directive/demand**
  - If child already has the star or is clearly in the process of getting it, the utterance is not a directive/demand, and would be coded as residual language (see below).

**4. SUGGESTION:** utterances that involve:

- 1) Use of a *conditional verb* (e.g., could, would, should)  
e.g., “Should we read a book?” / “Would you get your ball?”
- 2) The proposition of an activity or action  
e.g. “Can we (cook it)?” / “Want to (play catch)” / “Can you say (butter)?”
- 3) The proposition of an object for the child to take [e.g. “Want (your doll)?”]
- 4) Polite requests for objects [e.g., “Can you get (object)” / “Can mom see (object)” / “Can mom have (object)”] / “Let me see (object)”
- 5) Mother makes a “polite” demand. A *polite demand* is a demand made in a question format and *does not* involve a conditional (e.g., “Gonna zip it?” / “Gonna do it?” / “You get it?”)
  - The polite demand must be made **before** the child acts. If the child has already performed the action and the mother is simply commenting on it, code residual language.

*Note: Suggestions are **not** requests for information; e.g., “What is that?” / “Where is your puzzle?” / “Who is in that picture?”*

**5. RESIDUAL LANGUAGE:** General statements made by parent to child with no response expected (e.g., “You like to play catch” / “You are being silly today” / “We’re gonna cook it”)

## VI. Describe child attentional focus BEFORE/ AFTER

### maternal utt.

After you code Utterance Function, you are able to determine if a particular utterance should be further coded for child attentional focus and child response.

**Continue with coding Steps 5-9 if and ONLY if:**

1. The utterance function is Call to Attention, Labeling, or Directive/Demand
2. ANY **Mixed + G/A/B** or **G/A/B only** utterance, regardless of Function!

*Note: There is one exception to this rule – if the utterance involves a representational gesture (head nod/shake) and the Utterance Function is Suggestion or Residual Language, DO NOT code child attentional focus or child response!*

Once you have determined that an utterance falls into one of those 2 categories, you must record the child's attentional focus immediately before and immediately after the maternal utterance. This involved simply describing what the child is focusing on or doing. On the coding spreadsheet, you will see two columns where you will describe the child's attentional focus.

1. The first column is located before the "Vocal Production" column, and is titled "**Child's Attn'l Focus (before mother speaks).**" Play the video back 1-2 seconds before the utterance, and describe what the child was attending to or doing **immediately** before the utterance. This will help you determine the correct code for Focus Type.

e.g., "Child staring at the dog" / "Child looking at the mother"

2. Next, play the video again and watch closely for the child's attentional focus immediately (1-2 sec) after the utterance. Describe the child's attentional focus in the column titled "**Child's Attn'l Focus (after mother speaks).**" This will help determine the Child Response.

## VII. FOCUS TYPE

Your descriptions of the child's attentional focus before and after the maternal utterance will help you to code Focus Type. Your descriptions should justify what you code for Focus Type.

### **1. MAINTAIN:**

Coded when a child is *attending* to a source of stimulation and the mother's utterance relates to the current focus of the child's attention. When focus type is ambiguous, it is **most conservative** to code maintain. Code **maintain** if:

- a.) The mother produces utterances that refer to the toy/group of toys the child is holding, touching, or manipulating.

e.g., Mother and child are putting shapes into a container and mother produces utterances such as “Put the diamond in that hole,” “Put it in that hole”

b.) If no toys/objects are involved, the mother is producing utterances that keep the child’s focus on herself or her speech

“Attending” may appear **active** (e.g., child is engaged with a toy or stimulus and actively manipulating it), OR **passive** (e.g., child is holding a toy but not actively manipulating it; child is touching a toy that is in front of him/her without actually appearing engaged with it).

**Coding Example:** Child looking at a book (*Description of child attn’l focus before mother speaks*) and mother points at a picture and says “What’s that?” Child continues looking at book (*Description of child attn’l focus after mother speaks*). Here, the mother is **maintaining** the child’s focus on the book. The child’s attentional focus was on the book before the mother spoke, and it remained on the book after the mother spoke.

As long as the mother and child are jointly focused on the same stimulus or object, code maintenance. **BUT** if you have clear evidence that the mother and child are focusing on completely different aspects of the same object (e.g., child is looking at one picture in a book and mother is trying to focus child’s attention on a different picture), any utterances that *clearly* attempt to focus the child’s attention on a different aspect of the same toy would be coded as a **change** (see below for further explanation).

e.g., Mother and child are looking at a picture book. Child is clearly focused on a particular picture, and mother points to a picture on the opposite page. Code as a **change** in focus – although the utterance is still related to the book, it is evident the mother is trying to change the child’s focus to a different aspect of the book.

**2. CHANGE:** coded when the child is attending to a particular stimulus and the maternal utterance is related to a *different* object or aspect of an object. Changes involve the mother attempting to redirect the child’s focus to something different in the immediate environment. Two common situations:

a.) Maternal utterance attempts to redirect child focus to a *completely different* object/person/location (e.g., Child is looking at a book and mother says “Let’s play with this puzzle” / child is manipulating a toy and mother says “Look out the window!”)

b.) Maternal utterance attempts to redirect child focus to a different aspect of the same toy/object/event that the child is already attending to (e.g., Child is playing with a red stacking ring and the mother holds out a blue ring to the child and says “Put this one on first”)

*Note: To code change, the child’s attentional focus before the mother speaks must be unrelated to the maternal utterance (e.g., Child is looking at a book and mother says “Get your ball!”). If it is ambiguous if the mother is actually trying to change the child’s focus, it is most conservative to code as maintain*

## VIII. DESCRIBE CHILD RESPONSE

Provide a brief description of how the child responds to the maternal utterance. In some instances, the description of child response will be similar or exactly the same as the description of child attentional focus after the mother speaks. The description of child response is simply a way to note how the child responded, in order to help choose the best possible code (see below) for his response.

e.g., Child continues looking at mother, Child walks away, Child does not follow mother's point

## IX. CHILD RESPONSE

Code the child's response to the maternal utterance.

### Criteria for Child Response

The child response to the maternal utterance **MUST** occur within a **2-second period** after the end of the utterance. If the bid involves speech + G/A/B, begin the 2-second period after the conclusion of both the speech and the G/A/B. The 2-second rule is especially important in situations where the mother produces a number of utterances quickly in succession.

e.g., Mother says quickly "Look at the ball" followed by "Where is the ball?" and points at it. First determine if the child looks at the ball within two seconds after the first bid. If the child did, and continued to look at the ball for the second bid, code both responses as adequate. If the child does not look at the ball within 2 seconds following the first bid, but looks within two seconds following the second bid, code the first response as inadequate and the second response as adequate.

e.g., Mother says "Go get your ball" and points at the ball. The point lasts longer than the speech. Begin the 2-second window of response from the child when the *point* ends.

There are 4 codes that can be used when coding Child Response to **all** utterance types. **BUT** the **directive/demand** category also involves an *additional 2 possible codes*, since the child has the ability to respond to a directive/demand not only by **looking**, but also by **performing the requested action**.

### *4 Possible child response codes for all utterances:*

**1. Look at mother:** Child responds to maternal bid for attention by looking at the mother's face. For instances where the mother is not holding an object and you are deciding between "look at

mother" or "no response," if the child **clearly** looks in the mother's direction, code as "look at mother," even if the child didn't actually look at her face.

e.g., Mother says "Hey you!" and child looks up at mother's face

**2. Look at target:** Child responds to mother by looking at the focus of the utterance, or continuing to focus on the same object, event, or aspect of an object as the mother. For instances in which the mother is holding/showing an object, and it is unclear if the child is looking at the mother or the object – our conservative code will be "**look at target.**"

*Exception:* if the mother is holding an object and the child **clearly** looks at her face, there is enough evidence to code "look at mother" and not "look at target."

**3. No response:** Child *ignores* a maternal bid for attention by failing to look at the mother, the focus of the utterance, or the G/A/B

e.g., Mother says "Look at the flower" and child ignores mother.

**4. Uncodable:** Code in response to the following situations:

a) Simultaneous Bid-Response: Mother bids child's action as child is already performing that particular action.

e.g., Mother says "Give me that block" as child is already picking up the block.

b) Poor camera angle: the child's gaze cannot be seen or the child's action cannot fully be seen; there is not enough evidence to determine if the child's response

e.g., Mother says "Look at the car" and child's face is blocked, so it cannot be determined if child looked or not.

***Child response to Directive/Demand utterances can be coded as one of the above 4 codes, or one of the following 2 codes (for a total of 6 possible codes):***

**5. Appropriate motor response:** Two potential scenarios:

a) Child responds to maternal bid by performing the requested action or another action that is *reasonably related* to the focus of the utterance (no more than 2 seconds after the bid).

e.g., Mother says "Get your ball" and child brings a ball.

e.g., Mother says "Show me how you tap dance" and child jumps up and down.

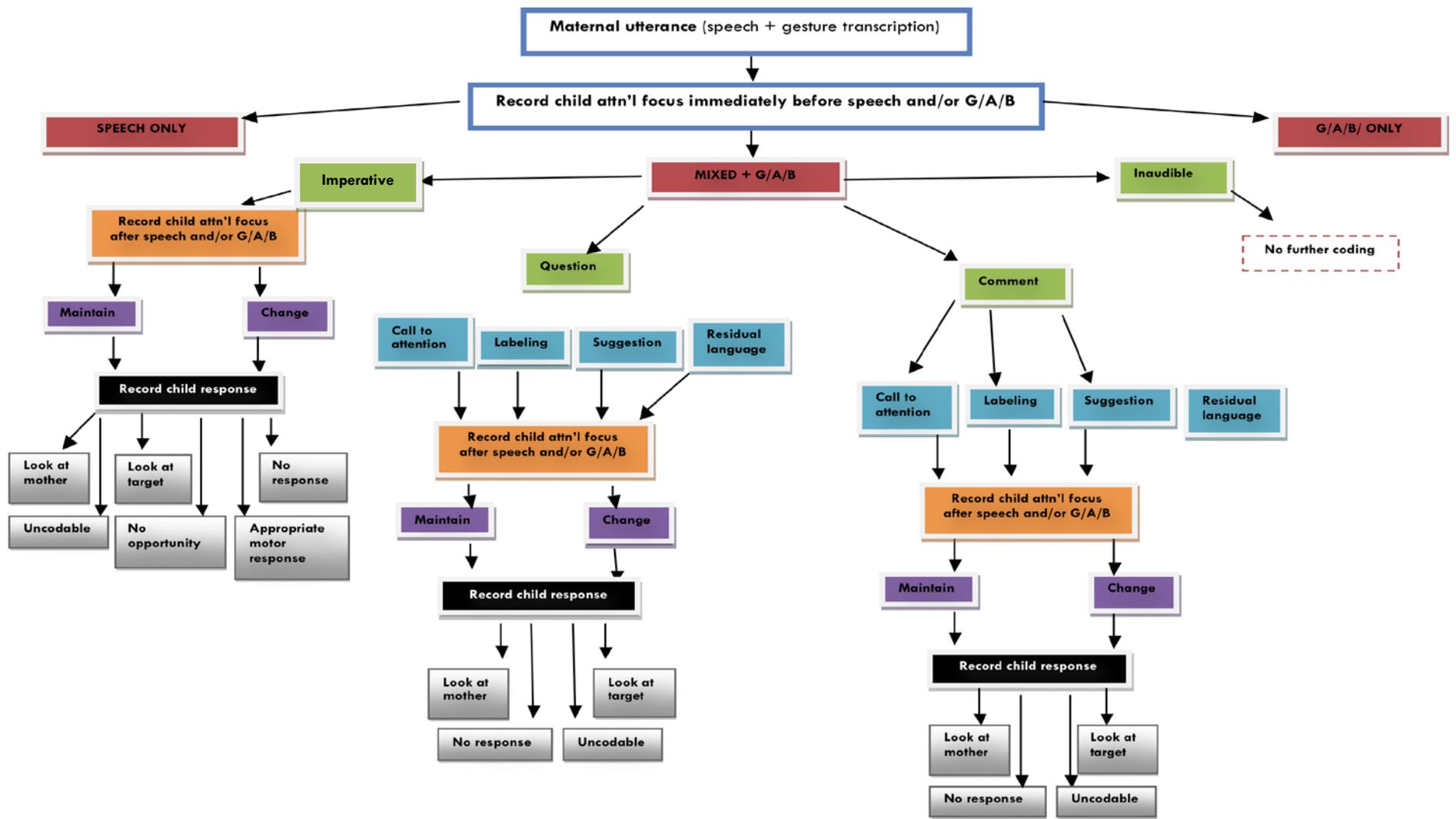
b) Mother requests a verbal response from the child (e.g., "Say duck") and the child responds by immediately producing a sound, even if it does not sound like the requested word.

**6. No opportunity:** A mother produces a Directive/Demand, and immediately responds to her request for action before the child has an opportunity to respond. The mother's response to her own bid must be *immediate*; there cannot be any time for the child to attempt to respond.

e.g. Mother says "Get your shopping cart" and grabs it herself, before child has an opportunity to get it

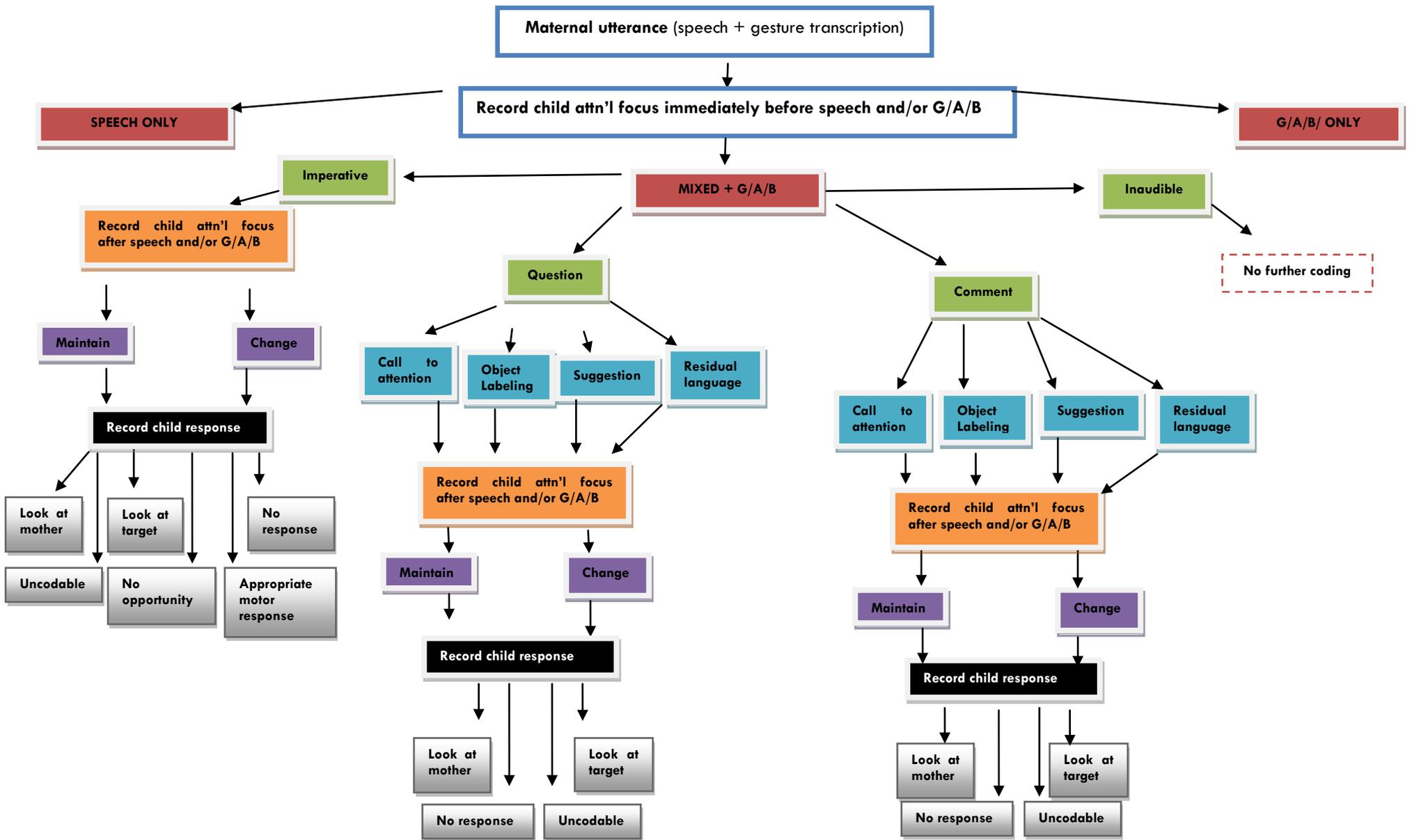
## **APPENDIX C**

### **FLOW CHART: SPEECH ONLY UTTERANCES**



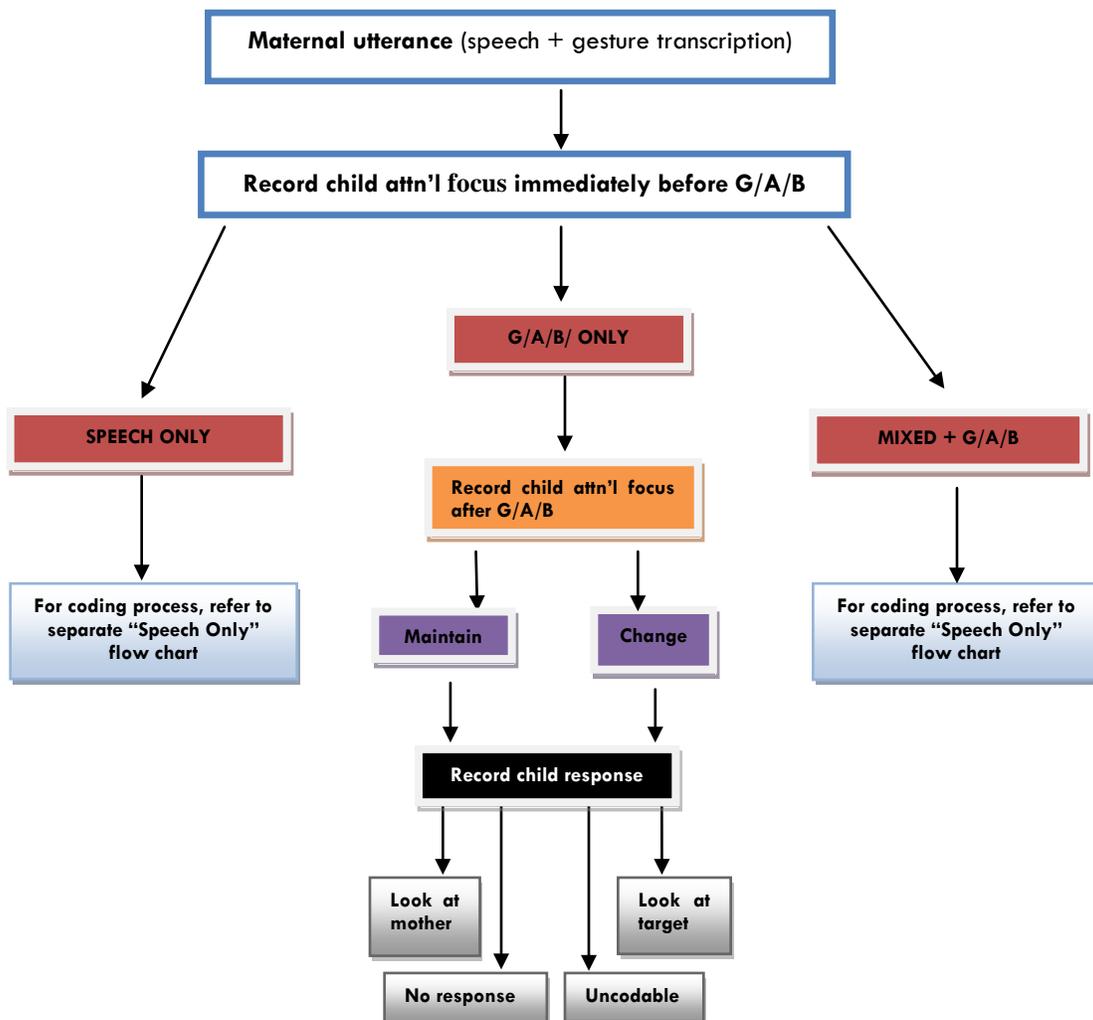
## **APPENDIX D**

### **FLOW CHART: MIXED + G/A/B UTTERANCES**



## APPENDIX E

### FLOW CHART: G/A/B ONLY UTTERANCES



## APPENDIX F

### FLOW CHART: UTTERANCE EXAMPLES

Code	Example 1	Example 2
<b>Maternal utterance</b>	"Conor"	"Take the cup"
<i>Description of child's attn'l focus before mother speaks</i>	<i>Child looking at box of ESCS toys</i>	<i>Child running after a soccer ball</i>
<b>Utterance composition</b>	Speech only	Mixed + gesture
<b>Description of maternal G/A/B</b>	↓	<i>Mother holding up a cup</i>
<b>Speech type</b>	Comment	Imperative
<b>Utterance function</b>	Call to attention	Directive/demand
<i>Description of child's attn'l focus after mother speaks</i>	<i>Child ignores mother</i>	<i>Child continues to focus on soccer ball</i>
<b>Focus Type</b>	Change	Change
<i>Description of child response</i>	<i>Child continues to look at toys in box</i>	<i>Child runs past mother</i>
<b>Child response (code)</b>	No response	No response

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