Quantifying infant social responsiveness:
Microanalysis of home videos of a set of triplets for early indications of autism

by

Jennifer Jay Gerwing
B.Mus., University of Victoria, 1991
B.A., University of Victoria, 2000
M.A., University of Victoria, 2003

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ABSTRACT

The first objective in this dissertation was to use microanalysis and a dyadic approach to investigate infant social responsiveness. Therefore, I developed a method that used a projective pairs framework: Parental social actions towards infants (i.e., *overtures*) projected particular infant behaviours. I analyzed whether infant behaviours following these overtures matched what the overture had projected; if they matched, the infant's behaviours were a response. The data were one family's home videos of their triplet infants (two males, one female), filmed when the infants were 6 to 15 months old. When the triplets were approximately three years old, clinical assessment indicated that one of the males had Autism Spectrum Disorder (ASD), which impairs an individual's social behaviors. The second objective here was to test whether the projective pairs framework would reveal early social deficits in the infant with ASD. This result would hold potential for earlier diagnosis (and thus earlier intervention). Researchers have used home videos to look for signs of ASD retrospectively, but these studies have been vulnerable to variability in the data, and often analyses of infant social behaviours did not connect these

behaviours to their social, dyadic context. In this dissertation, the home videos were from one family; therefore the data were more homogeneous, and the projective pairs framework preserved the immediate context. The data for Study I were 23 minutes of excerpts (infants' age 11-15 months). The microanalysis focused on overall infant responsiveness (i.e., the number of times each infant responded over the number of overtures that infant received). The infant with ASD was significantly less responsive than his two siblings. The data for Study II were all of the family's home videos from when the infants were 6-15 months old (approximately 6 hours). Study II included (1) an exploration of specific functions of overtures (e.g., greeting the infant, getting the infant's attention), and (2) an analysis of infant behaviours preceding overtures (e.g., looking at the parent, actively engaged elsewhere). The findings from Study II replicated Study I, they also painted a more complex picture. First, like his siblings, the infant with ASD responded to all non-social overtures, almost all helping overtures (e.g., taking a bottle that the parent had passed), and approximately half of overtures that served to seek his attention or to tell him to do something. Second, the infant with ASD was significantly less responsive to parental overtures that were more ambiguous (e.g., playing with the infant, narrating the infant's actions). Third, regardless of the overture's function, the infant with ASD was more likely to respond if he had looked at the parent immediately before the overture or if the overture included his name. A dyadic approach to the microanalysis of infant responsiveness identified those social interactions in which (1) the infant with ASD was as responsive as his siblings; (2) the infant with ASD was significantly less responsive than his siblings; and (3) the infant with ASD was the most responsive.

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Acknowledgements

I thank my supervisor Dr. Janet Bavelas for being an inspiring research mentor and for her unwavering confidence in my ability to do a project that differed in so many respects from our usual work. During all stages of my doctoral program, I have appreciated her experience, practicality, excellent advice, and humour.

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It took awhile for me to realize that the “Fisher” cartoons I enjoyed over my morning coffee would actually provide whimsical and eerily accurate illustrations of my definitions. I thank Philip Street for allowing me to use nine of his cartoons as examples of particular parent-infant interactions.

My work on this project was supported by a doctoral scholarship from the Social Sciences and Humanities Research Council. The project itself was supported by a research grant from the Queen Alexandra Foundation for Children and the Vancouver Island Health Authority Child, Youth, and Maternal Health Program.

Finally, I thank my father for always challenging me to strive harder to meet my intellectual and creative potential. I’ve appreciated his enthusiasm for this project more than I can say.

Dedication

This project is dedicated to the family who, knowing that their situation was unusual, volunteered their home movies for research purposes. Their willingness to share this aspect of their personal life displayed incredible trust and generosity. Thank you so much.

CHAPTER ONE: OBJECTIVES AND PRECIS

Some time ago, my colleague Sara and I were flying home from a conference. Across the aisle and few rows ahead of us, a mother held her baby girl, who was looking over her mother's shoulder toward us. Sara began to make big smiles and wide, surprised eyes at the baby. The baby watched, would smile and look away, then glance back, then squeeze herself into her mother's shoulder, peeking back to look at Sara again. The baby timed and coordinated her charming repertoire of social behaviors to respond to Sara's funny faces and waves. The social connection that Sara and the baby shared for those few moments was palpable and enchanting. Infants, with their gaze and their range of facial expressions and vocalizations, can be delightfully responsive. How tightly are their behavioral responses connected to the types of social actions adults direct towards them? Are playful exchanges, such as the ones I witnessed on the plane, the same as more serious ones? Will infants with a disorder characterized by reduced social interactive abilities also coordinate their social behaviors with others? These are the kinds of questions driving the research presented here.

This research had two main objectives. First, the aim was to apply an interactional (i.e., dyadic) approach to investigating infant social reciprocity. To meet this aim, I developed a systematic method for quantifying and characterizing infants' observable social behaviors, specifically, those behaviors that indicate social responsiveness to their parents. The data were one family's home videos of their triplet infants (two males, one female), filmed when the infants were 6 to 15 months old. The method was a *microanalysis* of sequences of observable interpersonal behaviors in the filmed data; most of these sequences were less than a few seconds in length. Specifically, the sequences were pairs that began with a parent's social behavior towards an infant (i.e., an *overture*) and ended with the infant's immediately subsequent behavior. The behaviors of the parent and infant, when compared and considered together, either complemented each other or not. For example, a complementary relationship between the two might be that the mother directed playful noises to the infant, who then looked at the mother and giggled in return. However, if the infant looked away from the mother and did not smile after she made the playful noises, then the relationship was not complementary; that is, the infant's behaviors were not a social response to the mother's overture. The proportion of overtures to which an infant responded in a socially reciprocal manner represented that infant's overall level of responsiveness to social overtures. In addition, a more specific characterization of parental overtures and complementary infant responses, revealed each infant's responsiveness to particular kinds of parent overtures. The latter analysis addressed questions such as how infants responded to greetings from parents versus how they responded to parental attempts to get their attention. The analysis of each infant's behaviors following different kinds of overtures created an individual profile of social reciprocity that indicated the infant's responsiveness in different interactive contexts.

The second objective of this dissertation was to test the relationship of social reciprocity to Autism Spectrum Disorder (ASD). After the period of time represented in the data, when the triplets were approximately three years old, a clinical assessment indicated that one of the males had ASD and that the other two infants (the other male and the female) were developing normally. Thus the second, equally important, aim here was to investigate how ASD influenced that infant's pattern of social responsiveness: Were the social features usually associated with ASD (i.e., deficits in social interactive behaviors) apparent and quantifiable in infancy? My prediction was that this infant would be generally less responsive than his siblings, a finding that would provide predictive validation for the method. In addition, a comparison of that infant's *profile* of responsiveness (i.e., to different kinds of overtures) with the profiles of his same-age siblings may be particularly informative for a more detailed understanding of one instance of the social expression of autism in infancy. Understanding social responsiveness more deeply holds promise for understanding ASD in two different respects. First, the contexts in which the infant with ASD was less socially responsive than his siblings are of interest because these may differentiate more precisely between this infant and the other two, thereby providing a promising direction for future, similar investigations into the early social expression of ASD. Second, perhaps more importantly, identifying the contexts of *successful* interactions for an infant with ASD (i.e., ones where the infant responded) offers potential for a socially focused, positive intervention. These already established patterns of interactive success between an infant and his or her parent could provide a strong foundation for learning new social behaviours. That is, the analysis presented here holds promise for future research that could inform clinical intervention.

Précis of Dissertation Chapters

In Chapter Two, I introduce my theoretical framework in detail and use this framework to review three disparate islands of literature, focusing on their methodological congruence with my theoretical assumptions. These three areas are (1) theoretical and empirical support for a *dyadic* (as opposed to monadic) system of analysis; (2) investigations into *parent-infant interaction*; and (3) methods for discovering the phenotype of ASD in infancy, in particular, the use of *home videos* to discover how infants express ASD. The overarching purpose of Chapter Two is to outline my criteria for a social, dyadic microanalysis of home videos, and Chapter Three is an account of an investigation that met these criteria, namely, Study I that led to the larger scale analysis of this dissertation (Study II). In the Study I, I developed a general measure of social responsiveness. It is important to note that, while I developed and conducted the analysis, I did not know which infant was later diagnosed with ASD. The results of Study I revealed the following pattern. Two of the infants had equal response proportions. They responded at the same rate to overtures from their parents. The third infant, who was the one later diagnosed with ASD, was significantly less responsive than his siblings. He responded to fewer overtures than his two typically developing siblings did. These findings provided empirical justification for the larger, more detailed, analysis of social reciprocity reported in Chapter Four. Besides necessary replication of Study I (i.e., by cross validation), and extension of the analysis to a larger age range (6-15 months), the major contribution of Study II was to investigate the various specific functions of parent overtures. I reliably grouped overtures into nine separate, inductively-derived social functions in order to investigate if the infant later diagnosed with ASD was more responsive to some kinds of overtures and less responsive to others. Chapter Five reports the results of Study II, including the planned replication. I have summarized the results in three ways, corresponding to the main goals of the project. First, there is a comparison of the responsiveness of the infant with ASD to that of his brother and sister. Second, there is a developmental comparison, tracking the responsiveness of the infant with ASD across three age ranges (6-8; 9-11; and 12-15 months). Third, there is an examination of those specific contexts in which the infant with ASD was more or was less responsive. Chapter Six is a discussion of the findings, which I integrate into the initial framework as well as into the findings reported from previous, relevant literature. Finally, a detailed set of Appendices supplements the empirical Chapters (Chapters Three, Four, and Five), providing both a full inventory of the data and a copy of the materials used in both Study I and Study II.

CHAPTER TWO: LITERATURE REVIEW

The purpose of the literature review in this chapter is not to provide comprehensive coverage of either parent-infant interaction or the expression of Autism Spectrum Disorder (ASD) in infancy. Its purpose, instead, is to orient the reader to the underlying logical foundation and subsequent construction of the research project reported in the later chapters. That is, the present review serves to integrate the project into a theoretical framework and an existing, directly relevant body of literature.

Prefacing the literature review is a detailed account of the theoretical assumptions that the project reflects. A congruent, overarching framework (the *collaborative theory of communication*) summarizes the assumptions, and the method that fulfills the underlying theory of the project is *microanalysis* (the moment-by-moment analysis of sequences of communication). The assumptions, theoretical framework, and method provide the criteria for the next section, reviewing the literature on parent-infant interaction as well as the literature on the relationship between ASD and infant responsiveness. The last section of this chapter focuses on methods that researchers currently use to look for signs of ASD in infancy; because the data for this project were home videos, the reports of retrospective home video analysis are covered in the most detail.

Theoretical Assumptions

For most researchers, there is an obvious relationship between their theoretical assumptions and the methodological features of their research projects. However, in actual reports of research, the assumptions that had provided the foundation for research questions, analysis methods, and interpretations of the results are often unacknowledged. Rather than allowing my own theoretical assumptions to remain implicit, I will articulate them explicitly here, indicating how they determined my choices throughout the project. In this section, I present four assumptions, casting each as a contrast between two alternatives for approaching home video data. Each of my chosen alternatives explicates how my analysis proceeded and why it did so, with the goal of demonstrating the relationship between theory and practice.

Contrast 1: Mental Processes vs. Social Processes

With videotaped data, the researcher has a record of directly observable behaviors, and analysis would logically center on them. What these behaviors mean for the researcher cannot be clear until the researcher articulates what aspect of infancy is of interest. Does the investigation focus on discovering what the infant is feeling or thinking (e.g., emotions, motivations, perceptions, cognitions)? Or does it focus on analyzing how the infant is acting in relationship to others (i.e., social behaviors)? If the researcher's interest is in mental states or processes, these internal processes are themselves unobservable, and they can never be known except by inference from the clues in the infant's behaviors. In contrast, if the interest is in social processes, the behaviors are not merely suggestive of what is happening in the social interaction; they are themselves part of the social interaction. In other words, the researcher need not infer the existence of social processes, these processes are directly observable. For this research project, my interest was on social behaviors, not on the mental processes that gave rise to those behaviors. For example, the focus was on how the social interaction unfolded, not on the extent to which an infant seemed interested in social interaction or on the infant's level of social motivation or understanding. My assumption is that these social behaviors are interesting in and of themselves, so that it was neither necessary nor desirable for me to also make inferences about their relationship to processes inside the infant's head.

There are at least three diverse precedents for my focus on social rather than mental processes. First, Sears (1951), in his presidential address to the American Psychological Association, went further than this, stating that *actions* (as opposed to perceptions or traits) ought to be the events of most importance to psychologists in general (not just those interested in social processes), if for no other reason than that actions are most amenable and available to observation and measurement. He maintained that internal processes such as "needs or motives, perceptions, traits, and other such internalized structures or processes" were not necessarily irrelevant, but what could be learned from them was only of real interest in terms of how knowledge of these internal structures and processes could be used to predict actions.

Second, Watzlawick, Bavelas, and Jackson (1967) went even further and characterized the human mind as a "Black Box", that is, they compared the internal workings of the human mind to electronic hardware that is either too complex to study or is invisible to the observer. It is therefore more expedient to disregard the internal structure of the device in order to concentrate investigations on what the device is doing in relation to the outside world. Although the observed behaviors may permit inferences about what is 'really' going on inside the box, such inferences are not essential for the study of the function of the device, especially its function as part of the larger system of which it is a part. (In a later section, I will return to the metaphor of the Black Box.)

A third source for the assumption that inferences about internal processes are not essential for understanding how the infant functions in the parent-infant social system is the ethological perspective (e.g., Bull, 2002; Hutt & Hutt, 1970; Kendon, 1990; Kraut & Johnston, 1979). Whether studying animal or human behavior, most ethologists study observable behaviors in order to understand their role in the organism's social environment and do not use them to infer mental processes. For example, Kraut and Johnston focused on smiling as a social *display* to others rather than as an *expression* of an emotional state.

In order to connect this particular theoretical assumption to the present specific project, it was essential not just to avoid mental inferences but also to study the infant's actions within the social context of interaction with the parent. Therefore, the behaviors analyzed were only those that occurred within that context, and their interpretation did not extend past the social realm. Also, throughout this dissertation and especially in the materials used for analysis, I endeavored to reflect a social approach in my vocabulary. For example, instead of saying that an infant who was smiling was happy at that moment, I would say that if he smiled while looking at a parent, he was displaying enjoyment to that parent. I've employed this discipline of terminology in order to keep the reader's, the analyst's, and my own focus strictly on social behaviors and away from inferences regarding internal states. For the same reasons, the review of the literature does not focus on topics such as intersubjectivity (whether primary or secondary) or infants' expectations of regularity (i.e., social contingency). Finally, although some of the results may have implications for the emotional or cognitive development of the infants, I did not make such attributions, focusing instead on the implications for social development.

Contrast 2: All Observable Behaviors vs. Selected Behaviors

Home videos of parents and infants are often action packed: Parents talk to each other, to the infants, and even to future audiences by addressing the camera; infants babble, scream, wiggle, crawl, and grab things; adults and infants play little games together or sometimes accomplish tasks together, such as feeding or bathing. From this vast array of behaviors, the researcher must decide which ones are directly of interest (and therefore should be analyzed) and which ones are not directly of interest (and therefore will not be analyzed).

One alternative, a purely inductive approach, is to analyze *all observable behaviors* (i.e., all vocalizations and all actions) of everyone who is onscreen. The purpose of this method is to record what is happening without transforming or reducing it according to preconceived principles or categories. A famous example of this approach was an innovative research project called the Natural History of the Interview (NHI), which was undertaken by a multi-disciplinary team at the Center for Advanced Studies in the Behavioral Sciences near Stanford University in the nineteen fifties and sixties (Leeds-Hurwitz, 1987). The NHI data were videotapes of a family’s interactions with (and without) a therapist. A keen interest in illuminating psychiatric intuition motivated these pioneering researchers, and their approach reflected a fundamental belief that any *a priori* basis for selecting which behaviors to analyze would impede the discovery of the true complexity and patterning of human behavior in interaction. Using an innovative frame-by-frame analysis technique, they painstakingly transcribed and analyzed all overt behaviors of all participants on the videotapes. The manifestation of their efforts, including vast transcriptions and training materials, was colossal in scope, resulting in volumes of unpublished information, most of which is only available on microfiche (Kendon, 1990; Leeds-Hurwitz, 1987).

Although impressive in innovation, depth, and scholarship, the NHI approach would prove unwieldy for most researchers. Also, the field of human communication and interaction has advanced sufficiently so that present-day researchers can take a more focused approach. A contrasting approach is to conduct a comprehensive analysis of a narrow, well-defined *selection of behaviors*. This latter method suits research driven by a focused, specific purpose or question. Therefore, because my project had a clear purpose, which was to explore infants' social responsiveness in interaction, I chose a selective approach, focusing the scope of analysis on behaviors that occurred sequentially between parents and infants during interaction. My assumption was that a comprehensive analysis of behaviors during these moments would most clearly elucidate infant responsiveness to parents. Furthermore, I assumed that the analysis of additional behaviors at other moments would only obscure social patterns and processes that would otherwise emerge with more clarity. In other words, the potential gain of clarity and focus more than offset the cost of eliminating other data, especially because the specific purpose of the project provided clear criteria for including or excluding the behaviors to be analyzed.

At a practical level, the selective approach dictated that analysis should begin with the precise definition of the moments during which behaviors of interest would occur. Specifically, these moments began when one parent directed social behaviors towards a single infant. As noted above, I excluded a myriad of behaviors that might otherwise have been of great interest. For instance, because the focus here was on infant responsiveness to parents, it was not on infant responsiveness to other infants or to other adults, to family pets, or to new vs. familiar objects. Therefore, although these sequences would also be indications of responsiveness, I did not include them because they were not relevant to the purpose of the present project.

Contrast 3: Monadic vs. Dyadic Unit of Analysis

Another critical step in any scientific investigation is to define the unit of analysis. Successful observation in any science begins with a definite understanding about the size of unit one is going to observe at a given time (Lewin, in Deutsch, 1968, p. 419). The most common unit of analysis for psychology is the individual, that is, a *monadic* approach. Applying this approach to the home video data in this project would mean analyzing only the infants' behaviors. One monadic method would be to count the frequency of infant behaviors, but this common approach has several disadvantages. By focusing on locating a particular individual behavior, the analyst would have no mechanism for noting occasions when the behavior did not occur. If the interest were in understanding infant responsiveness, then overt individual behaviors (such as smiling or looking at the parent) might be considered indicators of responsiveness, but locating these behaviors would tell us nothing about how often the infant was unresponsive. So a second method might be to create a proportion of the amount of time an infant is responding out of total amount of time analyzed (e.g., proportion of time spent smiling or looking at the parent). This method would at least tell us how often there was a lack of infant behaviors, but it would not elucidate why the infant responded sometimes and not at other times. A third monadic approach would be to look for temporal contingency between the parent and infant behaviors, that is, to look at the point where the parent directed a social action towards the infant and then record whether the infant exhibited a behavior at that moment. Although the behaviors of both the parent and the infant would be temporally linked, this would still be an essentially monadic analysis. The parent's initiating behaviors would remain in the background, undifferentiated. That is, all parental behaviors would be the same, precluding the possibility of connecting infant responsiveness to a specific parental behavior. The results of such an analysis would not fully reflect the infant's capacity to make differentiated social responses. For example, take the case of an infant who did not look at the parent after the parent's social action. This would be unresponsive if the parent's action had been to seek the infant's attention, but it would be *responsive* if the parent's action had been to direct the infant's attention to something else. That is, even if the timing of the infant's actions are carefully related to the timing of the parent's actions, unless the analysis extends to the meaning of those actions, the unit of analysis is still monadic and does not illuminate social processes.

In this study, I chose an alternative approach, using a *dyadic* unit of analysis: Both the timing and the social meaning of parent and infant behaviors were analyzed directly in relationship to each other. The analysis began with locating parents' social actions and analyzing them for their social meaning. Then I analyzed infant behaviors during and immediately after the parental actions in terms of their social relationship to the parent's actions. Recall the above example of the infant who did not look at his parent: if the preceding parental action had been to say, "Look over there," then the infant's behaviors would be socially responsive. However, if the parental action had been to say, "Look at mummy," then the infant's actions would not be socially responsive. In both examples, the infant did something in relation to the timing of the parent's actions, but only in the first case could the infant's actions be considered a social response. The dependent variables in this analysis were therefore truly dyadic; they were complementary sets of parent-infant behaviors. That is, I matched specific parental actions with specific infant responses, which H. Clark and Krych (2004) called “projective pairs” (see the next section for a fuller explanation of this concept).

Again, this decision was hardly unprecedented. For example, Sears (1951) argued that a dyadic, not monadic, unit of analysis is necessary to understand social behavior, and he defined the dyadic unit of analysis as “one that describes the combined actions of two or more persons” p.479. Kendon (1990) characterized participants’ behaviors in an interaction as “steering a course in relation to one another” (p. 28) and, because each interactant shaped the other’s behaviors during interaction, the investigation of social behaviors requires examining what both participants were doing at that moment. My choice of the dyad over the monad was therefore based on an understanding that how one defines the unit of analysis transforms the events recorded on the videotape. A social understanding of the behaviors of both the parent and the infant required that the analysis treat them as a dyadic unit.

Contrast 4: Classifying Behaviors by Form vs. by Function

Fundamental to any science is to go beyond investigating a given phenomenon’s individual properties to finding commonalities among phenomena. Thus scientists create methods and rules for grouping and comparing objects, processes, or systems. The researcher must decide which units are similar to each other and on what basis, and by discovering these similarities and differences, the researcher finds patterns and predictability. Because the purpose of this project was to profile infant social responsiveness and to find what differentiated between an infant with ASD and his two typically developing siblings, discovering patterns and predictability were both essential. The following four short, dyadic vignettes will serve to illustrate two alternative methods for grouping or classifying these four sequences.

1. An infant boy is standing next to his mother, holding on to her leg and looking down at her feet. The mother says “Andrew” to him; he looks up at her without smiling, then he looks back down.
2. An infant boy is sitting on the floor close to his mother. He looks over to her and looks directly at her face. His mother says “Andrew” in a warm and friendly tone; the infant continues to look at his mother’s face, then he smiles and turns away.
3. An infant boy is standing in his highchair and looking at his mother. The mother asks him to sit down, but he does not sit, instead he continues to stand and look at her. His mother then says “Andrew” in an angry tone; he looks away from his mother while continuing to stand.
4. An infant boy is watching television. His mother says “baby boy”; he turns to look at his mother, smiles, and begins to toddle over to her.

One alternative for grouping behaviors such as these is to put together ones that have a similar *form* (i.e., they look alike or sound alike). By such a method, one would group the mother’s behaviors in cases 1-3 together because they all have the same form (saying the infant’s name), and case 4 would be in a different group. If the researcher’s purpose were to discover how infants respond to their name, then analysis would continue on this variable (“response to name”) for cases 1-3, and case 4 would no longer be of interest. Next, because the unit of analysis is dyadic, the form of the infant’s behaviors must be classified as well: How does the infant respond to the mother saying his name? Again, if classifying by form, the researcher would decide what specific form the infant's behavior should take in order to constitute a response. Perhaps the researcher decides that for an infant's behavior to count as a response to his name, he must look at his mother's face. In each the first three cases, the infant looked at his mother, therefore, according to this approach, the infant was fully responsive to his name being called.

An alternative approach is to group behaviors together because they have a similar *function*. In doing so, the behavior's form is relegated to only one of several indicators of function; it is not the only criterion. When classifying by function, the researcher takes into account the context of the behavior, including the immediate situation, what was said or done, and how it was said and done (e.g., prosody and style). These factors all provide criteria for identifying the function that the particular behavior was serving in that context and at that moment. In the first of the four cases above, the infant was looking at his mother's feet when his mother said his name. One possible function of saying his name was to get him to look up at his mother's face. Therefore in this context, "Andrew" was serving an *attention-seeking function*. In the second case, the infant was already looking at his mother when his mother said his name. Thus in this instance, "Andrew" could not have been serving an attention-seeking function. Instead, it served the function of acknowledging that the infant was looking at his mother; it served a *greeting function*. This case would be grouped with other greetings, such as when the mother said "hello" or "hi." In the third case, the infant was standing in his highchair, which was dangerous, so the infant was being somewhat naughty. Again, he was looking directly at his mother, so the function could not have been to seek the infant's attention.

Because she had already told him to sit down, the infant was being disobedient, so the function was not likely to be a greeting either. Furthermore, the mother used an angry tone when she said his name. This case of saying “Andrew” was serving the function of telling the infant boy that he should sit down and stop being naughty; it served a *directing function*. This case would therefore belong with instances where the mother directed the infant to do things, such as “sit down,” “stop dribbling water on the floor,” or “come to mummy.” Finally, the fourth case has features in common with the first, namely that the infant was looking away from his mother, and the words “baby boy” served an attention seeking function. Note that this analysis by function grouped the four cases completely differently than categorizing by form had done. The next step of analysis would be to classify the infant’s behaviors by function. To do so, the analyst would ask, “would this infant’s behavior function as a response to the mother, given the immediate context and the function of the mother’s behavior?” However, a functional approach to the infant’s behaviors in each of the four cases is too lengthy for inclusion in this chapter; this topic will be covered in detail in the introduction to Chapter Four.

In conclusion, these four assumptions provided the foundation for my choices throughout all stages of this research project. My goals were to understand social processes between parents and infants more deeply and to see how an infant with ASD behaved differently than his typically developing siblings in social interactive contexts. To meet these aims, I focused on social rather than mental processes, chose key interactive moments in the videos at which to analyze behaviors, used a dyadic unit of analysis, and analyzed both parent and infant behaviors according to their function rather than their form.

The Analogy of the Black Box

My assumptions can be summarized, perhaps unexpectedly, by reference to some principles of cybernetics. Cybernetics is a general theory about self-regulating systems, and it provides some investigative principles that are useful for studying human interaction. Cybernetics initially developed out of a need to design an anti-aircraft gun that could automatically track its moving target. The central idea was that the system controlling the output of the device was directed by information about the consequences of this output (Kendon, 1990). The consequences of feedback and self-regulation clearly apply in human interaction: each interlocutor responds to the other on a moment-by-moment basis (thus providing feedback), and this system of feedback allows the conversation to proceed in an ordered and self-regulated manner (Kendon, 1990; Watzlawick et al., 1967). In cybernetics, a scientist is said to have encountered the problem of the Black Box anytime the device he is studying has an internal mechanism that is not accessible to direct observation, but the device itself has input and output possibilities that allow the scientist to study what the device does (Ashby, 1957). What is inside the Box is invisible, but the Box's outputs in response to the scientist's inputs provide the data for scientific observation. As mentioned earlier in this chapter, human beings can be characterized as a Black Box device, that is, one's internal processes (e.g., cognition, emotions, motivations) are essentially invisible, but one's behavioral "outputs" in response to "inputs" are amenable to direct observation. Ashby wrote principles for studying Black Box systems, four of which map directly onto my assumptions:

1. What is happening inside the Black Box (i.e., the internal mechanisms) is not only unavailable for inspection, it may be of less interest than the Box's behaviors (i.e., its outputs in response to inputs). As Ashby put it,

> The experimenter who is not interested in Black Box theory usually regards any casing [that is, what blocks access to the inside] as merely a nuisance, for it delays his answering the question 'what is in this Box?'. We, however, shall be considering such larger questions as "How should an experimenter proceed when faced with a Black Box ?" "What methods should be used if the Box is to be investigated efficiently?"(1957, p. 87)

These ideas map onto my first assumption, which was that the informational and investigative value of observable behaviors does not have to be measured by the extent to which they can inform the researcher about internal processes; these behaviors are scientifically interesting in and of themselves.

2. Ashby postulated that the only way to understand a Black Box is to influence it with various inputs and then record the consequent outputs. That is, a Black Box is best understood by relating its inputs and outputs. Imagine you have a Black Box device that you are trying to understand, and you have amassed an SPSS data file that lists all your antecedent inputs in one column and a detailed account of the Box's consequent outputs in the other. While you are out for coffee, a nefarious colleague deletes your input column and leaves you only with your detailed list of outputs. Is your list of outputs, even if described in great detail, going to help you understand your device? Likely not, and you will have to start your investigation again. These outputs, abstracted from their contexts are essentially meaningless. I propose that a list of isolated outputs is analogous

to a list of behaviors that have been classified exclusively by form. Stripped of context and function, they are also essentially meaningless. My theoretical assumption is therefore that observable social behaviors can only be understood in terms of their function within the system, that is, their relationship to other behaviors.

3. When two Black Boxes are coupled (i.e., connected), their emergent properties cannot be predicted by what is known about each one individually. Ashby likened coupling to the results of combining ammonia and hydrogen chloride: When these two gases are mixed, the result is a solid, which is a property that neither reactant possesses. The same could be said of individuals in an interaction. Their behaviors together as a system cannot be understood by examining their individual characteristics. The two together must be understood as a new system with emergent properties. Investigating the properties of coupled Black Boxes is analogous to investigating those of a parent and an infant who are interacting. By adopting a *dyadic* unit of analysis, I acknowledged that the two together will exhibit emergent behaviors. While together, they will act differently than either would have acted alone.

4. When Black Box systems are complex and coupled, the method of study must be precise. Ashby wrote that his experience has shown that in such cases the scientist must be very careful about what questions he asks. “He must ask for what he *really* wants to know, and not for what he thinks he wants” p. 113. Ashby’s example is that of a beginner, who, approaching the complex system, decides that he wants to know everything that a particular cluster will do. If this knowledge, however, could be given to him, it would take the form of many volumes filled with numerical tables, and he would then realize that he did not really want all that. In fact, Ashby continued, it is usually the

case that a significant question is something simple, for example, “will the cluster contract to a ball, or will it spread out into a disc?” Previously I described the NHI project, which resulted in the careful gathering of too much information, and I proposed that an alternative method for studying is to be selective about which behaviors will be analyzed, and that this selection is inextricably tied to the precise question the researcher is asking.

Collaborative Theory and Microanalysis

The assumptions and choices just described are most expeditiously met within the framework of the *collaborative* theory of communication (H. Clark, 1996) and using the method the *microanalysis* of communication, as developed in experimental research by our group (e.g., Bavelas, Black, Lemery, & Mullett, 1986; Bavelas, Chovil, Lawrie, & Wade, 1992; Bavelas, Coates, & Johnson, 2000, 2002; Bavelas, Gerwing, Sutton, & Prevost, 2008; Gerwing & Bavelas, 2004).

Collaborative Theory

Although H. Clark (1996) developed his collaborative theory for language use and therefore implicitly for adult interactions, the basic principles apply equally to non-linguistic parent-infant interactions. Clark characterized language use as a joint activity, drawing an analogy between conversation and other forms of joint activity, such as playing tennis or playing a piano duet (vs. hitting against a backboard or playing a solo). Collaborative theory is a useful framework for approaching interactive data because it emphasizes the relationship between participants’ behaviours and clarifies how investigating individual actions would be a misguided method for understanding communication. Within a collaborative perspective, behaviours that occur in interaction (e.g., actions, words, or gestures) cannot be extricated from their immediate interactional context and still be understood. Abstracting an interactive behaviour from the context in which it occurred strips it of its meaning, import, and function. Clark has introduced a number of conceptual tools that focus on the collaborative rather than individual aspects of language use.

One specific conceptual tool that Clark offered for studying behaviors in interaction went beyond verbal or linguistic actions, characterizing certain two-part sequences of behaviours as *projective pairs* (H. Clark, 2004; H. Clark & Krych, 2004). In a projective pair, the first person proposes a joint project to the second, and the second person takes up that proposal. For example, if one person asks another what he would like for dinner, it is likely that the other will say something related to dinner plans. Or if one says “do you mind shutting the window”, the other will either agree to shut the window (thus taking up the first’s proposal) or will not shut the window (thus indicating that he is not taking up the proposal). Projective pairs are “projective” in the sense that the first action projects (i.e., suggests or enables) the second. The first behavior sets up an expectation for what might happen with the second. Thus the two behaviors are linked together both in time and in meaning. In my analysis, infant-directed adult social behaviours, which I called *overtures,* began each projective pair. The context, form, and function of each social overture projected the infant’s post-overture behaviour; the parent’s overture created an expectation for how the infant should respond[1]. For example,

[1] The term *adjacency pairs* (Sacks, Schegloff, & Jefferson, 1974) is similar to Clark’s projective pairs in that the first utterance in an adjacency pair produces expectations for the second (e.g., question-answer), but because adjacency pairs explicitly refer only to verbal acts that do not overlap, and projective pairs encompass both verbal and nonverbal acts even if they overlap with each other, I have adopted Clark’s terminology.

calling an infant's name to get his attention projects that the infant should shift his orientation towards the adult, whereas saying his name when he is disobeying projects a different response than mere orientation (namely, compliance). Note how adopting the framework of projective pairs shifts the analysis away from the infant's individual actions or characteristics. Instead, it provides a framework for evaluating the infant behaviors in direct relation to the parent behaviors; that is, it treats the two sets of behaviors as a dyadic unit. Thus the concept of projective pairs meets my assumptions and also reveals each instance where the infant responded socially as well as each instance where he did not.

Microanalysis

The method that best fits the analysis of projective pairs in this project is *microanalysis* as our research group has developed it for the study of adult social interactions (e.g., Bavelas et al., 1986; Bavelas et al., 1992; Bavelas et al., 2000, 2002; Bavelas, Gerwing, Sutton, & Prevost, in press). Our method focuses analysis on the relationship between observable behaviours at a micro-level (often shorter than one second) and at a functional rather than purely descriptive level. That is, the analysis I developed here reveals the moment-by-moment relationship between sequences of behaviours (i.e., projective pairs) rather than simply categorizing individual behaviours (such as infant behaviors abstracted from their interactive context). Microanalysis as a method is directly suited to the analysis of videotaped data, and it meets my theoretical assumptions in the following respects. First, microanalysis is the systematic analysis of *actual, observable behaviours*. Furthermore, because the focus of microanalysis goes beyond words alone and can include *all visible and audible behaviours*, it is well-matched to an analysis of interactions between preverbal infants and their parents who are tailoring their contributions accordingly (e.g., sometimes using vocalizations or nonsense syllables instead of words). Second, because microanalysis is a rigorous and intensive method, it is best applied on short selections of data. Thus, by analyzing only carefully selected sections where parents and infants are potentially interacting, I can undertake the frame-by-frame method of microanalysis without getting mired in too much information. Third, microanalysis focuses on the *dyad as the unit of analysis* rather than each individual and is thus a method well-suited to exploring social interaction. As the following literature review will show, most previous research focused exclusively on infant behaviours, ignoring the immediate (micro-)social context of the infant's behaviour. Fourth, microanalysis uses detailed operational definitions that provide a systematic, consistent method for deciding on the meaning of participants' behaviors. That is, it is possible to apply a *functional* analysis with high inter-analyst reliability.

Microanalysis, as our group uses it, offers some additional benefits to this project. First, it is a method in which the researcher starts with a specific research question but develops the procedures for analysis inductively from the data (rather than adopting a generic coding system). That is, the researcher tailors the rules and operational definitions so that they both fit the nature of the data and address the research question directly. An inductive method aids new discoveries, but it is also best to combine it with replication. For this project, I developed my procedures inductively from a subsection of the data (the inductive phase) and then tested and extended them by applying them to the rest of the data (the deductive phase). Finally, because microanalysis is rigorous and systematic, the results of analysis are quantifiable and amenable to statistical analysis. That is, the analysis may focus on qualitative (rather than scalar or parametric) phenomena, but they can become quantitative. Because one of the purposes of this project was to compare the social responsiveness of the infant with ASD to his two typically developing siblings, a method that offers the tools for statistical analysis was essential.

Studies of Parent-infant Interaction

Many researchers have implicated social responsiveness between parents and infants as the origin of capabilities that are fundamental to human functioning, such as language acquisition and development (e.g., Bruner, 1983; Bruner, 1985; E. V. Clark, 2003; Jaffe, Stern, & Peery, 1973; Kuhl, Tsao, & Liu, 2003; Schaffer, 1977; Sugarman, 1984), understanding and using symbols (e.g., Camaioni, Aureli, Bellagamba, & Fogel, 2003; Hobson, 2007), emotional understanding and exchange (e.g., Beebe & Gerstman, 1984; Golinkoff, 1993), social relations (e.g., Bateson, 1975), social rituals and culture (e.g., Carpenter, Tomasello, & Striano, 2005; Newson & Newson, 1975), social cognition (e.g., Rochat, 2001a; Rochat, 2001b; Rochat, Querido, & Striano, 1999), and cognition (e.g., Hobson, 2004; Kaye, 1982). Given the proposed importance of social responsiveness to so many crucial aspects of development, the analysis of the behavioral relationship between parents and infants is well worth undertaking.

Parent-infant Interaction as a Dialogue

As mentioned above, when H. Clark and Krych (2004) proposed the construct of projective pairs, they were explicitly expanding the purely verbal concept of adjacency pairs to include communicative acts that were not verbal, for example, combinations of words and speech-related gestures. This change makes projective pairs a tool that is arguably applicable to the pre-linguistic behaviours of infants. Bruner (1985) proposed that language acquisition begins when mother and infant create a predictable format of interaction. Bateson (1975) and Condon and Sander (1974a) concurred, suggesting that by the time an infant begins to speak, he or she may already have laid down the form, practice, and structure of the language system of his culture. Furthermore, many researchers have characterized early mother-infant interaction as *dialogues* or *conversations* (e.g., E. V. Clark, 2003; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001; Jaffe et al., 1973), or as *dialogue-like* or *conversation-like* exchanges (e.g., Bateson, 1975; Newson & Newson, 1975). Therefore, the use of a framework designed for studying dialogue is congruent with conceptualizations of parent-infant exchanges.

Not only have the above authors characterized early parent-infant interaction as a dialogue or conversation, the research literature on typical development has a tradition of studying infant behaviours in a dyad, that is, within their interactional context. Perhaps because preverbal infants are so highly dependent on parents, their individual acts are not meaningful out of their interactional context, and many authors have conceptualized parent-infant interactions as joint action. Stern (1974) saw the behaviours of each participant as being "so unique to the situation and tailored for each other that the forms and functions of these social behaviours must be studied in the presence of the other partner." In their analysis of the relationship between mother and infant behaviours in interaction, Brazelton, Koslowski, and Main (1974) found that neither the mother's nor the infant's behaviour was ever independent of the other's behaviour within that particular interaction: Single behaviours isolated from their sequence lost their meaning. In his introduction to *Studies in mother-infant interaction*, Schaffer (1977) stated that using the mother-infant dyad as the unit of analysis was a major methodological advance:

The fact that many researchers had created dyadic dependent variables indicated that "interactive situations need not be reduced to variables pertaining only to individuals but may be treated in terms peculiar to themselves" (p. 7). Bruner (1983; 1985) defined *formats* as the interactive pairing of behaviours between mother and infant, which formed "a contingent interaction… in the sense that the responses of each member can be shown to be dependent upon a prior response of the other" (1985, p. 39). Bruner succinctly described the responsiveness of mothers and infants to each other as a "rule-bound microcosm" (1985, p 39).

Microanalysis as a Method

Many researchers interested in parent-infant interaction also support microanalysis as a method for studying parent-infant interaction. For example, Newson and Newson (1975) proposed that analysts must create a detailed sequential description of the alternating flow of communication gestures to study infants' social actions. They proposed that, in particular, such an analysis would require (1) technology that captures both audio and video and permits repeated replay, with slow motion when needed; (2) a clear recording of the signaling behavior of both the mother and the infant, which would include the direction and quality of their changing attentiveness as well as the overall setting; (3) that the analyst relate activities of each partner to those of the other in an accurate time sequence; (4) that coding methods are sensitive to the meaningful content of whatever communication is taking place. Schaffer (1977) proposed a similar list, stating that what is needed for an understanding of infant social development includes: (1) treatment of social behavior in dyadic terms; (2) emphasis on temporal relationship in interactive situations; (3) the use of microanalytic techniques; and (4) an interest in processes rather than products. The following studies are reports of microanalysis of parent-infant interaction.

Infant Social Responsiveness

Research on videotaped mother-infant interaction is extensive, and many researchers have used microanalysis as a method. Some of these, however, conducted a microanalysis of either mother or infant behaviors without reference to the relationship between the two (e.g., Flynn & Masur, 2007; Nwokah, Hsu, Davies, & Fogel, 1999; Peery & Stern, 1975) or without articulating exactly how they analyzed the actions of the other partner (Stern & Gibbon, 1979).

Other researchers used a dyadic unit of analysis (e.g., Beebe & Gerstman, 1984; Brazelton et al., 1974; Cohn & Tronick, 1987; Condon & Sander, 1974b; Feldman & Eidleman, 2004; Jaffe et al., 2001; Stern & Gibbon, 1979; Stern, Jaffe, Beebe, & Bennett, 1975; Stern, 1974). Some of these studies have shown synchronous changes in mother and infant behaviors (e.g., Condon & Sander, 1974a, 1974b; Feldman & Eidleman, 2004). In these studies, analysis focused on synchronous changes in behavior, but the mode of behavior was unimportant. For example, analysts might have coded an infant's wrist as beginning to rotate to the left at the same time as they coded the mother as beginning to say a syllable. Other studies demonstrated sequential co-ordination between mother and infant behaviors, both in the laboratory (Beebe & Gerstman, 1984; Brazelton et al., 1974; Cohn & Tronick, 1987; Jaffe et al., 2001) and in the participants' homes (Jaffe et al., 2001; Stern & Gibbon, 1979; Stern et al., 1975; Stern, 1974). For example, Brazelton et al. (1974) showed that, as the mother increased the number of behaviors she did, the infant increased the number of his or her behaviors as well. Other researchers focused analysis on one particular class of behavior, such as only vocalizations (Jaffe et al., 2001; Stern & Gibbon, 1979; Stern et al., 1975), only gaze (Stern, 1974), or only visible actions (Beebe & Gerstman, 1984). For example, when the mother vocalized, did the infant then vocalize? What the mother said would be inconsequential for this kind of analysis, and any other actions while talking, such as gaze or handling the infant, would be similarly unimportant.

The above studies all reported coordination in the behaviors of the mothers and the infants. However, none attempted to demonstrate a functional relationship between the two. None conducted an analysis where they matched infant behaviors to specific parent actions in order to assess whether the infant was behaving in a socially responsive manner, which is the framework of the analysis in this dissertation. One limitation of these studies is that they focused on the form of behaviors without regard to any behavior's meaning in that particular moment of interaction. Categorizing behaviors by form alone necessarily removes their interactive meaning. Indeed, Brazelton et al. (1974) commented that they felt the results of their analysis did not capture the interpersonal, meaningful exchanges between the mothers and infants:

> "Although this detailed analysis seemed complicated, we felt that this record of 37 coded variables did not adequately describe the interaction. For example, the quality and tempo of each behavior, the spatial relationships within the dyad, the descriptive form (contact was patting, stroking, or shaking), and the affective significance of the behavior within the incident could not be revisualized by this kind of analysis" (p. 53).

One reason that the researchers might have focused on form instead of function was that all of the infants in the above studies were very young (between newly born and four months old). Perhaps the researchers did not consider that infants so young would be sensitive to meaning.

One specific kind of sequential and functional coordination in mother and infant behaviors that examines specific behaviours is *imitation* (i.e., when an infant copies an adult's vocalization, facial display, or action). To establish whether an infant is imitating, there are usually two requirements: First, the researchers must have a clear visual recording of both the modeler of the action (the adult) and the imitator (the infant), in order to establish that the infant is imitating the specific action of the adult. Second, the temporal direction of imitation must be clear, that is, the infant must be imitating the adult and not vice versa. For these reasons, focusing on imitation would be impossible with home videos. Researchers typically study imitation using experimental tasks in controlled, laboratory conditions. In these situations, infants are typically able to mimic the experimenter's body movements and postures, vocalizations, and facial movements (e.g., Heimann & Ullstadius, 1999; Kugiumutzakis, 1998; Meltzoff, 1985; Meltzoff & Moore, 1977, 1983, 1997). Although these experiments reveal what infants can do under controlled conditions, they cannot reveal what infants actually do in everyday interactions (Masur, 2006). Some researchers have had success investigating imitation in less controlled situations. Pawlby (1977) filmed mothers and infants in unstructured interactions in the laboratory. Each was clearly visible onscreen, and the mother was interacting freely with her infant. Pawlby found that these dyads participated in about 5 to 8 imitative sequences every 10 minutes. In these sequences, the infants were imitating the mothers about 21% of the time (i.e., most of the imitation was in the opposite direction, where the mothers imitated their infants). Still, 21% of 5-8 times per 10 minutes means that the infants were imitating their mothers about once every 10 minutes. Pawlby found that infants imitated their mothers more often as they got older and that, as they developed, their imitation sequences led to sustained interactive exchanges with their mother. Masur and Rodemaker (1999) analyzed imitation outside the laboratory by filming mother and infant dyads interacting at home. These authors reported that imitation occurred in these dyads about once per minute, and, like Pawlby, they found that mothers tended to be the imitators more often than the infants and that infants imitated more frequently as they got older. Kokkinaki and Kugiumutzakis (2000) also filmed interactions in the participants' home, analyzing both mother-infant and father-infant interactions for instances of imitation. Their findings were consistent with the previous two studies; in particular, parents imitated infants more than the reverse. Like Pawlby, these authors mentioned that some imitation sequences led to sustained turn-taking interactions. These and other authors have emphasized that imitation is intrinsically interpersonal and may be the foundation for the development of social and communicative behaviour (e.g., Heimann & Ullstadius, 1999; Meltzoff & Moore, 1997) and even cognition (e.g., Hobson, 2004).

Summary

In summary, parent-infant interaction is a phenomenon that is of great interest to researchers from a broad range of disciplines. Many authors have proposed that a dyadic unit of analysis and the method of microanalysis are both necessary for understanding parent-infant interaction, and they have undertaken such analyses. These studies have contributed findings that mothers and infants coordinate the timing of their behaviors and that infants are able to imitate their mother. These findings suggest that infants are highly responsive. However, most investigators have studied the coordination of mother and infant forms of behaviors without addressing their functional (i.e., social) relationship. Even though researchers conducted these analyses with frame-by-frame precision, they focused on coding forms of behaviors (e.g., specific movements of body parts or the presence or absence of vocalizations) rather than analyzing their meanings and functions. Furthermore, with the exception of studies on infant imitation, none have analyzed infant responsiveness by investigating the one-to-one correspondence between particular parent behaviors and infant responses. For this project, I am interested in addressing issues such as what kinds of parental social actions infants respond to, and how an infant with ASD might respond differently. Earlier in this chapter, I explicated four assumptions that would be necessary to address my particular interest in infant responsiveness. Although many of the above researchers have stated similar assumptions, few studies appear to have congruent procedures. In this sense, my approach was radically different from most of the previous literature.

Early Identification of Autism Spectrum Disorder (ASD)

The final section of this chapter addresses the literature on the analysis of home movies where the infant was later diagnosed with ASD. This section is introduced by a brief description of ASD, including what it is, why early detection is important, and the role that home video analyses play.

A diagnosis of an Autism Spectrum Disorder (ASD) requires that an individual shows impairments in social interactive and communicative behaviors and that the individual has a restricted repertoire of interests, behaviours, and activities (American Psychological Association, 1994; World Health Organization, 1993). There is no known biological marker for ASD; therefore, clinicians must diagnose it based on clinical assessments of the client's behaviour (Palomo, Belinchón, & Ozonoff, 2006). In British Columbia, the current government standards of practice (British Columbia Ministry of Health Planning, 2003) recommend that primary health care providers screen with CHAT, the Checklist for Autism in Toddlers (Baron-Cohen, Allen, & Gillberg, 1992; Baron-Cohen et al., 1996) or M-CHAT, the Modified Checklist for Autism in Toddlers (Robins & Dumont-Mathieu, 2006; Robins, Fein, Barton, & Green, 2001). Requirements for clinicians are to conduct a diagnostic assessment using a standardized observation of communication and social abilities, such as the Autism Diagnostic Observational Schedule- Generic, Modules I or II (Lord et al., 2000) as well as a standardized parent interview specific to ASD (e.g., the Autism Diagnostic Interview-Revised). All of these tools use criteria for diagnosis that rely on social behaviours, skills, and language abilities that emerge around 18 months, for example, looking in the direction in which someone is pointing or playing with an object as though it were a different object (e.g., pretending that a banana is a phone).

Probably because researchers have tailored the existing screening and diagnostic tools for toddlers, the average age of diagnosis for ASD is around age 4 to 6 years (e.g., Filipek et al., 2000; Gray & Tonge, 2001; Mandell, Novak, & Zubritsky, 2005). However, these authors and others have pointed out that parents of children diagnosed with ASD report suspecting differences in infancy, that is, even before their child is 2 years of age. Social responsiveness does not require skills associated with verbal ability or the ability to use symbols; thus impairments in social responsiveness could very well appear and be measurable in infancy. Interactions between infants and their parents offer the opportunity to observe responsiveness even before the infants are able to talk. Bateson (1975) proposed that “to the extent that any disorder in communication involves interpersonal factors, the optimum place to study its etiology would be in conversations between the future patient and caretakers, “conversations” beginning long before the patient knew how to speak” (p. 112).

Furthermore, several researchers have speculated that social interaction between parents and infants provides the groundwork for later language acquisition (e.g., Bruner, 1983; Bruner, 1985; E. V. Clark, 2003; Jaffe et al., 1973; Schaffer, 1977; Sugarman, 1984). As Bateson (1975) put it, “the place filled by speech in the behavior and relationships of an older child is not a new place, but a development of context of previous types of behavior” (p. 112). Thus, looking to social responsiveness for early differences between typically developing infants and infants with ASD may be important not just for early identification of ASD but also as a critical area for early intervention. Outcome studies have shown that intervention for children with these disorders is most effective when it is started early (e.g., Filipek et al., 2000; Goin & Myers, 2004; Mandell et al., 2005), optimally before the age of 4 years (Gray & Tonge, 2001), but this obviously requires early identification.

Therefore, for both diagnosis and earliest possible intervention, identifying the specific behavioural manifestations of ASD before the age of 2 years is an important research focus. The National Institute of Mental Health strongly recommended that researchers should focus on developing assessment tools for ASD specifically for infants and young children (e.g., National Institute of Mental Health, 2004). Others have proposed that early identification would contribute to a deeper clinical understanding of the disorder (e.g., Filipek et al., 2000; Volkmar, Chawarska, & Klin, 2005).

Signs of ASD in Toddlers

As mentioned above, research has identified enough signs of ASD in toddlers to make it possible to develop screening and diagnostic tools for this age group (approximately 18 to 36 months). For instance, by the age of 18 months, a toddler with ASD exhibits deficits in (1) the use of protodeclarative pointing (i.e., pointing to share interest or enjoyment), (2) gaze monitoring (i.e., following where another person is looking), and (3) pretend play. These signs are specific to ASD; that is, they differentiate a toddler with ASD from typically developing toddlers as well as from those with mental retardation (Baron-Cohen et al., 1996; Charman et al., 1997). According to a review by Rutter (2006), the signs of ASD that are clearly evident by the time the infant is in the second year of life are also perceptible (albeit barely) at one year. These signs include deficits in all of the following: social interest and engagement, protodeclarative pointing, integrating looking at faces into acts of communication, and responding to being called by name. Chawarska and Volkmar (2005) expanded and specified the list of signs that a toddler with ASD would present by age two. I have summarized these signs by grouping them into three categories: (1) *interactive* differences (including diminished eye contact, limited interest in peers, limited participation in social games and turn-taking exchanges, not looking often at parent for reference, a preference for being alone, delayed motor and vocal imitation); (2) *production* differences (a limited range of facial expressions, difficulties using spontaneous pointing, and difficulties using words and vocalizations communicatively); and (3) *comprehension* or response differences (not understanding the meaning of another person's pointing, and not responding to speech, especially to their name being called). Notice that most of the above specific signs of ASD in toddlers are not behaviors any infant could do, let alone one with ASD, and the observable signs in infancy are vague. For example, it is difficult to know exactly how a deficit in social interest or engagement (e.g., Rutter, 2006) would manifest in an infant's behavior.

Given that there are perceptible signs of ASD in infancy, but formal clinical assessment is not possible until the child is a toddler, it would be advantageous to identify specific behavioral signs of ASD in infancy. However, an investigation of signs of ASD in infancy presents a methodological puzzle. By the time researchers know which children have ASD, the children are obviously no longer infants. Rather than attempting to travel back in time, researchers have developed three methods for identifying signs of ASD in infancy, each of which has clear advantages and disadvantages.

Parental reports. One method is to rely on the experience and expertise of parents. After a child is diagnosed (or as part of the diagnostic process), a clinician can interview the parents, probing for aspects of their experience with the child in infancy that would differentiate between their child's early development and typical development. This method draws on the expertise of the parents, who are intimately familiar with their infant's behavior in everyday situations. However, information gathered in these retrospective interviews is vulnerable to poor or biased recall, especially given that the interview follows assessment and diagnosis. In addition, the information cannot be as specific as what a researcher could glean from videotaped data. For example, although the parents might remember feeling as though their infant had been difficult to engage socially, the infants' specific behavioral responses that led to this impression would be impossible to recall.

Prospective investigations. Another method is to conduct research on the behaviors of infants who are at risk of having ASD. When parents who have one or more children with ASD have another infant, this infant is at a greater-than-average risk for developing ASD. In prospective studies, researchers conduct longitudinal investigations on the behaviors of the new infants, starting as early as possible (e.g., Bryson et al., 2007; Mitchell et al., 2006; Zwaigenbaum et al., 2005). The ASD and control groups emerge over time; as the infants develop, all will undergo clinical assessment, and only some will receive a clinical diagnosis with ASD and some will not. Mitchell et al. (2006) used ongoing parent reports to assess the infants' language and communication development. Parents with infants who later developed ASD reported that at 12 months their infants were not responding appropriately to commonly used, routine phrases. Bryson et al. (2007) reported results based on observational schedules, where the experimenter made clinical judgments about the infant's behavior based on his or her own interaction with that infant and on observations of the infant and mother interacting. In this study, the infants who later developed ASD were difficult to engage socially, showed little social smiling (i.e., smiling in response to another person), and showed little interest or pleasure in interacting with the experimenter or their mother. The researchers analyzed these interactions in real time (i.e., without videotape), so the results are not comparable to microanalysis of videotaped interaction. However, the results do suggest that social responsiveness would be a promising avenue for microanalytic inquiry. Finally, Zwaigenbaum et al. (2005) used a series of laboratory tasks, and found that infants who were later diagnosed with ASD took longer to shift attention. Because shifting attention would be important for the ability to respond socially, this finding seems the most relevant to the studies presented in this dissertation. It suggests one possible mechanism for delayed or absent social responses. However, if the infant with ASD did respond but the responses were not social (i.e., the response did not match the parent's action), or if the infant did not respond at all, one could not implicate response latency as the cause. Prospective investigations afford the opportunity to interview parents during the infant's development and to test the infant's abilities in a controlled laboratory setting from birth through later development. However, these are long term projects requiring massive investments in time and funding. Besides the arduous process of recruiting a large number of families who are at risk of having an infant with ASD and arranging for them to participate in repeated testing for two to three years, the researchers must deal with more than the usual attrition associated with longitudinal work: These families are not only coping with a new baby; some of them are also handling a child with an ASD. The prospective method, although very promising, requires a commitment by both researchers and participants to a prodigious program of research. See Zwaigenbaum et al. (2007) for a comprehensive review of the methodological considerations involved in prospective investigations.

Retrospective video analysis. A third method is the analysis of home videos that parents filmed prior to the infant's diagnosis. With the increasing ease of video technology, many families film their children during infancy. These films provide a record that becomes of great interest when a child is subsequently diagnosed with a developmental disorder that medical practitioners (e.g., the family's general practitioner) did not notice in the child's infancy. Families who have a child diagnosed with an ASD may either volunteer their movies spontaneously, or researchers can actively recruit them. These videos provide data that are not vulnerable to bias because the parents filmed them before they took their child for clinical assessment. In contrast to an experimental, laboratory setting in which the infant and parent may not be sufficiently comfortable to act in a typical manner, home videos have the added advantage that they present the infant in an everyday, often interactive setting. However, like the previous two methods, retrospective home video analysis has some distinct limitations. In the next section, I will briefly review the accumulated literature on home video analysis and address these limitations and other issues more specifically.

Retrospective Video Analysis and ASD

Since the 1970's, researchers have used home videos as sources of retrospective data to discover behaviours associated with ASD in infancy. I was able to find the following 29 retrospective video studies: (Adrien et al., 1991; Adrien et al., 1993; Adrien, Perrot et al., 1992; Baranek, 1999; Baranek et al., 2005; Bernabei & Camaioni, 2001; Bernabei, Camaioni, & Levi, 1998; Burford, Kerr, & Macleod, 2003; Colgan et al., 2006; Danon-Boileau, 2007; Eriksson & de Chateau, 1992; Lösche, 1990; Maestro, Casella, Milone, Muratori, & Palacio-Espasa, 1999; Maestro et al., 2001; Maestro et al., 2005; Maestro et al., 2002; Mars, Mauk, & Dowrick, 1998; Massie, 1977, 1978; Osterling & Dawson, 1994; Osterling, Dawson, & Munson, 2002; Receveur et al., 2005; Rosenthal, Massie, & Wulff, 1980; St Clair, Danon-Boileau, & Trevarthen, 2007; Teitelbaum, Teitelbaum, Nye, Fryman, & Maurer, 1998; Trevarthen & Daniel, 2005; Werner & Dawson, 2005; Werner, Dawson, Osterling, & Dinno, 2000; Zakian, Malvy, Desombre, Roux, & Lenoir, 2000). My review of these studies is in three parts. The first part is a broad overview of this literature, outlining the general characteristics of these studies, such as the nature of the control and ASD groups, researchers' interests, and their analysis methods. Second, I will describe some of the limitations in previous home video analyses and note how this dissertation project addresses those limitations. Finally, I will review in detail the quantitative studies that included at least one social, dyadic dependent variable.

General Characteristics of Studies

Raw data and control groups

Although some home video analyses were case studies in which researchers analyzed the behaviors of only one infant (e.g., Eriksson & de Chateau, 1992; Massie, 1977), most researchers analyzed home videos from several families. Some researchers did not recruit a comparison group; that is, they analyzed videos only from families with infants with ASD (Adrien et al., 1991; Maestro, Casella, Milone, Muratori, & Palacio-Espasa, 1999; Receveur et al., 2005). Others analyzed two groups of home videos: one of infants with ASD and one of typically developing infants (Adrien et al., 1993; Adrien, Perrot et al., 1992; Lösche, 1990; Maestro et al., 2001; Maestro et al., 2002; Mars, Mauk, & Dowrick, 1998; Osterling & Dawson, 1994). Lösche (1990) went further and matched the typically developing infants to the infants with ASD by gender and sibling status. Finally, some researchers compared the videos of infants with ASD both to typically developing infants and to infants later diagnosed with developmental delay (e.g., Down Syndrome or William Syndrome); thus they could differentiate between behavioral deficits due to ASD specifically and deficits due to a more general developmental delay

(Baranek, 1999; Baranek et al., 2005; Osterling, Dawson, & Munson, 2002). The present project compared an infant with ASD to his two typically developing same-age siblings.

Research Foci

Beyond an interest in characterizing ASD, the researchers in this body of literature had diverse interests, including mother-infant attachment behaviours (Massie, 1977, 1978), parent-infant synchrony (Trevarthen & Daniel, 2005), infants' sensorimotor intelligence (Baranek, 1999; Lösche, 1990; Rosenthal, Massie, & Wulff, 1980), the way infants played with objects (Baranek et al., 2005), infants' behaviors in social communication and their ability to engage in joint attention (Osterling & Dawson, 1994; Osterling et al., 2002), evidence for infants' social competence and intersubjectivity (Maestro et al., 2001), and their social and non-social attention (Maestro et al., 2005; Maestro et al., 2002). In the analysis presented here, I was interested in infants' social responsiveness to their parents.

Analysis Methods

To conduct their analyses of home videos, researchers required specific methodological tools including, at the very least, lists of the behaviors of interest, their operational definitions, and their procedures for analysis. Researchers who focused on symptomatology (i.e., identifying symptoms of ASD) analyzed the home videos using previously developed clinical scales (Adrien et al., 1993; Adrien, Perrot et al., 1992; Eriksson & de Chateau, 1992; Maestro et al., 1999; Receveur et al., 2005). Because clinical scales function to reveal an infant's deficits, the predominant findings of analyses using such scales were the identification of deficits associated with ASD in infancy. Other researchers developed their own scales to address the specific focus of their study

(Baranek et al., 2005; Maestro et al., 2002; Osterling & Dawson, 1994; Osterling et al., 2002; Werner & Dawson, 2005; Werner, Dawson, Osterling, & Dinno, 2000). For example, some conducted investigations of sensorimotor intelligence by developing analysis procedures based on identifying behaviors associated with Piaget's stages of sensorimotor development (Baranek, 1999; Lösche, 1990; Rosenthal et al., 1980). By drawing from what is known about typical development, the findings of these studies provided a more informative profile of infants with ASD. They indicated which developmental milestones infants with ASD were able to meet and which ones they were not. The study presented here is similar. It revealed a profile of social responsiveness, for each infant, identifying those contexts in which the infant with ASD was responsive and those in which he was not.

Addressing the Limitations in Retrospective Video Analyses

Heterogeneity of the Data

As Palomo et al. (2006) pointed out in a comprehensive review of retrospective video analysis, this method has provided ecologically valid findings that complement controlled laboratory studies of parent-infant interaction. However, Palomo et al. called attention to several serious limitations with previous work. First, because all infants came from different families, researchers found the data to be quite variable: The infants' environment, the immediate social context, and the parents' filming style all varied greatly. Thus the advantages of this type of data (i.e., that it was a record of everyday, unscripted, natural interactions) created corollary disadvantages (i.e., it lacked experimental control).

Some researchers addressed this variability by selecting home videos of first birthday parties, so that all the infants would be the same age and in the same immediate social situation (e.g., Osterling & Dawson, 1994; Osterling et al., 2002; Werner & Dawson, 2005). This strategy did decrease variability, but it had other limitations. A birthday party is a potentially stressful time for the parents and a novel social context for the infants, who are having their first birthday party. Infants (and parents) in atypical situations such as a first birthday party might behave differently than they do in their usual day-to-day activities. By attempting to address heterogeneity in the data, these researchers introduced a different kind of variability, which could affect the generalizability of their findings. For example, my dissertation data included the triplets' first-birthday parties (which occurred over consecutive weekends), and my impression was that all three infants were far less responsive than usual. When an infant did seem to be responding to something, the situation was far too chaotic to ascertain exactly which adult action prompted the response.

Studying twins or triplets creates a quasi-experiment that eliminates much of the variability that has limited other home video analyses. Trevarthen and Daniel (2005) analyzed interactions between a father and his twin infants, one of whom was later diagnosed with ASD. The data for this dissertation were similar: The infants in the videos were triplets, only one of whom was later diagnosed with ASD. The parents often videotaped the triplets in the same circumstance (e.g., playing with a ball, eating at the table, being chased by their mother). Thus, variables such as parenting styles, the infants' age, environment, activities, and immediate context were more or less constant across the three infants.

Clinically Derived Coding Schemes

A second limitation Palomo et al. (2006) identified concerned the analysis tools that researchers used in many of the retrospective video studies. As mentioned previously, many researchers used clinical screening and diagnostic tools as their analysis method. Although Palomo et al. criticized this strategy, they did not specifically explain why the use of clinical scales may not be desirable as a research method. I propose several reasons: First, because the tools that the researcher used for the analysis would be the same as the tools that the clinicians used for diagnosing autism there is some danger of circularity. That is, the same clinical criteria that established the independent variable (ASD vs. not ASD) also assessed the dependent variable (differences between infants who are ASD and not ASD). Second, using pre-existing clinical criteria is a purely deductive approach. Any analysis limited to locating already identified signs of ASD precludes the discovery of previously unrecognized signs. New, unexpected findings cannot arise from a purely deductive strategy. Third, clinical scales lack the precision that formal analysis requires. For example, they typically direct the clinician to watch the video and then make global judgments regarding each behavior of interest (e.g., judging if the infant made eye contact constantly, periodically, or not at all). The analysts are not focused on specific instances of behaviors or their immediate context. Fourth, as mentioned previously, clinical scales focus on the symptoms or deficits associated with ASD. Analyses focused exclusively on locating deficits cannot reveal instances where the infants with ASD were competent or successful. Consequently, researchers using this method are likely to overlook the infants' intact abilities as well as the contexts that evoke or reveal them.

The present project avoided the problems that arise with clinically based analyses. The diagnostic tools that clinicians used to diagnose the infants were unrelated to my analysis method. I focused specifically on social responsiveness in the moment-by-moment relationship between specific parent and infant behaviors and then developed the operational definitions and analysis procedures inductively. These procedures were ones that could identify both the social strengths and the social deficits of the infant with ASD.

Infant Social Responsiveness in Retrospective Video Analyses

Because impairments in social interaction are a hallmark of ASD, many researchers have expressed an interest in infant social behaviors. Some have pointed out that, although infants with ASD are less responsive than typically developing infants, they often do respond; they just take longer or require more prompting (Baranek, 1999; Mars et al., 1998; Osterling et al., 2002). Osterling et al. advocated that professionals should be “aware of and sensitive to typical patterns and frequency of social attention and social responsiveness in order to accurately identify infants at risk for ASD” (p. 249). What is the empirical evidence so far for how infants with ASD respond in social situations?

In the following, I have reviewed the home video analyses based not just on which studies expressed an interest in social behaviors but also on which ones used a dyadic unit of analysis for their social variable. In order to decide which studies were most relevant to this dissertation, I evaluated their dependent variables using a set of hierarchical criteria, eliminating some studies at each step: (1) Did the study include any dependent variables that related to social behaviors or not? (2) If they did include any social variables, was the unit of analysis dyadic or monadic? (3) If the analysis was dyadic, did the dependent variables represent specific observations (e.g., rates or frequencies) or the analysts' global impressions? Figure 1 is a schematic representation of the decision tree that I used, and it indicates where each study stood on each criterion.

Of the 29 studies, eight did not have any variables or even qualitative descriptions relating to social behaviors; these studies focused on other, non-social characteristics of ASD (Baranek et al., 2005; Burford, Kerr, & Macleod, 2003; Eriksson & de Chateau, 1992; Lösche, 1990; Maestro et al., 2002; Massie, 1977; Rosenthal et al., 1980; Teitelbaum, Teitelbaum, Nye, Fryman, & Maurer, 1998). Each of the remaining studies had at least one social dependent variable.

Next, I applied my assumption that the analysis requires a dyadic focus. The definitions in two reports were not sufficiently detailed for me to ascertain whether they were dyadic or not (Adrien et al., 1991; Massie, 1978). The social dependent variables in two others were monadic rather than dyadic (Maestro et al., 1999; Maestro et al., 2005). For example, their social variables were the infant's vocalizations, whether the infant looked at faces, or whether the infant pointed. These variables did not require that the analyst consider context (e.g., a vocalization was a vocalization, regardless of context); therefore they were not dyadic variables.

In the remaining studies that included dependent variables that were social and dyadic, several measured these variables by the analysts' global impressions rather than specific behaviors at specific times (Adrien, Barthélémy et al., 1992; Adrien et al., 1993; Bernabei & Camaioni, 2001; Bernabei, Camaioni, & Levi, 1998; Maestro et al., 2001; Receveur et al., 2005; Zakian, Malvy, Desombre, Roux, & Lenoir, 2000). Although the analysts may have observed many specific social behaviors, they reduced their observations to a single, global impression. For example, the Infant Behavioral Summarized Evaluation (Adrien, Barthélémy et al., 1992) directs the analyst to rate whether the infant responds to overtures on a scale of 0 (never) to 4 (continuously). Other social, dyadic dependent variables reflected only the presence or absence of the behavior in question, regardless of its frequency, over the whole video (Bernabei & Camaioni, 2001; Bernabei et al., 1998; Maestro et al., 2001). I did retain papers in which researchers used interval coding, that is, when analysts reported on the presence of absence of a behavior of interest during arbitrary divisions of times, such as each minute (Mars et al., 1998; Osterling & Dawson, 1994) or each second (Werner et al., 2000).

Finally, two papers that had social, dyadic measures of specific behaviors reported only qualitative results (Danon-Boileau, 2007; St Clair, Danon-Boileau, & Trevarthen, 2007). Because these would be impossible to compare to the results reported in the other studies, I did not include them in the review.

Eight studies remained: Each had at least one social, dyadic variable that reflected specific observations or instances of that behavior that led to quantitative analysis (Baranek, 1999; Colgan et al., 2006; Mars et al., 1998; Osterling & Dawson, 1994; Osterling et al., 2002; Trevarthen & Daniel, 2005; Werner & Dawson, 2005; Werner et al., 2000). Ideally, the results of these studies would indicate the extent to which infants with ASD are socially responsive and the contexts in which they are the most and the least responsive. Unfortunately, the results of these studies often contradict each other. I will propose below that the contradictions stem from the operational definitions for these variables. I have summarized the results for each dyadic variable (see also Table 1).

Response to Name

The most frequent dependent variable across these eight studies was whether the infant responded to his or her name. Researchers calculated these either as frequencies or as proportions (e.g., the number of times the infant responded divided by the number of opportunities that infant had to respond). The results of this variable, however, are not uniform across studies. Three studies report no difference between infants with and without ASD in terms of their response to their name being called: Baranek (1999) found no difference at 9-12 months and Mars et al. (1998) found no difference at 12-30 months. Likewise, Werner and Dawson (2005) found no difference at 12 months in infants' response to name and the extent to which they had difficulty responding to their name (which were two separate variables in this study), but on both of these variables, the results indicated a (non-significant) trend where the infants with ASD were less responsive and had more difficulty than the infants without ASD. Four studies reported a significant difference on this variable: Baranek (1999) reported that infants later diagnosed with ASD, at 9-12 months, required more prompts in order to respond to their name being called. Osterling and Dawson (1994) and Osterling et al. (2002) reported that infants with ASD at 12 months were less likely to respond to their name than those without ASD. Finally, Werner et al (2000) found the same difference when infants were 8-10 months old.

Follows Verbal Directions

Results on this variable are similarly inconsistent, with Mars et al. (1998) finding that at 12-30 months of age, infants with ASD were less likely to be able to follow directions than infants without ASD. Osterling and Dawson (1994) found that at 12 months, there was no difference between the two on the same variable.

Participates in Social Games

Mars et al. (1998) found that infants without ASD participated in social games equally to those with ASD, but Osterling et al. (2002) found that infants without ASD were twice as likely to participate in social games (such as “peek-a-boo”) than those with ASD.

Socially Engaged

Mars et al. (1998) defined social engagement as “an infant’s motor or vocal response within 5 seconds of a motor or vocal response by another child or adult, including sharing, pushing another child, or talking to another person” (p. 502). They found that infants who did not have ASD were socially engaged 32% of the time, and infants with ASD were socially engaged only 12% of the time. This difference was significant.

Gestures

Colgan et al. (2006) defined *social interactive gestures* as behaviors that infants used to attract or maintain the attention of another person for social purposes, such as waving “hi” or “bye-bye,” or dancing with others to music. These authors found that whereas 71% of typically developing infants used these gestures, only 40% of infants with ASD did. The variety of gestures that each group used was also different. When they gestured, infants with ASD used fewer types of gestures, and infants without ASD used significantly more different kinds of gestures.

Rhythmic Synchrony

With data from home videos of twin girls, one of whom later developed as ASD and one who was developing normally, Trevarthen and Daniel (2005) studied the relationship between infant and adult behaviors in terms of their timing and the direction of attention. First they noted all behaviors of the infant and the adult, then they interpreted these behaviors, frame by frame, as indications of whether each participant's attention was on or off the partner and whether each participant was building up anticipation. Then analysts summed the behaviours they interpreted as emotional build-up for each partner and plotted them on a graph as either positive (when attention was on the partner) or negative (when attention was off the partner). The two participants' plots were then superimposed to correlate them over time. What the authors found was that, for the father and the infant without ASD, the plots were somewhat synchronized; that is, their levels of behaviour indicating arousal and attention often matched. Furthermore, this infant and the father cycled in phases of attention on each other, then attention off. In contrast, the infant later diagnosed with ASD and the father did not have matching plots, and they lacked the predictable cycles that characterized the other dyad. Given the complexity and minute scope of the analysis, it is not surprising that the authors only reported these results for one short excerpt of behaviour (about one minute per dyad). Although they reported finding similar results with other excerpts, they only reported those results qualitatively.

Imitates Verbalizations

Mars et al. (1998) found that infants without ASD imitated adult vocalizations more often than infants with ASD. No other studies reported results about imitation, probably because home videos are not ideal for measuring the extent to which infants are imitating adults (e.g., often the adult is not clearly onscreen because the focus of attention is on the infant, or the adult is off-screen because he or she is doing the filming).

Gaze or Social Touch Aversion

Finally, Baranek (1999) analyzed the extent to which infants who were 9-12 months old exhibited gaze or touch aversion. She based both of these variables on opportunities the infant had to avert gaze or touch. Baranek found that infants with ASD averted gaze about 3 times per 100 opportunities, and infants without ASD did so about 1 time per 100 opportunities. These rates were not significantly different. However, infants with ASD, when given the opportunity for physical contact, averted touch 10% of the time, and infants without ASD did so only 1% of the time. This difference was significant.

Conclusion from the Retrospective Video Analysis Literature

Most researchers using home video data have tended to focus on individual infant behaviors (such as frequencies of social smiling or of bizarre motor behaviours) instead of dyadic interactive behaviors (such as infant responsiveness to particular kinds of parental actions). By overlooking the moment-by-moment dyadic interactions between the infants and the parents, these analyses have been unable to observe, analyze, and quantify the social interactive aspect of the disorder. Thus they have not yet systematically analyzed or revealed patterns of social responsiveness.

I found eight articles in which the researchers developed dyadic variables, but the findings from these studies did not consistently replicate. For example, half of the studies that reported the extent to which infants with ASD respond to their name found no difference from control infants; the other half found that these infants were less responsive. I propose that the contradictions in these eight studies are due to problems with their operational definitions. First, many of the operational definitions for the same variable were different from each other. For "response to name," some researchers measured how often the infant responded; some measured how often the infant had difficulty responding; others measured how many prompts the infant required before responding. One study used both "response to name" and "prompts required before responding," and these yielded contradictory results: There was no difference in the response-to-name measure, but infants with ASD required more prompting. Unfortunately, subsequent citations of these results sometimes conflate the results and report only that infants with ASD do not respond as often to hearing their name called.

A second problem with operational definitions of dyadic variables is that many authors provided only the names of their variables and did not explain clearly how they operationally defined those variables. For example, when did the researchers consider a parental action as being an opportunity for the infant to respond? Was it only when the infant's name was called? Or could it be when the parent used a nickname? Was it only when parents were trying to get their infant's attention? Or was it anytime they used the infant's name? Which infant behaviors did researchers consider a response? How soon did an infant have to respond for it to count as a response? Differences in definitions might explain differences in results, as above, but in some cases, there was insufficient information to make such comparisons.

Finally, the quantification techniques in these papers were not always comparable. For "response to name," some researchers based their rate on a fixed time interval (e.g., did the behavior occur in each minute, regardless of frequency), and others derived a rate from responses divided by opportunities. Moreover, although most researchers explicated how they quantified their variables, some were not clear in this respect. In one paper, the authors reported in the text that they calculated “response to name” as a proportion of total opportunities, but in their tables they reported the results once as raw frequencies and once as durations.

Home videos permit the investigation of the behaviour of ASD infants in the moment-by-moment context of naturally occurring, everyday interactions with their parents. However, any insights into the social interactive aspect of ASD requires more than a suggestion that interactive behaviours are important, more than one or two dyadic variables, and clear definitions of dyadic variables to permit replication. Instead we need a systematic method for quantifying social responsiveness and explicating the micro-contexts of infant’s social behaviours in interaction.

CHAPTER THREE:

DATA, RESEARCH DESIGN, AND STUDY I

I conducted two separate studies on the home videos of the triplets. Study I used a (non-random) subset of the data originally provided; the infants were 11 to 15 months in this data set. I used these data to develop a generic measure of social responsiveness and to provide an initial test of whether such a measure could predict which infant was later diagnosed as ASD. In Study I, I did not know which of the infants was later diagnosed with ASD. Study II (reported in Chapter Four) was an expanded replication of Study I. Study II used all of the analysable video data from 6 to 15 months (except the material in Study I) and included separate measures of social responsiveness for several different kinds of parental overtures. In Study II, I was aware of the identity of the diagnosed infant, but the two other, independent analysts were not. The data (i.e., the infants), equipment, and the research design were the same in both studies, and these are described below. Chapter Four gives a more detailed description of how Study II differed from the Study I. Note that I applied for and obtained permission for this project from the Human Research Ethics Boards of the University of Victoria and Vancouver Island Health Authority (for Queen Alexandra Centre for Children's Health); see Appendix A for the forms.

The Data

The data for both Study I and Study II were one family's home videos of their triplet infants. The family gave their home videos to Dr. Mary Anne Leason and Dr. David Batstone at Queen Alexandra Centre for Children's Health to be used for research purposes. I collaborated with these two clinicians for the duration of this project.

The infants in both studies were a set of non-identical triplets, two males and one female. At the age of 3, all three went through standardized assessment at the Queen Alexandra Centre for Children's Health. The infant who was later diagnosed with ASD received a full assessment (Child Development Inventory; Child Behaviour Checklist; Wechsler Preschool and Primary Scale of Intelligence, 3rd edition; Mullen scales of Early Learning; Vineland Adaptive Behaviour Scales; Autism Diagnostic Interview- Revised; and Autism Diagnostic Observational Schedule- Module 1). Clinicians assessed the other two infants with the Vineland Adaptive Behaviour Scales; the Autism Diagnostic Interview – Revised; and the Autism Diagnostic Observation Schedule. Based on these assessments, one of the males was diagnosed with Autism Spectrum Disorder, while the other two (one male and one female) were functioning within the normal range.

The raw data were videotapes of the infants in the form of the family's home videos, which the parents of the children had spontaneously volunteered to the clinicians for research purposes. The full set of home videos that they volunteered covered shortly after the infants' birth to when they were approximately four years old.

Equipment

The parents originally filmed the home videos in Hi-8 with audio. A previous research assistant had copied these onto VHS tapes. I digitized them into Broadway .avi format, using Broadway (available from http://www.b-way.com/) and then converted them to .mpg format. I used ELAN (EUDICO Linguistic Annotator, version 3.10; available from http://www.mpi.nl/tools/) to view the .mpg files. Elan is a simple and efficient system for frame-by-frame analysis and repeated, consistent viewing of a selected segment.

Research Design

Both Study I and Study II used a quasi-experimental design that compared the social responsiveness of the infant later diagnosed with ASD to that of his two typically developing siblings. As mentioned in Chapter Two, having data from these particular triplets afforded three advantages. First, comparing same-age infants from the same family removed much of the unwanted variability that often confounds home video data. Second, having two siblings for comparison provided a control for individual differences. That is, if the comparison were between the infant with ASD and only one sibling, it would have been difficult to confidently implicate ASD as the source of the difference; any differences could have been due to the individual, idiosyncratic characteristics of each infant. Because I could compare the extent to which the two typically developing infants resembled each other and differed from the infant later diagnosed with ASD, I could more confidently attribute the differences to ASD. Third, one of the typically developing infants was male and the other was female, which provided some additional generalizability.

The ultimate dependent variables were proportions that represented the social responsiveness of each infant, calculated as the number of responses the infant displayed over the number of opportunities that the infant had to respond (i.e., the number of parental overtures to that infant). I had two hypotheses in regard to these proportions: First, the infant later diagnosed with ASD would be less likely to respond to overtures than the other two infants (i.e., his response proportion would be lower than the other infants' proportions). Second, the two typically developing infants would respond approximately equally to overtures. That is, their response proportions will be higher than their diagnosed sibling's and similar to each other.

Study I

Data Subset

A previous research assistant had sampled 23 minutes of data (12 separate episodes) from the full set of home videos that the parents had provided. I used these twelve separate short episodes for the Study I. The parents had filmed these episodes when the infants' were between 11 and 15 months of age. Appendix B is the list of episodes.

Analysis

The analysis tools were the detailed operational definitions and procedures that I developed for these data. Note that while developing and implementing the analysis, I was "blind" to the identity of the infant who was later diagnosed with ASD (as was the second analyst when conducting reliability checks).

The dependent variable for Study I was a proportion representing each infant's *general social responsiveness*, which I operationalized as the number of times that an infant responded to parental overtures divided by the total number of parent-initiated social overtures directed towards that infant. This dependent variable provided a summary of many specific pairs of parent and infant behaviours. In each pair, the parental overture projected a specific response from the infant. If the infant's behaviour matched what the overture had projected, it counted as a response. The following section is a summary of the rules and procedural steps I used for the analysis of adult overtures and infant responses. For the full manual of all the definitions, rules, and the format of analysis sheets used in Study I, see Appendix C. For a detailed summary of all reliability checks, see Appendix D.

Visibility

Because adult overtures towards an infant counted only if the infant was visible on screen, the first step of analysis was to determine when each infant was visible. Using a continuous timeline for each infant, the analysts noted (by striking out) the periods of time when each infant was off screen. I did the analysis for all 23 minutes of data. A second analyst conducted the visibility analysis on a randomly selected subset (approximately 20%) of the data. We compared our decisions for every second on the timeline (i.e., whether we had agreed that each infant was or was not visible during each second) and agreed on 755 of 774 of the seconds in the timeline (97.5%). We conducted all subsequent analyses for each infant (i.e., overtures and responses) only on those times when that infant was visible.

Overtures

The first part of social responsiveness as a projective pair was an adult overture, each of which created a social opportunity to which the infant could respond. The adult making the overture was usually a parent, and the overture could be verbal or nonverbal or both. However, I limited these overtures to social actions towards only one visible infant. Thus, for an adult's behaviour to be characterized as an overture, it had to be (a) unambiguously social in nature and (b) directed towards a single infant who was visible and identifiable onscreen while the overture was occurring. Verbal overtures could be, for example, calling the infant's name, saying something specific about the infant to the infant (e.g., "oh what a beautiful boy" while looking at the infant), or making vocalizations clearly directed to that infant. Verbal actions that were not overtures were, for example, narrating while filming (e.g., “now he’s climbing onto the couch”) or addressing all three infants at once (e.g., “standing babies!” or “hi guys!”). Nonverbal overtures were, for example, touching the baby, smiling or making faces at him or her, giving the baby something, reaching towards or moving the baby (e.g., the father picking up a baby and putting him on the couch). Most overtures were simultaneously verbal and nonverbal, for example, the mother said “monkeyhead” playfully while she touched an infant’s head with a toy.

Locating overtures. The overture analysis required two steps. The first was locating all of the periods of time when overtures were occurring. Using the timelines photocopied from the visibility analysis, I divided the parts of the timeline where each infant was visible into periods when that infant was receiving an overture and periods when that infant was not. A second analyst did the same analysis on a randomly selected subset of the data. We compared our decisions for every second when the infant was visible (i.e., whether we had agreed that an overture was or was not occurring during each second) and agreed on 425 of 443 (95.9%) of the seconds in the timeline. Although this second-by-second calculation credited all of the decisions that we made, it necessarily included long periods in which no overtures were occurring but which still counted as many seconds of agreements. Therefore, we also calculated agreement based solely on locating overtures. Each time both of us agreed that an overture started was one agreement, and it was one agreement no matter how long the overture lasted. There was no credit for agreeing that an overture had not occurred. If only one of us recorded that an overture occurred, it was a disagreement. The measure of inter-analyst reliability was the number of agreements divided by the sum of agreements plus disagreements. This much more conservative measure was still high, 25/31 (80.6%). Note that, in both measures, our reliability represented (1) agreeing that the adult did something, (2) agreeing that the adult action was unambiguously social, (3) agreeing that the social action was directed towards only one infant, and (4) agreeing on the identity of the infant.

Dividing overtures. The second step of the overture analysis was to examine the periods of time where an overture was occurring more closely. Some of these periods actually contained several shorter, separate overtures, which therefore provided several opportunities for the infant to respond. There were three kinds of changes that would lead to dividing the period into more than one overture. First, the *agent* of the overture could change; that is, more than one person addressed the same infant during this period. For example, while the father was dangling mittens in front of one baby, the mother called that baby’s name. Because these two actions overlapped, we had considered them to be one overture in the initial analysis. However, in this second stage, they became two separate overtures, each with a different agent. The second way an overture could be divided was a change in the *function* of the overture. For instance, while bathing the infants, the mother tickled one of them who was standing and touching the faucet. The mother shifted, without a pause, from tickling him to gently pulling him into a sitting position while saying “Come on now, none of that.” Her continuous action became two separate overtures at the point when the function changed: The first part of the overture was a playful action toward the infant, and the second part directed him to stop touching the faucet. Third, the *modality* of the overture might change. For instance, the mother was trying to get one of the infants to stop hitting another one with the remote control. She tried to get his attention verbally ("[name], don't hit your brother"), then before she had finished speaking, she pulled on the arm of his sweater. The change in modality gave the infant a second overture to respond to. In summary, I divided overtures when there were changes in the agent of the overture (e.g., father, then mother), its function (e.g., playful, then directive), or its modality (e.g., words, then touching). I made each of these divisions in the hierarchical order just listed, so that each division increased the number of overtures that I would consider at the next level. The goal was to locate each separate overture that had a single agent, a single function, and a single mode of expression. This degree of specificity was necessary for ensuring that we had identified each distinct opportunity that each infant had to respond to an adult.

For each overture in the data set, I decided whether and precisely when division was necessary. The second analyst made the same decisions for the randomly selected subset of overtures she had already located in the first step. Our inter-analyst reliability at each possible division was 39/39 for agent (100%), 39/40 for function (97.5%), and 42/47 for modality (89.4%). Note that the denominator in these fractions increased because a division at one level increased the number of overtures that the analysts had to consider at the next level . For example, when the analysts agreed to divide one of the 39 periods of overtures into two because the agent changed, then they had to examine 40 overtures (instead of 39) for possible division by function, etc.

Infants' Post-overture Behaviour

Recall that each overture was a parent's proposal to an infant for a joint project (e.g., tickling the infant proposed that they have fun together in this activity). It therefore projected a particular response from the infant (e.g., parental tickling projected giggling and laughter from the infant). The analysis here was to ascertain whether the infant's behaviour after each overture matched the behaviour that the overture had projected. If so, then the behaviour indicated that the infant took up the parent's proposal; if not, there were no observable behaviours indicating that the infant did. In the example given, laughing after tickling matched what the overture had projected and thus indicated that the infant took up the parent's proposal. Not laughing (or perhaps crying) would have indicated otherwise. The analysis required a comparison of the infant's behaviour immediately before and after the onset of each overture, focusing first on whether the behaviour changed. Next, for all overtures where the infant's behaviour changed, I assessed whether the infant's new behaviour after the onset of the overture matched what the overture had projected. In other words, when there was a change in behaviour, was the new behaviour an indication that the infant had taken up the parent's proposal? If the new behaviour was what the overture had projected, I deemed that the infant had responded to that particular social opportunity.

The following are some examples from the data that show how I assessed post-overture behaviour. The first example illustrates two overtures; the infant did not respond to the first, and he did respond to the second. The infant was facing away from his mother, who was filming him, and he was holding on to the bottom of a floor-length curtain, moving it back and forth. The mother called his name. Her proposal in this overture was for the infant to stop looking at the curtain and turn to look at her instead. After her overture, the infant continued to look at the curtain, still playing with it. His actions did not change and therefore did not match what her overture had projected; his behaviour was not a response to her overture. Next the mother called out, "baby" in a singing tone. Again, her overture projected that he should turn and look at her, and the infant, still hanging onto the curtain, turned and looked at her. His behaviour after the second overture matched what she had projected; it was therefore a response to her overture.

In a second example, the infant's behaviour changed, but it did not change in a way that the mother's overture had projected. The mother was chasing an infant who was running away from her. When she caught up to him, she teasingly called out, "I got you" and simultaneously tickled his waist a little bit. Tickling the infant projected that he should show enjoyment, perhaps by laughing or smiling. After she tickled him, however, the infant sat down, turned away from her, and then got up and walked away. Sitting down and walking away was a change in behaviour when compared to running, but it could not be considered a change that matched what his mother's overture had projected. Thus the behaviour was not a response to the mother's overture.

In a third, more subtle example, the mother directed two overtures to an infant and he responded to both of them. While the mother was filming, an infant slipped off a hobby horse that he had been sitting on. The mother said to him "oh, you falling down?" Her overture indicated that she noticed he fell, and it proposed that he indicate to her that he had indeed fallen. The infant's behaviour following this overture was to look up to her and make some stylized crying noises. Crying (even if stylized) was a reasonable way for him to "say" that he had fallen off the toy, and thus it matched what his mother's overture had projected. While he cried, she said, "s'okay" in a soothing tone. This second overture indicated that although she noticed that he fell, she wasn't worried about it. The overture therefore projected that he shouldn't worry about falling; that is, he could stop crying. His behaviour after this overture was indeed to stop crying, and he looked back at the toy and began to crawl back onto it. Again, these new behaviours matched what her overture had projected and were therefore a response.

In summary, instances where the infant's post-overture behaviour changed in the way that had been projected by the overture were responses; instances where either the infant's behaviour did not change or when it changed in a way that had not been projected by the overture were not responses.

As before, I assessed infants' post-overture behaviour after all overtures in the data set, and a second analyst assessed a randomly selected 5 minutes. Agreement as to the responsiveness of the infant's post-overture behaviour (response vs. not a response to the overture) was 50 out of the 59 overtures (i.e., 85%).

Social responsiveness proportions. The above analyses led to a social responsiveness proportion for each infant. The numerator was the number of times that the infant responded as projected by the overture. The denominator was the sum of all overtures directed towards that infant, that is, the number of opportunities for response presented to the infant. The resulting proportion was the summary measure of social responsiveness for each the three infants. A proportion of 1.0 would mean that the infant responded to all of the overtures he or she received. A proportion of 0.5 would mean that the infant responded to only half of them.

Results

Visibility

I calculated the amount of time each infant was onscreen. For each episode, I calculated a proportion for each infant based on the duration that infant was visible in that episode divided by the total duration of the episode. The average duration of visible time was the same across the three infants: Each of the infants was visible about 60% of the time. Specifically, the infant with ASD was onscreen M=.65 (SD=.28) of the time, the male infant without ASD was onscreen M=.57 (SD=.30) of the time, and the female infant without ASD was onscreen M=.61 (SD=.22) of the time.

Overtures

There were 138 separate social overtures to the three infants in the 23 minutes of data. They were distributed equally amongst the three infants: The infant later diagnosed with ASD was the recipient of 45 overtures; the female and male infants without ASD received 42 and 51 overtures respectively.

Infant Responses

I've summarized the raw frequencies of infant responses and the social responsiveness proportions in Table 2. The infant with ASD responded to 20 of the 45 overtures he received; his overall social responsiveness proportion was therefore 0.44. The female infant without ASD responded to 30 of the 42 overtures she received (0.71) and the male infant without ASD responded to 36 of his 51 overtures (also 0.71). Note that the infant later diagnosed with ASD was not completely unresponsive, neither were the other two infants always responsive. However, the infant with ASD was less responsive than his two siblings.

To compare the three infants (ASD infant vs. non-ASD female vs. non-ASD male) in terms of whether they responded or not, I used an omnibus 3 X 2 chi-square for whether the observed differences in proportions were statistically significant. If this test indicated a significant difference among the responsiveness proportions of the three infants, I could proceed to test my specific hypotheses directly. My first hypothesis was that the infant with ASD would be less responsive than the other two infants. To test this hypothesis directly, I used a one-tailed, complex 2 X 2 chi-square to test whether the responsiveness of the infant with ASD was lower than the responsiveness of the other two infants (i.e., ASD vs. non-ASD). My second hypothesis was that the two typically developing infants would be equally responsive. To test this hypothesis directly, I used a simple 2 X 2 chi-square comparing the responsiveness of the infant male without ASD to the infant female without ASD. All of these tests assume that the observations are independent, which is often taken to mean that no participant can be represented more than once in the data. However, the assumption of independence refers to independence between events or observations (Conover, 1999, p. 18). In this case, statistical independence means that an infant's response (or lack of a response) to one overture could not artificially influence the likelihood that he or she would respond (or not) to the next one.

Table 3 presents the results of the omnibus chi-square and the two tests of specific hypotheses. The omnibus test indicated that the response proportions were significantly different ($X^2_{(2, N=138)} = 9.09$, $p<.05$). The complex comparison indicated that the proportion of social responsiveness of the infant later diagnosed with ASD was lower than those of his siblings ($X^2_{(1, N=138)} = 9.09$; $p<.01$), which supported my hypothesis: The infant later diagnosed with ASD was less socially responsive to adult overtures than his siblings were. The simple comparison indicated that the responsiveness of the two typically developing siblings did not differ from each other ($X^2_{(1, N=93)} = 0.01$; *n.s.*), which supported my hypothesis that the responsiveness of the two typically developing siblings would not differ from each other.

The sampled videos spanned a period of time when the infants were between 11 and 15 months old, so it was of interest to know whether the above differences were present throughout this age range. Applying the above statistical tests to the 11-12 month and a 13-15 month age ranges separately revealed that the patterns were consistent across both age ranges (see Table 3). The two typically developing infants were equally highly responsive and the infant who was later diagnosed with ASD was less responsive at 11-12 months as well as 13-15 months.

Discussion

The results of Study I supported the two predictions. First, the results strongly supported the hypothesis that the proportion of social responses by the infant with ASD would be lower than those of the other two infants. This difference was significant, even with such a small sample of data (23 minutes) and even when the data were divided into two separate age ranges (11-13 and 13-15 months). Second, the results confirmed the hypothesis that the two typically developing infants would have similar response proportions. This second confirmation was important because it argues against the possibility that the first finding was simply due to individual variation among siblings. The two typically developing infants showed the same response proportions, even though they differed in gender and even when they were compared at different ages. The most plausible interpretation of their sibling's lower response proportion is therefore that he was showing early signs of ASD.

Although these findings matched my hypotheses, they were a fairly broad analysis of the data. The success of the projective pair framework suggested that an even more detailed analysis would be worth undertaking. Consequently, I built upon the same framework to ask several more specific questions: Does the same pattern of responsiveness among the infants appear in an earlier age range? Does the infant with ASD become more or less responsive over time? Does this infant respond to certain kinds of overtures more than to other kinds? Does what the infants were doing *before* the overture affect whether they respond? I answered these and other questions in a more detailed analysis of a larger data set, reported in Chapter Four.

CHAPTER FOUR: STUDY II

Refinements in Study II

Study II was a considerably enlarged analysis that included all of the analyzable data from ages 6 months to 15 months; a new analysis of the projective pairs that divided them into nine different functions; and an analysis of what each infant was doing *before* each parental overture.

The findings of Study I indicated that it was possible to define, systematically analyze, and quantify infant responsiveness in home video data, using a projective pairs framework. Furthermore, Study I provided a test of whether this method could discriminate between an infant later diagnosed with ASD and his typically developing siblings, and the answer was positive. The dependent measure (a response proportion for each infant) and the significant findings were a necessary foundation for future analyses. Moreover, they suggested promising directions for a second analysis in which I could investigate the overture-response pairs more deeply. Three main interests motivated the modifications and extensions that I made for Study II. The first was discovering whether there were specific overture-response pairs in which the infant with ASD was more likely to respond. The new analysis would reveal whether this infant's profile of social responsiveness differed systematically from his typically developing siblings. The second was whether the overture analysis could be extended to an earlier age range. If it could, would the infant later diagnosed with ASD be measurably less responsive at an even earlier age? The third interest was to find out whether each infant's behaviours before an overture influenced his or her responsiveness to that overture; for example, if an infant had been engaged with a toy before a parental overture unrelated to the toy, would that infant be less likely to respond to the overture? In Study II, I addressed these new directions by expanding the analysis of overture function, broadening the age range, and adding an analysis of infant's pre-overture behaviours. The next section is a detailed explanation of these changes.

Overture Functions

A major focus in Study II was developing a comprehensive exploration of the specific *functions* overtures served in interaction. Because the function of the overture featured prominently in this analysis, I will describe the functions in detail. In Study I, I had used the principle of function to help analysts decide (a) whether an overture should be divided, and (b) whether the infant's response matched what the overture had been projecting. However, at no point did analysts articulate each overture's particular function. That is, there were no clearly identified subsets of functions for the analyst to choose from. Each overture had a particular function, although the analysis did not make these distinctions.

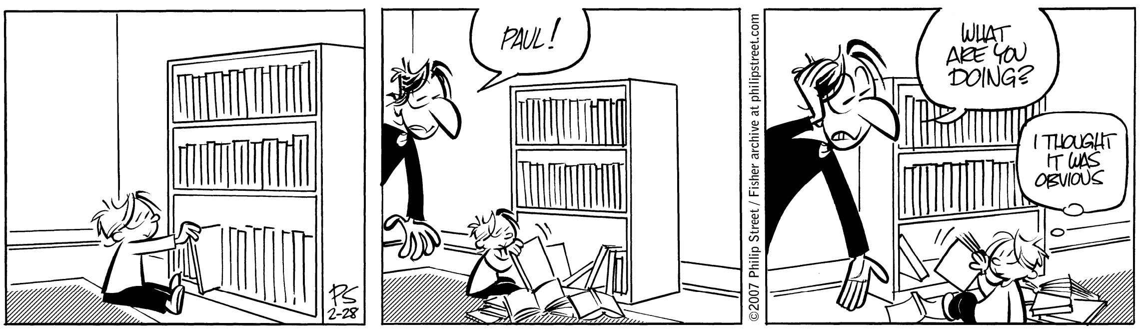
In Study II, I identified nine specific functions that an overture could serve, based on what I had observed in Study I. As in Study I, an overture could be divided if it were serving two different, consecutive functions (such as when the infant in the bathtub was touching the faucet and the mother tickled him for fun and then immediately afterwards pulled him into a sitting position while saying, "no no no"). Unlike Study I, however, the analyst had to identify which specific function each overture was serving (e.g., a *playful* overture followed by a *directing* overture). Exploring these specific functions could be valuable for discovering whether the infant with ASD was more or less likely to respond to different kinds of overtures. In other words, this more differentiated analysis made possible an exploration of the contexts of interactive success for this infant. Furthermore, by meaningfully grouping overtures by function, the analysis differentiated among different kinds of projective pairs, making the analysis of infant responses more systematic and consistent. For example, all playful overtures would project a certain kind of infant response (such as giggling when tickled), and these responses would be different than those projected by directing overtures (which would be to obey). The following is a brief description of the nine functions, including the infant response that they projected and which behaviours would be an indication that the infant had responded. Note that these descriptions are not the operational definitions of the functions, which are in the method section.

The examples included here to illustrate each function are different from those I used for training the other analysts. The examples for training were actual excerpts from the home video data. However, the reader cannot view these videotaped examples in this dissertation. Although some examples in the following sections are descriptions from the home video data, I have supplemented them with example from a cartoon called *Fisher* by Philip Street, which features many scenes of parents and their infant boy. With the artist’s permission, I have illustrated the overture functions with these cartoons.

Attention- seeking Function

An overture was serving an *attention-seeking* function when the parent was using it to tell the infant to look towards the parent. Specifically, an attention-seeking overture occurred when the infant had been directing his or her gaze away from the parent, and the overture projected that the infant should re-orient his or her gaze towards the parent. A parent could seek the infant’s attention in a number of ways, including calling the infant’s name or nickname, whistling, or giving the infant a little poke. For the infant's behavior to be a response to an attention-seeking overture, the infant had to look at the parent after the overture. In the second panel of Cartoon 1 below, the father makes an attention-seeking overture.

Cartoon 1. Attention-seeking overture: "Paul!"



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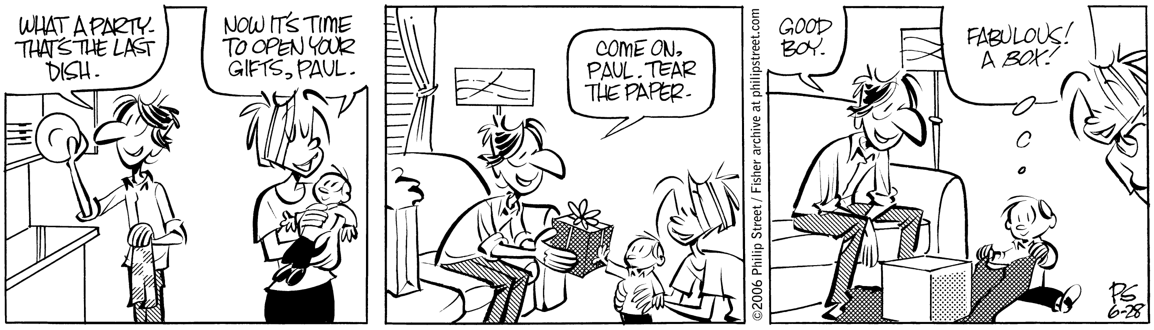
In Cartoon 1, the infant is looking at some books and pulling them out of the shelf. The father calls the infant's name ("Paul!") to get his attention. In the third panel, it is clear that the infant is now looking at his father instead of the books. Because it corresponds to what the father's overture projected, the infant's behavior is a response.

Directing Function

When a parent told an infant to do something, the overture had a *directing* function. Directing overtures projected that the infant should do what the parent asked him or her to do, and if the infant did so, the behaviour was a response. Cartoons 2 and 3 illustrate some directing overtures and infant responses.

Cartoon 2. Directing overture: "Come on Paul. Tear the paper."



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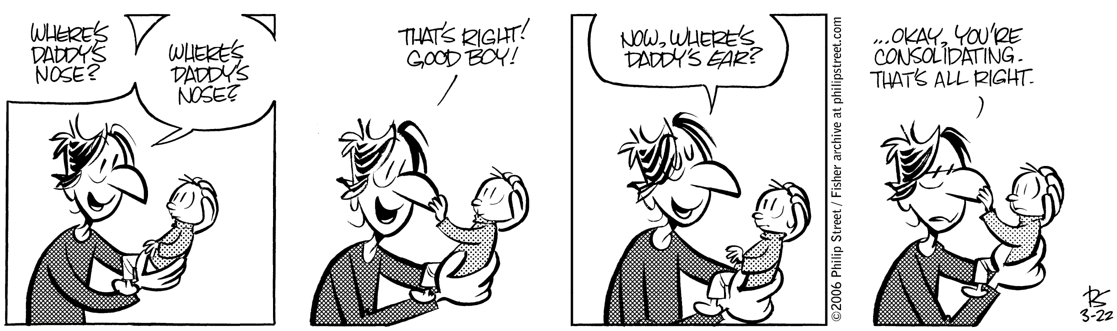
In the second panel of Cartoon 2, the overture, "Come on Paul. Tear the paper" serves a directing function. It projects that the infant should tear the paper off of the box that the father is handing him. In the third panel, the paper is off the box and the father says "good boy," suggesting that the infant tore the paper off himself. Because the infant's behavior matches what the overture projected, it is a response. In Cartoon 3, the first and third panels illustrate directing overtures as well.

Cartoon 3. Directing overtures: "Where's daddy's nose?" and "Now where's daddy's ear?"



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The father's question in the first panel ("where's daddy's nose?") serves a directing function; it projects that the infant should indicate the location of his father's nose. In the second panel, the infant touches his father's nose, which matches what the overture had projected and is therefore a response to his father's overture. In the third panel, the father asks, “now, where’s daddy’s ear?” This is another directing overture, which projects that the infant should indicate the location of his father’s ear. In the last panel, however, the infant touches the father’s nose again. This behaviour does not fit what his father’s overture projected and is therefore not a response.

Helping Function

Often the infants in the home videos made appeals to their parents for something. Sometimes these appeals were requests that the parent do a concrete action for them (such as give them a bottle, put them in a swing, or help them out of a box that they had been playing in). Other appeals were infant requests for soothing, which the infants indicated by crying. When parents responded to these requests, their overtures were serving a *helping* function. Helping overtures projected that the infant demonstrate acceptance of the parent’s action, that is, cooperate with the helping overture. For example, if a parent slid a bottle towards an infant who was reaching for it and the infant grabbed the bottle, then the infant’s behavior was a response to this overture. If the parent held a crying baby and made soothing noises (such as “sh, sh, sh”) and the infant’s crying stopped or abated, then the infant’s behaviors were a response. In the first three panels of Cartoon 4, the infant is crying loudly. In the last panel, the father’s overture (bringing “Ed Funt,” the elephant toy) serves a helping function.

Cartoon 4. Helping overture: Giving the infant his toy.

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The infant in this example is conveying distress, apparently because he wants his elephant toy. In the fourth panel, the father hands him the toy: This action is a helping overture, and it is projecting that the infant should stop crying because now he has what he wanted. Note that the infant is smiling and not crying as he reaches for the toy, which matches what the overture had projected and therefore constitutes a response in my framework.

Greeting Function

When parents' overtures were a salutation (e.g., "hi baby!"), they were serving a *greeting* function. Typically, parents used these overtures when the infant had looked at them; these overtures were a way for the parent to sustain the interaction that the infant had initiated. Greeting overtures projected that the infant should also sustain the interaction in some way. Infant behaviors that were responses to greeting overtures were therefore those changes in behaviors that sustained the interaction. Infants could do this in one of three ways. (1) If they had looked away from the parent during the overture, they could look back. (2) If they were still looking at the parent, they could look away and look right back. (3) If they were still looking at the parent, they could add new behaviors while looking (e.g., smiling, wiggling, reaching toward the parent). Not all greeting overtures were in the form of a salutation (such as "hi" or "hello"). For instance, if the infant was looking at the parent and the parent said only the infant's name or nickname in a pleasant or happy way, it was serving a greeting function. (Details for how analysts made these decisions are in the operational definitions in the method section of this Chapter.) The greeting in Cartoon 5 is without a formal salutation.

Cartoon 5. Greeting overture: "Sweetie!"

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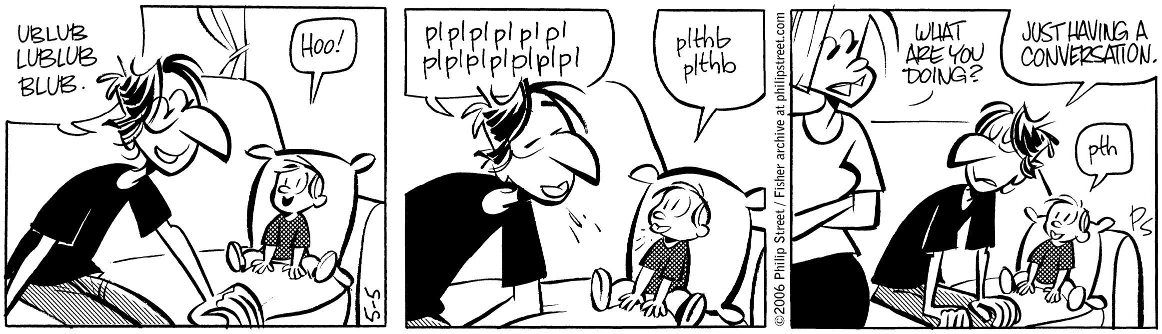
In the first panel of the cartoon above, the father says “sweetie” while the infant is looking at him. This overture (“Sweetie”) is not serving an attention-seeking function (because the infant is already looking at his father); it is instead serving the function of greeting the infant. In this example, the father makes another overture to the infant (“Are you eating your feet?”) before it is possible to see what the infant did in response to his greeting overture.

Playful Function

Some of the parental overtures seemed to function only as an invitation to the infant to have fun together. These overtures served a *playful* function and were typically little vocalizations, nonsense syllables, or tickles. They projected that the infant should interact playfully as well. For an infant to respond to these overtures, the infant had to look or move towards the parent (indicating engagement with the parent) and smile or laugh (indicating enjoyment). Cartoon 6, below, has two playful overtures.

Cartoon 6. Playful overtures: “Ublublublubblub” and “plplplplplplplplplplplpl.”



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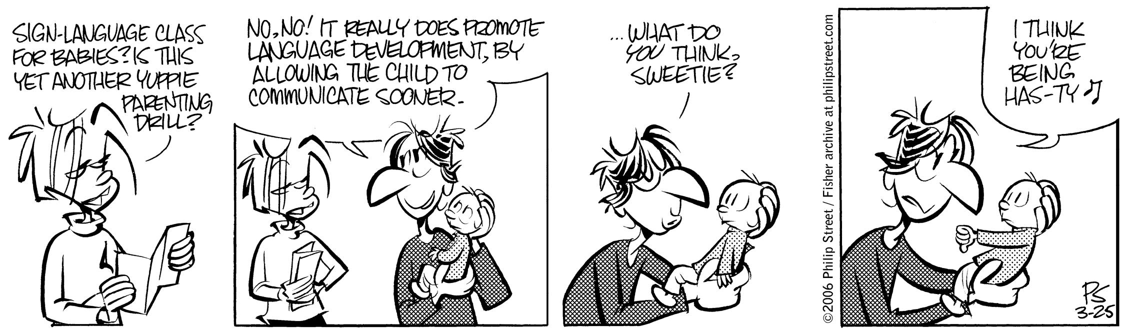
In Cartoon 6, the father's vocalizations in the first two panels are serving a playful function. In the first panel, the infant responds by looking at the parent and by smiling while he answers with his own vocalization ("hoo!"). In the second panel, the infant responds by looking and making more nonsense syllables. Because his mouth is turned up slightly, his behavior would be a response to his father's second playful overture.

Conversational Function

Sometimes in the home videos, the parents acted as though their infants could or did say words, even when the infants obviously did not. These overtures served a *conversational* function. The parents might ask the infant a question about his or her internal state (e.g., preferences or feelings). If the parent could not know what the infant's state was but the baby could demonstrate his or her state, then these questions were conversational overtures: They projected that the infant answer in some way. Infant responses to these overtures were ones that both (1) answered the question and that (2) directed the answer towards the parent (i.e., by looking at the parent). For example, the third panel of Cartoon 7 illustrates a conversational overture followed by the cartoonist's whimsical idea about how an infant could respond to it.

Cartoon 7. Conversational overture: "What do you think, sweetie?"



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In the third panel, the father asks, "what do you think, sweetie?", and in the fourth panel the infant makes a thumbs-down gesture while looking at his father. Here the infant's behaviors (although in the negative) constitute a response to his father's conversational overture. For another example, in the home video data, one of the infants was outside, standing next to his swing and looking towards his mother. His mother asked, "oh, you wanna go on the swing?" Whether the infant wanted to go on the swing was something that the infant knew and that he could demonstrate. After his mother's overture, he looked up at the swing and then back towards his mother. Because looking at the swing could be an answer to her question, and because he looked back at her right away, his behaviors constituted a response to his mother's overture. Questions that the infant could answer were not the only kind of conversational overtures. Another way that parents acted as though their infants could use words was by pretending that the infant did speak. That is, sometimes infants babbled and the parents responded as though the infant had spoken actual words. Some conversational overtures were, "oh, is that right?" or, "I see!" These conversational overtures projected that the infant should continue the conversation (by making another vocalization) and direct the vocalization to the agent (by looking at the agent).

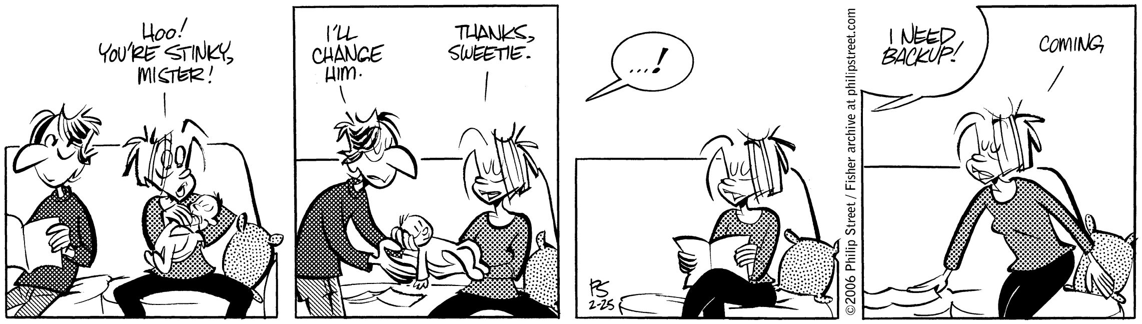
Rewarding Function

The infants often acted in ways that encouraged praise from their parents (e.g., by walking, by moving a truck that was hard to move, or by lifting a box that was heavy). Parental overtures that praised infants for their actions served a *rewarding* function. These were statements like, “Yay! You’re walking!” or, “you’re doing it, you’re doing it, yes!” or, “look at the big strong boy!” In Cartoon 2, above, after the infant had torn the paper off the present, the father said, “good boy.” This was a rewarding overture. In Cartoon 3, also above, after the infant had touched his father’s nose, the father said, “That’s right! Good boy!” These overtures projected simply that the infant receive the praise, which the infant could do by looking at the agent of the overture. If the infant had been looking away from the parent during the overture, a look towards the agent was sufficient for a response; if the infant had been already looking at the parent, the infant needed to change in their behavior in any way, which could include simply looking away or adding new behaviors while looking. For example, during the overture, “look at the big strong boy,” the infant was looking at a box he had lifted. After the overture, he looked at his mother (the agent of the overture), which was a response. Looking at his mother was a change in behavior (from looking at the box to looking at her), and it indicated engagement with her; that is, it indicated that he had received her verbal reward.

Narrative Function

Very often, the parents commented on what they were filming. Sometimes they directed these comments to the infants, either with their words or their prosody. These overtures served a *narrative* function. For example, in one video, the infants were sitting in their highchairs and eating messy food out of their bowls. One of the infants licked his bowl, then pulled the bowl away from his face and said “mmm” while he rubbed his hands into the food stuck on the sides of the bowl. His mother said, “that’s good, hey?”. The infant continued to look at his bowl, then, after approximately two seconds, he looked directly at his mother while beginning to lick the food out of it again. Because he looked back at his mother, his behaviors were a response to her narrative overture. In another example, one infant, while looking at her mother, squealed and tried to walk towards her. Instead of walking, she made a tiny jump with both feet and then landed in a seated position on the floor. After saying, “ha ha good girl”(which was a rewarding overture), the mother said, “you jumped.” In this narrative overture, she said what the infant had done. The infant had been looking at her mother during “you jumped,” and immediately afterwards she smiled and moved towards her mother a tiny bit. As with greeting overtures, because the infant was already looking at her mother, she had to add a new behavior to indicate a response to the overture. Because her smile and movements towards her mother were new behaviors, she had responded to the overture. Parental assessments of, or reactions to, what was happening also served a narrative function. For example, in the previously mentioned episode when the infants were in their highchairs, one infant accidentally dropped his bowl on the floor and looked at it as it fell. His mother said, “uh-oh,” which was a narrative overture that depicted her reaction to dropping a bowl of food on the floor. As soon as she said the overture, the infant looked up towards her. By directing his gaze to her, he responded to her narrative overture. The first panel in Cartoon 8 is another illustration of a narrative overture.

Cartoon 8. Narrative overture: “Hoo!”



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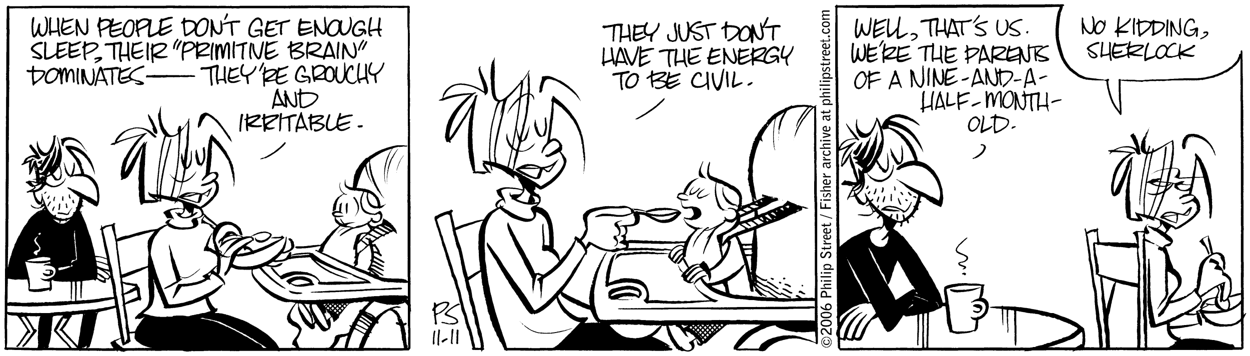
The mother says “Hoo! You’re stinky, mister!” This is her reaction to an apparently unpleasant aroma emanating from the infant. Her statement serves a narrative function. The infant is looking at her, but there is not enough information in the cartoon to tell if his behavior changed in response to her overture.

Instrumental Function

Not all the parental actions with infants were social. Parents, even in home videos, often have to do tasks that involve infants in a non-social way, such as moving them or feeding them. In my analysis, if these actions were not accompanied by words directed at the infant, they were considered as serving an instrumental function, and they were not social overtures. *Instrumental actions* projected physical cooperation from the infant, but they did not project social behaviors (e.g., infants did not have to look at the parent or smile for their behavior to be considered a response). In Cartoon 9, the mother directs an instrumental action to her son in the second panel.

Cartoon 9. Instrumental action: feeding the infant.



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In the second panel in Cartoon 9, the mother is holding a spoon up to the infant's mouth. She is speaking, but her words are obviously directed towards her partner, not the infant. She is projecting that the infant should cooperate in the feeding, but she is not projecting that he necessarily engage socially with her. In the same panel, the infant is opening his mouth to accept the food; his behaviors are cooperating with her spooning food in his mouth, and therefore they are a response to her instrumental action. Similarly in the second panel of Cartoon 8, above, the mother passes the infant to the father. The father takes the infant without saying anything to the infant; therefore his actions are instrumental, not social. Because the infant does not appear to struggle, he is being cooperative and therefore responding to the action. Instrumental actions provided a check on each infant's ability to co-ordinate his or her behaviors with the parent in non-social contexts.

Summary of Social Functions

Two dimensions on which these eight social overture functions differed were (1) the amount of interactive pull the overture demanded, and (2) the specificity of response that was required from the infant. Using these two dimensions, I grouped the social overtures into four broader categories. First, Attention-seeking and Directing overtures had a *strong pull* (or demand) for a response, and they demanded a *specific response*. If the parents called an infant's name to get his attention, they could expect that the infant should respond. And the response to these overtures was specific: The infant should look at the parent. Likewise, when the parents told the infant to do something (such as "sit down" or "come to mummy"), they could expect that the infant should fulfill the demand, and the fulfillment was specific to the meaning of the overture (e.g., the infant should sit down or the infant should go to his mother). Second, Helping overtures had a *medium pull* for a response, and the response was again *specific*. For example, if the mother pushed a baby bottle towards the infant who had been reaching for it, she could expect him to respond, and his response would be specific (i.e., he should take the bottle that she was offering). Third, Greeting, Playful, Conversational, and Rewarding overtures had a *weak pull* for a response. In contrast to the previous overtures, whether an infant responded to them or not was not terribly consequential. Furthermore, the expected response to these overtures was *not specific* (i.e., it was more ambiguous). In the analysis, although we focused on gaze as the crucial aspect of their behaviors, a broad range of other infant behaviors could constitute responses to these overtures. Fourth, Narrative overtures had *no interactive pull*. When the parent was simply narrating the home videos, whether the infant responded or not was of no consequence. Like the previous set of overtures, the infant behaviors that would constitute responses to narrative overtures were ambiguous (i.e., *not specific*). Figure 2 represents how the eight social functions fit into these four broader categories.

New Age Range

The data for Study II included the home videos starting from when the infants were 6 months old. It was useful to attempt analysis in earlier infancy for two reasons. First, the overture definitions that I developed in the pilot data might require adaptation for application to the earlier age range. Second, it was important to compare the infants' responsiveness at the earlier age range to the two later ones to see whether (and how) they changed over time.

Analysis of Pre-overture Behaviours

Overture-response pairs did not occur in isolation; these were typically only a few seconds within more extended everyday situations at the family's home. The immediate context preceding each overture might influence the likelihood of the infant's response. One aspect of this context was what the infant was doing immediately before the overture, so I developed a new analysis to explore what each infant was doing immediately before each overture. For the *infant's pre-overture behaviours,* the analysis focused on the direction of the infant's orientation or actions. Specifically, the analysts decided whether the infant was looking at the parent, engaged in some other activity (e.g., pulling Kleenexes out of a box), or neither looking at the parent nor actively engaged. This variable allowed me to examine one influence on whether the infant was more or less likely to respond to an overture, given what the infant had been doing before the overture began. The results could have implications for intervention. If infants with ASD were more likely to respond to overtures under certain conditions, such as when already looking at the parent, then parents could capitalize on those conditions either by directing overtures to the infant when these conditions existed or even by creating them before they made overtures. For example, if an infant with ASD tended to be more responsive to overtures when he was already looking at the parent, then his parents could direct more overtures towards him when he was looking at them. This strategy might increase the likelihood of his responding to his parents.

Method

Home Video Data

The data were all of the family's home videos from when the infants were 6 months to 15 months old, excluding the excerpts that I had used for Study I. I separated the data into three separate age ranges for the analyses. These age ranges were exactly 6-8 months, 9-11 months, and 12-15 months. The parents filmed approximately 6 hours of video over this period, about 2 hours at each of the three age levels.

Data Preparation and Inventory

Using the same equipment as in Study I, I digitized the videos and separated them into *episodes*, each of which represented all videotaped material from a single day. I labeled each episode by the date (indicated by its date stamp) plus its position in chronological order for that age range (e.g., the first episode in the 6-8 month age range was labeled 3.23.2000.01, which indicated that it was filmed on March 23, 2000, and it was the first episode in this age range). When an episode did not have a date stamp, I labeled it with the same date as the previous episode plus its position after that episode (e.g., the second episode in the 6-8 month age range did not have a date stamp, so I labeled it 3.23.2000.02).

While digitizing the episodes, I conducted a detailed inventory of the whole set of videos, noting each episode's duration, whether there were any technical problems (e.g., poor audio quality), what activities took place, which infants were onscreen, and whether there were others on screen besides the infants and their parents. (See Appendix E for detailed procedures and the inventory itself.) As part of the inventory process, I also compared the contents of the family's original Hi-8 tapes to the VHS tapes I had been given, and I added any episodes that were missing from my VHS tapes. The inventory in Appendix E indicates that the parents recorded the triplets every few days (sometimes every day) and in a variety of settings (e.g., eating in high chairs, having a bath, running around, playing on the porch). The inventory served two purposes. First, it provided a catalogue of what was on the original tapes. Second, it helped me to determine which data were unsuitable for subsequent analysis.

Selection of Data for Analysis

I judged the suitability of episodes using four main criteria. (1) For a valid replication of Study I, I excluded all material previously analyzed in Study I. (2) The permission to analyze their home videos that I had obtained from the parents on behalf of themselves and the three children did not extend to their other family members or to their friends. Therefore, I excluded any episode that included a visible adult or child other than the parents or a triplet infant. (3) I excluded excerpts that were too dark to analyze or that had poor audio quality. (4) I shortened very long episodes because they could contribute a disproportionately large amount to the overall results. That is, for each age range, I calculated which durations of episodes were outliers when compared to the mean duration of episodes for that age range. I shortened each outlier episode to the length of the longest, non-outlier episode for its age range. Again, Appendix E reports these procedures in more detail.

Applying these four criteria reduced the 6 hours of data to 3 hours, 31 minutes, and 4 seconds. After analysis began, I excluded approximately 3 minutes of data either because I heard an adult other than the parents on the video (although not visible on film) or because the parents were delivering numerous simultaneous overtures to an infant. The final data set was therefore distributed in the following way among the three age ranges: 84 minutes and 8 seconds for 6-8 months; 55 minutes and 50 seconds for 9-11 months; 68 minutes and 31 seconds for 12-15 months.

Analysis

Training and Reliability Assessment

In order to check for analyst bias and to test the definitions, procedures, and rules for analysis, I conducted inter-analyst reliability on approximately 20% of the data at each stage of analysis. Sara Healing (SH) and Christine Tomori (CT) were the two analysts working with me. After the completion of Study I, the clinicians I was working with had told me which infant was later diagnosed with ASD; thus for Study II, I was no longer blind to the identity of this infant. However, neither SH nor CT knew which of the three infants was later diagnosed with ASD. For each stage of analysis, I set aside a randomly selected 20% of the data that we would use later for reliability. The remaining 80% of the data was available for training. First, SH and/or CT and I worked on the analysis together, drawing from this 80% of the data. If the stage of analysis was a new one (i.e., one that was not designed and tested during Study I), we refined the definitions, rules, and procedures during this phase. If it was a stage that I had used in Study I, the purpose of this phase was for training SH or CT. Second, still using data from the 80%, each analyst practiced the analysis procedures on her own, testing occasionally whether her training was complete (i.e., not formal reliability trials). During this phase, we calculated our agreement for the purpose of diagnosing any difficulties with interpreting or implementing the rules. Once this agreement was high, we were able to begin formal reliability assessment. In this last phase, we worked independently on the random 20% of the data that I had initially set aside for reliability. After recording our independent reliability, we resolved any disagreements. All final results used our resolved decisions.

The following sections present a brief description of the final operational definitions, rules, and procedures for analysis. Appendix F is the manual containing the full operational definitions, rules, and (blank) analysis sheets that we used. Appendix G is a summary of all reliability procedures (i.e., who conducted the analyses at every stage, the procedures we used for reliability, and what our independent agreement was).

Locating Overtures

Operational definitions. I operationalized overtures using the same definitions as in Study I, that is, as “a period of time when one or more adults are making some sort of social contact (verbal and/or nonverbal) with one baby.” As before, for an infant-directed social behavior to be an overture, (a) the overture had to be directed to only one infant, and (b) that infant had to be visible.

Procedures and reliability. Analysts located all overtures using a detailed operational definition and a decision tree for difficult decisions (see Appendix F). We assessed reliability at this stage in two ways. First, we calculated second-by-second reliability. Agreement at each second meant that we agreed both on whether there was an overture occurring, and, if there was an overture, on the identity of the infant to which it was directed. Reliability for this decision was 96.84% (agreement on 2543 out of 2626 seconds compared). Second, we calculated reliability on an event-by-event basis. Agreement at each event meant that we agreed on the timing of each event change (e.g., from no overture occurring to an overture occurring), and, if the event was an overture, we agreed on the identity of the infant to which it was directed. Reliability for this second test of the rules and definition was 84.11% (or agreement on 344 of 409 event changes noted by both analysts). For a more detailed account of reliability calculations, including a report of reliability for each age range, see Appendix G.

Assigning an Agent to Overtures

Operational definition. I then noted the *agent* of each overture (i.e., whether the mother or father did the overture). When there was change in agent (from mother to father) in a given overture, I divided it at the point where the agent changed. As before, a change in agent occurred whenever one parent made an overture to an infant and the other made an additional one that started after the first one (i.e., the parents made consecutive overtures towards one infant without a gap of time between them). For example, once while the infants were in the bath, the mother took a teddy bear and "kissed" one infant's cheeks with it, and, just before she finished, the father made little growling noises. Because there was no gap between the two social actions, the analysts had previously treated this as a single overture. At this new stage of analysis, the analysts divided the single overture into two separate overtures at the point where the agent changed. Note that if the overtures from each parent were simultaneous, they would be not analyzable because it would be impossible to assign the infant's response to one or the other.

Procedures and reliability. We conducted inter-analyst reliability using the overtures that CT and SH had previously located, which was about 26% of the total number of overtures. Agreement as to whether an overture should be divided based on a change in agent was 100% (173 out of 173 overtures); agreement for assigning an agent to each overture (i.e., did the mother or the father make the overture to an infant) was also 100% (176 out of 176 overtures).

Assigning a Function to Overtures

The next step of the analysis was to decide which of nine separate *functions* each overture was serving in the interaction. The function of an overture referred to what the overture was doing in the interaction. That is, what was the overture for? What was its function in a projective pair? For example, did it function as a way to initiate or sustain play with the infant or as a way to get the infant's attention? In the introduction to this chapter, I described and illustrated the nine functions. The further information included here is (1) the criteria that analysts could and could not use to make their decisions and (2) a brief version of the operational definition of each kind of function, including some examples from the home video data. The full operational definitions (which are considerably more detailed) are in Appendix F.

Criteria that analysts included in decision making. Although analysts considered the overture's form (i.e., the parent's words or actions) when assigning its function, its form alone was insufficient for deciding the function that the overture was serving in the interaction. Two actions or utterances could have the same form but could still be serving different functions. For example, when a parent said an infant's name, it could be part of a greeting, it could be a way of getting the infant's attention, or it could be directing the infant to do something. Likewise, poking an infant could serve a teasing, playful function or it could be another way of getting the infant's attention. Therefore, in order to ascertain an overture's function, analysts had to integrate the overture's form with the overture's immediate context, which included the overall circumstances, the immediate situation, and how the parent said the overture (e.g., a playful tone or a stern tone). The following example illustrates how analysts integrated an overture's form and context in order to decide its function. The overture's form was the mother saying the infant's name. The overall circumstances were that the infant had been repeatedly standing up in her high chair. Each time she stood up, the mother asked her to sit down. The immediate situation was that the infant had been standing and looking directly at her mother, and her mother had asked her to sit down. Instead of sitting, the infant continued to stand and look at her mother. The mother then said the infant's name in an angry tone. By integrating the form of this overture (the infant's name) with its context (the infant was doing something that her mother had just told her not to do, and the mother was using an angry tone of voice), the analyst would decide that the overture served a directing function (i.e., telling the infant to sit down).

Criteria that analysts excluded from decision making. Although analysts could take many aspects of context into account while assigning functions to overtures, there were some criteria that they had to be careful to exclude. First, it was crucial to ignore the infant behaviors that *followed* the overture. Because these behaviors would determine whether the infant responded or not, the analyst could not use them as criteria for decisions regarding overture function. For example, analysts could not decide that an overture served an attention-seeking function on the basis of whether the infant looked at the adult after the overture. Analysts had to be able to defend their decisions about an overture's function using only the overture's preceding and immediate context and the overture itself. Second, the procedures and definitions directed analysts away from hypotheses regarding the parents' intentions and instead towards the parents' observable behaviors. In other words, analysts had to avoid making inferences about the parents' internal mental processes (such as their motivations or intentions) when deciding on the overture's function. One way to keep the focus on observable behaviors was for the analyst to consider the function that the overture was serving from the infant's point of view. For example, in one episode, the mother was tickling one of the infants as a way to distract him from playing with the bathtub faucet and knobs. If the analyst were inferring the mother's intentions, the analyst might say that she intended the overture to serve a directing function (i.e., to get the infant to stop playing with the faucet). However, based on her observable behaviors (tickling the infant), which were the behaviors that the infant was experiencing, her actions were merely playful.

Functions: Operational Definitions

I grouped overture functions into four broader categories based on differences along two dimensions. One dimension was the amount of *pull* (i.e., the implicit demand for a response) the overture had. An overture's pull ranged from strong (when a response appeared to be strongly expected) to weak (when no response could be perfectly acceptable). The second dimension was the *specificity* of infant responses that the overture projected. Specificity ranged from only one specific response (i.e., the overture projected only one possible response) to many possible responses.

Overtures with a strong pull, projecting specific responses. This set of overture functions had a high demand for a response, and they projected a specific response from the infant. For example, when the mother said to an infant, "[name], sit down," the overture strongly projected one specific response: The infant should sit down. Two different functions had a strong pull and projected a specific response: Attention-seeking overtures and Directing overtures. *Attention-seeking* overtures were ones that functioned to orient the infant's gaze towards the agent of the overture. Attention-seeking overtures often took the form of the parent calling an infant's name, but they could also take the form of the parent calling the infant by a nickname (e.g., "baby"), whistling, poking the infant, or even just saying "hey." For an overture to serve an attention-seeking function, the infant had to be looking away from the parent immediately before the overture began. The specific response strongly projected by these overtures was for the infant to look at the agent of the overture. *Directing* overtures occurred when the parent told an infant to do something, such as starting a behavior (e.g., "Come to mummy" or "Go get another toy") or stopping a behavior ("Stop hitting your brother"). The strong, specific projected response to these overtures was obedience with what the parent had directed the infant to do. If the parent asked the infant to sit down, the projected response was for the infant to sit down; if the parent told the infant to stop hitting his brother, the projected response was for the infant to stop hitting his brother. In all of these examples, what the parent was asking was explicit. Sometimes what the parent was asking the infant to do was more implicit but still strong and specific. For example, several times one of the infants stood in her highchair (which she wasn't supposed to do) while looking at her mother. The mother used a series of directing overtures. Usually the mother explicitly said what the infant should do in response, for example, "[name] sit down." However, at least once she said the infant's name in a scolding tone. The projected response to this overtures was still that the infant should sit down, even though this demand was only implicit.

Overtures with a medium pull that projected specific responses. Sometimes the infants expressed a need, and the parental overtures seemed to respond to that need; these were *helping* overtures. If the infant was reaching for a bottle that was just out of range, the parent's helping overture would be to hand the bottle to the infant. If the infant was crying, the parent's helping overture might be to say, "S'okay" in a soothing tone. Although these overtures were not as demanding as attention-seeking and directing overtures, they still had a moderately strong pull. If a parent pushed a bottle towards an infant who had been reaching for it, it is reasonable to expect that the infant should respond. These overtures also projected a specific response from the infant. For example, the response projected by pushing the bottle towards the infant was that the infant would take the bottle, and the response projected by soothing noises was that the infant would either cry less or stop crying.

Overtures with a weak pull and less specific projected responses. These overtures had a weaker pull in the interaction (i.e., they did not definitely project a response), and the overture did not project a specific response (i.e., a variety of possible responses would have been appropriate). Four kinds of overture functions fit into this category. First, *greeting* overtures were those the parent used to greet the infant when the infant looked at the parent. Often these included a salutation (e.g., "Hi [name]"). *Playful* overtures were little noises, nonsense words, or actions that appeared to have no purpose other than for the parent to have some fun with the infant. *Conversational* overtures were ones that occurred when the parent acted as if the infant could speak. Sometimes conversational overtures occurred after the infant had babbled (e.g., the parent might respond with "is that right?" or "good idea," as though the infant had actually said something). Other conversational overtures were questions to the infant when (a) the parent did not know the answer, and (b) the infant could answer in a nonverbal way. For example, “You want some more spaghetti?” is something that the parent did not know, but the infant could indicate by reaching for more spaghetti or by smiling. Finally, *rewarding* overtures were the parents’ positive expressions in response to something an infant did well. For example, “Good girl” in response to the infant who had finally sat down in her high chair, or, “You’re doing it, you’re doing it!” in response to the infant who had been working hard to push himself along a gravel path in his truck. None of these overtures projected a specific infant response; that is, many different infant actions could be responsive.

Overtures with no pull and no specific responses. These were overtures that occurred when making no response would be just as likely as a diverse range of responses. The only function in this category was a *narrative* function. Overtures that served a narrative function were comments to the infant that described the current situation in a way that somehow involved the infant. These could be a parent’s statement about what was happening (e.g., “Oh, you’re dancing” or “It’s a soft blankie, [name]”), or a parental assessment of the immediate situation (e.g., “Oh oh” said in an alarmed tone when an infant fell down or “Aaaaw” in response to something the infant did that was very cute). For example, one of the infants, who had been eating yoghurt in her high chair, looked up to her mother with yoghurt all over her face and head; it was slowly dripping off in congealed blobs. Her mother sighed and said, “Oh [name]” in a quietly amused voice. This was an overture to the infant that served as the mother’s assessment of the disgusting (but somehow still humorous) situation. The overture itself had little pull (the infant need not respond), and it did not in any case project a specific response (i.e., the infant could have done a number of different behaviors that would suffice as a response).

Non-social actions. Finally, *instrumental* actions were those by the parents that seemed to be serving only the function of accomplishing something practical that had to be done, for example, moving an infant from one place to another or placing an infant in the bath. For an action to serve an instrumental function, it had to be unaccompanied by words that the parent was directing to the infant. For example, if a parent put an infant into the bath without saying anything, the parent's action would be serving only an instrumental function. However, if the parent said "There you go" while putting the infant in the bath, the overture would be serving a narrative function (i.e., the parent was describing what was happening in a way that involved the infant).

In summary, social overtures could serve one of eight possible functions. The parents used strong, specific overtures to (1) get the infant's attention or to (2) direct the infant's behavior in some way. They used a less specific overture, with a medium pull to (3) help an infant who had requested something or who was expressing distress. The parents also used weaker, even less specific overtures to (4) greet an infant, (5) play with an infant, (6) talk to the infant as though in conversation, or (7) reward the infant for something he or she did. The parents also used overtures simply to (8) narrate what was happening in the video in a way that involved the infant somehow. (9) Finally, the parents sometimes used actions with infants only to accomplish tasks. These actions served an instrumental, or non-social function.

Procedures and Reliability

The analysts assigned a function to each overture. If an overture served two consecutive functions, the analysts divided it at the precise moment when the function changed. For example, at one point the mother was feeding an infant who was sitting in his highchair. She held up the spoon towards his face, then she opened her mouth. The first part of this overture was an instrumental action; she was feeding the infant and not saying anything. However, as soon as she opened her mouth, she was directing the infant to open his mouth as well. Once she opened her mouth, the instrumental action became a social overture that served a directing function. We assessed inter-analyst reliability using the overtures that CT and SH had previously located (about 26% of the total number of overtures). First, for each episode they analyzed, the analysts checked whether they had agreed that an overture should be divided or not, based on its function. Note that at this point in conducting reliability, the analysts limited their discussion to only whether they had divided the overture based on function; that is, they did not discuss which function(s) the overture served. Agreement for whether each overture should be divided was 94.9% (167 agreements in 176 decisions). The analysts resolved any disagreements, again without discussing the actual functions. Then, working independently, the analysts decided which of the nine functions each overture was serving. Agreement for this decision was 85.2% (161 agreements divided by 189 decisions).

Overture Modality

The overture modality analysis aimed to separate the verbal and nonverbal components of the overtures. An infant with ASD might respond differently depending on whether the overture included a facial display, a gesture, or words alone. The analysis of these nonverbal components of an overture requires that the analysts be able to see the agent's face and hands. However, in the home videos, the parent making the overtures was often behind the video camera. Even if one parent was visible onscreen, the focus of the filming was typically the infants, and the onscreen parent was not sufficiently visible. Therefore, the necessary preliminary to a full-scale modality analysis was to determine how many overtures were amenable to an analysis of their nonverbal components, that is, in how many of the overtures the agents were sufficiently visible. If too few overtures were visible (e.g., less than 10%), it would not be feasible to undertake a full-scale modality analysis.

Operational definition of visibility. The analysts considered the agent of an overture to be sufficiently visible if (a) the agent was on-screen during the overture, and (b) the analyst could see the agent's face and hands well enough to decide whether the agent had used a facial display or a gesture.

Procedures and reliability. SH and CT developed and implemented this analysis; they wrote the definitions and rules, did the analysis, and conducted inter-analyst reliability with each other. The first step of the analysis was to note whether the agent of the overture was onscreen at all. For those 814 overtures during which the agent was onscreen, the analysts proceeded to judge whether the agent's hands and face were sufficiently visible to be able to determine his or her facial display and gestures. If both the hands and face were visible, the analysts noted that the agent for that overture was sufficiently visible. SH and CT assessed inter-analyst reliability on 20% of the data (174 overtures). Agreement for whether the agent was onscreen during the overture was 98.85% (172 agreements divided by 174 decisions). Agreement for whether the agent's hands and face were sufficiently visible was 99.43% (173 agreements divided by 174 decisions).

Results. The analysts found that only 7.6% of the overtures (62 out of 814) were onscreen and sufficiently visible to be able to see both the facial display and the gestures. There were therefore too few analyzable overtures to justify the time and effort of developing and implementing a full-scale modality analysis for these data.

Analysis of Infant Behaviors

Infants' Post-overture Behaviors: Operational Definitions

Once we had located all overtures and classified them by agent and function, we began the analysis of infant behaviors. Recall that each parental overture was the beginning of a pair that projected the infant's subsequent behaviors. Whether we considered the infant's behaviors after an overture to be a response to that overture depended on the extent to which those behaviors matched what the overture had projected. For this analysis, I developed an overall operational definition of what infant behaviors constituted a response to an overture. In addition, because different overture functions projected different kinds of responses, I developed specific operational definitions for the overture functions. The following section outlines both the overall operational definition of a response to an overture as well as the specific operational definitions for responses to each overture function. The detailed operational definitions that we used for analysis are in Appendix F.

Overall Response

For an infant's behavior after an overture to be a response to that overture, it had to fulfill two criteria. First, the infant's behavior had to change in relation to the timing of the overture's onset. The analysts looked for a change in the infant's behaviour during a window of opportunity that started when the overture began and ended a few seconds after it ended. I defined a change in behavior as a new behavior (e.g., changing from not wiggling to wiggling), the cessation of a behavior (e.g., changing from wiggling to not wiggling), or an increase or decrease in an ongoing behavior (e.g., continuing to wiggle, but doing so more quickly). Second, if the infant's behavior changed, then for the new behavior to be a response, it had to match what the parental overture had projected. In short, I operationalized an infant's response to an overture as a behavior that was both temporally and functionally related to the parent's overture. The specific definitions for each overture function, below, indicate what constituted a functionally related new behavior.

Responses to Attention-seeking Overtures

An attention-seeking overture projected that the infant look towards the agent of the overture. Therefore, for an infant's behavior to be considered a response to these overtures, the infant had to direct his or her gaze towards the agent of the overture at least a few seconds after the onset of the overture. Or, if a new overture occurred within those few seconds, then the response had to occur before its onset.

Responses to Directing Overtures

A directing overture projected that the infant do what the parent was telling the infant to do in the overture. Therefore, the analysts first considered what the parent was telling the infant to do. As mentioned previously, some overtures were explicit in their direction. For example, if the overture was "Come to mummy," then the projected behavior was for the infant to move towards his mother until he reached her. Other overtures made more implicit demands. For example, if the overture was “Whoa” while the infant was running towards the parent, the implicit demand was for the infant to avoid bumping into the parent. Once the analysts understood what the overture was projecting, they watched the infant’s post-overture behavior and decided whether the infant’s behavior matched what the parent had projected. There were three issues that analysts had to take into account during their analysis of infant responses to directing overtures. First, because the infants sometimes needed time to get physically coordinated to meet the demands of the overture, the window of opportunity for the projected behavior was larger for this overture function. For example, if the mother was across the room from the infant when she told him to “Come to mummy,” then we allowed sufficient time for him to reach her. Second, sometimes the parent made a directing overture and then, immediately after or during this overture, maneuvered the infant to match what the overture had projected, thus changing the infant’s behavior. We considered these cases not analyzable on the grounds that the parent had intervened. For example, while holding an apple out for one infant to take a bite the mother said “Oh, will you share that with [name]?” The response that this directing overture had projected was for the infant to stop eating and move away from the apple so that his sister could have some. However, before he had a chance to do so, his mother moved the apple over to the sister. Because the mother had moved the apple away from him before he had a chance to respond, we considered his behavior not analyzable. Third, sometimes an infant appeared to be disobeying the parent. For example, often when the mother told her infant girl who was standing in her highchair to sit down, the infant did not sit down. Disobedient behaviors could indicate that the infant understood but did not agree to what the parent’s directing overture had proposed (e.g., the infant understood that she was supposed to sit but she chose not to), but it also could indicate that the infant did not understand or was not attending to the parent. Therefore, although disobedience was arguably a sophisticated kind of response, we did not consider possible acts of disobedience to be overture responses for the purpose of this analysis.

Responses to Helping Overtures

Before a helping overture, the infant would have conveyed a need to the parent. A helping overture then occurred when the parent's behaviors addressed that need, and the overture projected that the infant accept the parent's help. For example, when the infant reached for a bottle, then the parent's offering the bottle would be a helping overture. If the overture served to fulfill a specific instrumental need that the infant had expressed (e.g., by reaching for a bottle), then any indication of cooperation in the infant's behavior (e.g., taking the bottle that the parent offered) counted as a response. If the overture was serving the function of soothing an infant who was crying, any decrease in intensity of the crying would count as a response.

Responses to Greeting and Narrative Overtures

The response the parent was projecting in these overtures was for the infant to acknowledge the greeting or narrative overture by sustaining the interaction in some social way. In other words, neither of these two functions required more from the infant than a behavior that sustained the interaction. Exactly what the analysts considered a response to these overtures depended on whether the infant was looking away from or at the parent when the overture began. If the infant was looking away from the parent, then a response occurred if the infant looked at the parent shortly after the onset of the overture. If the infant was looking at the parent when the overture began, then a response occurred if the infant then looked away from the parent and then right back or if the infant added new behaviors along with the maintained gaze. New behaviors could be an increase in positive facial display (e.g., the beginning of a smile, a smile getting bigger, widening eyes, laughing) or an increase in orientation towards the parent (e.g., leaning towards parent, re-orienting body towards parent, crawling faster towards the parent).

Responses to Playful Overtures

What the parent was projecting in these overtures was for the infant to engage with him or her in having fun together. Thus for the infant to respond to these overtures, the infant had to display both *engagement* and *enjoyment*. Infant behaviors that indicated engagement included looking towards the parent, making actions towards the parent (e.g., moving hands or limbs towards the parent), or moving objects towards the parent (e.g., pushing a toy back to the parent). Infant behaviors that indicated enjoyment were smiles or laughter. Thus, for the infant to respond to a playful overture, the infant had to both orient to the parent (with gaze or actions) and show some sign of enjoyment.

Responses to Conversational Overtures

With conversational overtures, the parent could be either asking the infant a question that the infant could answer (such as, “Do you want to go on the swing?”) or talking to the infant as though the infant said something intelligible (such as, “Is that right?” after the infant had babbled). For the infant’s behavior to be a response for the question overtures, the infant had to indicate an answer to the question and direct that answer towards the agent of the overture by looking at the agent (e.g., looking towards the swing and then back to the agent). For the infant’s behavior to be a response to the overtures during which the parent acted as though the infant had been talking, the infant had to vocalize after the overture (thus continuing the “conversation”) and direct this vocalization to the agent (by looking at the agent). If an infant babbled after one of these overtures but did not look towards the agent of the overture at any time, it would not be a response.

Responses to Rewarding Overtures

The parents used rewarding overtures in order to convey to the infant that he or she had done something good. For example, after the mother had repeatedly asked her infant daughter to sit down in her high chair, when the infant sat down, the mother said, “that’s a good girl.” Or when another infant waved good bye after his mother had asked him to, she said, “yeah, bye bye” in a happy tone of voice. The infants responded to rewarding overtures simply by receiving the reward, which was indicated by looking at the agent of the overture. If the infant had not been looking towards the parent when the rewarding overture began, the infant had to look towards the parent. If the infant had already been looking at the parent when the overture began, any change in behavior constituted a response (e.g., smiling, repeating the behavior, or even just looking away).

Responses to Instrumental Actions

These actions were not social; therefore, infant responses did not have to include any social behaviors, such as looking towards the parent. Instead, these actions projected that the infant cooperate with what the parent was trying to accomplish. For example, if the parent was feeding the infant, then taking the food into his or her mouth would indicate that the infant was cooperating. If the parent was putting the infant down on the ground, then making contact with the ground in a smooth and coordinated manner indicated the infant's cooperation.

Procedures and Reliability

In order to ensure consistency, the analysts proceeded through the analysis of infants' post-overture behaviors one function at a time; they analyzed infant behaviors after all attention-seeking overtures, then they analyzed infant behaviors after all directing overtures, and so on. For all the overtures with social (i.e., not instrumental) functions, the analysis of infant behaviors involved three hierarchical decisions. The first decision was whether the infant behaviors were analyzable. Not analyzable overtures included those during which the infant was not sufficiently visible (i.e., was onscreen but not clearly visible) or after which the infant did not have sufficient time to respond (e.g., the video cut to a new scene or ended or another overture to that infant began). (As noted above, for directing overtures, the infant behaviors were not analyzable if the parent touched or moved the infant, because these actions inhibited our ability to judge whether the infant was responding on his or her own.) The analysts deemed 246 of the overtures to be not analyzable for infant responses, for several practical reasons: the analyst could not see the infant well enough to decide whether his or her behaviors were a response; the infant did not have enough time to respond because the parent made another overture immediately after the first; or the videotape of the episode ended before the analyst could judge the response. (See Appendix H for an accounting of all overtures.) Although the process of deeming responses not analyzable eliminated many of the overtures we had previously located, it ensured that the response results represented the fairest analysis for each infant, in the sense that the full projective pair could be analyzed for each overture.

Only if the infant's behaviors after an overture were analyzable, did analysis for that overture proceed to the next decision.

This second decision was whether there was a change in the infant's behavior timed with the onset of the overture. Only if the infant's behavior changed after the onset of the overture did analysis proceed to the third decision for that overture. This last decision was for the analysts to judge whether the new behavior was functionally related to the overture; that is, did the new behavior match what the overture had projected? For this last decision, analysts used the specific operational definitions outlined above. I was the primary analyst for this analysis, and SH did an analysis for reliability on a randomly selected 20% from each overture function. We did reliability for the social (i.e., non-instrumental) overture functions at each of the three consecutive stages of analysis described above. Reliability for whether infant responses were analyzable or not analyzable, aggregated across all social overtures, was 92.8% (141 out of 152 overtures). We resolved the disagreements and then proceeded independently to the next decision for all of the analyzable overtures, (i.e., whether the infant's behavior changed after the onset of the overture). Reliability for judging whether the infant's behavior changed or not, aggregated across all of the analyzable social overtures, was 92.8% (90 out of 97 overtures). We resolved the disagreements and then proceeded independently to the last decision for all overtures (i.e., whether the new behavior matched what the overture had projected). Reliability for judging whether the infant's change in behavior indicated that the infant was taking up the parent's proposal, aggregated across all analyzable social overtures, was 95.5% (or 84 of 88 overtures). The results for infants' post-overture behaviors reflect our resolved decisions at this third stage.

The analysis of instrumental (i.e., non-social) actions involved two decisions. First, we decided whether the infant's behavior was analyzable, according to the same definitions we had used for the social overtures. Second, we decided whether the infants' behaviors were cooperative, given what the parent was doing with the instrumental action. We assessed reliability for instrumental actions in two stages. Reliability for whether the infant's behaviors were analyzable or not was 100% (10 out of 10 actions). Reliability for whether the infant was cooperating with the instrumental action was also 100% (or 10 out of 10 overtures).

For more detailed accounts of the reliability for each separate overture function, see Appendix G.

Infants' Pre-overture Behaviors: Operational Definitions

In order to investigate the relationship between what each infant was doing before an overture and whether that infant responded to the overture, I analyzed each infant's pre-overture behaviors. Specifically, the analysis procedure guided the analyst to a decision as to whether the infant had been attending to the agent of the overture (*attending agent*), was engaged in a different activity (*otherwise engaged*), or was doing something more ambiguous (*potentially available*). Each of these is defined below.

Attending Agent

If an infant was looking at the agent of the overture anytime up to and including immediately before the overture, the analysts characterized the infant's pre-overture behavior as *attending agent*. Obviously, the analysts had to be alert to where the agent was when making the overture. If the agent was behind the camera, whether the infant was looking towards the agent was obvious (i.e., the infant looked towards the video camera). If the agent was somewhere else in the room, the analysts had to watch enough context before (and sometimes even after) the overture to determine where the agent was. In these cases, whether the infant was looking at the agent was slightly more ambiguous. If it seemed at all as though the infant was oriented towards the agent (e.g., by the orientation of the infant's head or body), even though the exact direction of the infant's gaze could not be determined, the analysts considered the infant to be attending to the agent.

Otherwise Engaged

It was often the case that, before an overture, an infant was busy playing with a toy or engaged in a project (such as taking tissues out of a box or watching the effect of turning his bottle upside down). In these cases, the infant was engaged in an activity that directed his or her attention away from the agent of the overture. The analysts characterized these behaviors as the infant being *otherwise engaged* before the onset of the overture. For example, in one episode, when the infants were approximately 6 months old, they were sitting in their highchairs, strapped in by little belts. Before the mother's overture to one of the infants, he was quietly exploring the belt that was holding him in the chair. The infant appeared to be intently engaged in his exploration of the belt, so he was otherwise engaged before his mother's overture.

Potentially Available

If the infant was neither looking at the adult agent nor obviously otherwise engaged, then the analysts characterized his or her behaviors as indicating that the infant was *potentially available*. Behaviors that led to this characterization were ones that lacked intensity; for example, the infant might be looking around or holding (but not actively exploring) objects. If the infant was almost looking at the agent's face (e.g., by looking at an area close to the face), the analysts characterized the infant as potentially available. Note that this characterization of behaviors was most clearly defined by what it was not. It captured those instances in which the infant was neither clearly attending the agent nor otherwise engaged.

Procedures and Reliability

This analysis applied only to the infants' behaviors immediately preceding social overtures that the analysts had deemed analyzable in the response analysis. To apply the above definitions of pre-overture behavior to the data, we selected a period of time that started a few seconds before the onset of the overture and ended just at the overture's onset. (When the analysts watched the selection for this analysis, they did not watch the overture itself.) If more context was required to make a decision, analysts could extend the time of the selection backwards, but not forwards. The only exception to this rule was when the agent of the overture was not behind the camera and the analysts had to watch enough context to determine exactly where the agent was. The analysts decided whether the infant who was the recipient of the overture was attending to the adult, otherwise engaged, or potentially available. I was the primary analyst, and CT analyzed a randomly selected set of 20% of all overtures, stratified by overture function, for reliability. The reliability for characterizing the infants' pre-overture behaviors, aggregated across all overtures, was 83.9% (or 94 of 112 overtures analyzed). The results reflect our resolved decisions. Agreement for each separate kind of overture is reported in Appendix G.

CHAPTER FIVE: RESULTS

This chapter has four main sections: First, there is a description of the parental overtures, which created the opportunities for the infants to respond. The description includes how many overtures the parents used, how many the parents directed to each infant, and how the functions of the overtures were distributed amongst the infants. The second section presents the results of the planned replication of Study I.

The third, much larger section, presents a comprehensive comparison of the social responsiveness of the infant with ASD and his siblings. The first test compared their overall social responsiveness, both for the whole age range analyzed and for each separate age range (6-8 months, 9-11 months, and 12-15 months). Then I focus on differences based on the nature of the initiating overture, reporting the comparison of responsiveness for each of the broad categories of overtures (e.g., strong, specific overtures) and then for each individual function (e.g., attention-seeking, directing, helping). Each of these comparisons pertained to separate projective pairs. However, the parent and an infant often participated in longer sequences that consisted of several projective pairs, that is, more than one overture and one response by the same parent to the same infant. It is also possible to analyze infant responsiveness in these extended, consecutive sequences of overture-response pairs, which I called *strings*. I compared the mean length of strings of the infant with ASD to the means of his siblings. The last section of comparative results examines one context that could influence the responsiveness of the infants, namely, the relation between what the infants had been doing before an overture (i.e., their pre-overture behaviors) and what they were doing after the overture (i.e., responding or not responding). This comparison examined whether the predictability of a response given the infant's behaviors before the overture was different for the infant with ASD than for his siblings.

The fourth and final section of this chapter focuses only on the infant with ASD . The goal was to examine his behaviour from the perspective of identifying which overtures he was most responsive to and under what conditions he was most responsive.

Appendix I presents a table of all the data, including the dates of filming, the length of overtures, who did the overtures and to which infant, a description of each the overture, each overture's function, and whether the infant responded to the overture.

Parental Overtures

Number of Overtures

The parents made 811 overtures to the three infants. The mother made most of the overtures (733); the father made 77; and on one occasion the two parents made an overture to an infant simultaneously (they cheered for him together when he did something well). The parents directed 267 overtures to the male infant with ASD, 227 to the male sibling without ASD, and 317 to the female sibling without ASD. As shown in Table 4, although the distribution of overtures amongst the infants varied across the age ranges, there appeared to be no systematic difference in the number of overtures the infant with ASD received compared to his siblings. That is, he received neither more nor fewer overtures than his siblings did.

Distribution of Overture Functions

Table 5 presents the distribution of overture functions (for all infants) across the whole age range as well as for each separate age range. To facilitate meaningful comparisons of these distributions, I calculated the proportion for each function for each age range (i.e., the number of overtures that served that function over the total number of overtures).

The distributions of overture functions were similar across the three infants for the whole age range and at each separate age range. (See Appendix J for the number and proportion of overtures for each function.) There appeared to be no systematic differences in the functions of overtures that the infant with ASD received compared to his siblings.

In summary, in these data, the parents offered each infant a variety of social overtures, and each infant received a comparable proportion of the different overture functions. If there had been any differences in the distribution of functions, these still could not affect the ultimate dependent variables, which were always proportions--the number of responses an infant made divided by the number of opportunities (overtures) to which that infant had to respond.

Replication of Study I

In order to test whether Study II replicated Study I, I analyzed a subsample from the whole data set that corresponded exactly to the age range analyzed for Study I (i.e., starting and ending on the same days of filming, which was when the infants were 11-15 months old). Because I had planned to cross-validate my findings from Study I with this replication, I had excluded all excerpts analyzed in Study I from the data for Study II. In other words, the results of the planned replication came from data that had not been analyzed in Study I but that was filmed during the same period of time.

The results from this new sample replicated the results of Study I. The infant with ASD responded to 43 of the 82 overtures directed towards him (his response proportion was .52). His siblings responded to a higher proportion of overtures. The male infant without ASD responded to 44 of the 71 overtures directed towards him (.62), and the female infant without ASD responded to 71 of the 106 overtures directed towards her (.67). I tested my specific hypotheses with the same two chi-square tests that I had used in Study I. First, to test whether the infant with ASD was significantly less responsive than the other two infants, I used a one-tailed, complex 2 X 2 chi-square test (ASD infant vs. non-ASD infants). This comparison indicated that the proportion of social responsiveness of the infant later diagnosed with ASD was lower than those of his siblings ($X^2_{(1, N=259)} = 3.700$; $p<.05$). Second, to test whether the two typically developing infants were equally responsive, I used a simple 2 X 2 chi-square test comparing the two non-ASD infants. This test indicated that the responsiveness of the two typically developing siblings did not differ from each other ($X^2_{(1, N=177)} = 0.469$; *n.s.*). In the following, all analyses used the full data set of Study II.

Comparisons of Infants' Responsiveness (ASD vs. non-ASD)

Overall Responsiveness to Social Overtures

Recall from the method section that, although there were 811 overtures, only 565 met the criteria for the response analysis. These 565 overtures were those for which the parent's words were clear, the infant was sufficiently visible to decide whether he or she responded, and the analysts judged that infant had enough time to respond to the overture.

Whole age range. Table 6 presents the infants' response proportions across the whole age range in this study (6-15 months). The infant with ASD responded to 105 of the 188 overtures he received (.56). His brother responded to 115 out of 162 overtures (.71), and his sister responded to 142 of the 215 overtures she received (.66). Using a complex comparison chi-square test, I found that the infant with ASD was significantly less responsive than his siblings. Using a simple comparison chi-square test, I found that the two typically developing siblings did not differ from each other in responsiveness. However, analyzing the results in the three separate age ranges revealed a more subtle pattern between the responsiveness of the infant with ASD and his siblings.

Separate age ranges. At 6-8 months, the response proportion of the infant with ASD (.63) was similar to both his brother's (.72) and his sister's (.66): All three infants responded to approximately 2/3 of the overtures they received and there was no significant difference between them. At 9-11 months, the infant with ASD (.67) appeared to be less responsive than his brother (.83) and sister (.73), but this difference was still not statistically significant (p=.074). At 12-15 months, the response proportions of all of the infants were lower, but the infant with ASD was significantly lower than his siblings. Whereas the infant with ASD responded to only 20 of the 58 overtures he received during this age range (.34), his brother responded to 39 of the 63 overtures he received (.62) and his sister responded to 62 of the 100 overtures she received (.62). The difference between the infant was ASD's response proportion and those of his siblings was statistically significant ($\chi^2_{(1, N = 221)} = 13.040$; $p < .001$).

Responsiveness to Strong/Specific Overtures

Strong/specific overtures were those that made a demand on the infant to respond that was both forceful and clear. These overtures strongly indicated a particular response from the infant; that is, what constituted an infant response to these overtures was both relatively powerful and specifically tailored to what the overture had projected. For example, when a parent called an infant's name to get his or her attention, this was a strong, specific demand for the infant to turn and look at the parent. Similarly, when a parent told an infant to sit down, the strong, specific demand was that the infant would obey and sit down.

Whole age range. When the infant with ASD received overtures with a strong pull that projected a specific response, he was equally as responsive as his siblings. All three infants responded to approximately half of these overtures. (See Table 7a.)

Separate age ranges. The infant with ASD was equally responsive to strong/specific overtures at each of the three separate age ranges. At the oldest age range (12-15 months), the infant with ASD appeared to respond less often than his siblings (.22 vs. .41 & .43), but this difference was not close to being significant ($\chi^2_{(1,\, N = 47)} = 1.217$; *n.s.*).

Attention-seeking and directing overtures. Overtures with a strong pull that projected a specific response could be of two different kinds: either attention-seeking overtures or directing overtures. Across the whole age range analyzed, as well as at all three separate age ranges, responsiveness to these two overture functions did not distinguish between the infant with ASD and his two siblings. (For infant responses to attention-seeking overtures, see Table 7b; for directing overtures, see Table 7c.)

In summary, the infant with ASD responded at the same rate as his siblings when the parental overtures made a strong demand for a response and the response that the overture projected was specific. So when his parents appeared to be trying to get his attention or when they were telling him to do something (such as, “Come to mummy” or “Don’t hit your brother”), he responded as often as his siblings did. Although it is tempting to say that he therefore did well with these overtures, that would not capture the actual pattern. In fact, the reason there was no difference in response proportions was that none of the three infants responded very often to these overtures. All three infants displayed a low rate of responsiveness to attention-seeking and directing overtures.

Responsiveness to Medium/Specific Overtures (Helping overtures)

Helping overtures were those in which the parent made a social overture that fulfilled a need that the infant had expressed. When the infant was crying, the parent might make helping overtures to attempt to soothe the infant (such as saying “it’s OK” or holding the infant and saying “sh, sh, sh”). If the infant was reaching for a bottle, the parent might make a helping overture such as handing the bottle to the infant. Infant behaviors that I considered to be responses were those that matched what the overture had projected: if the parent made soothing noises, the infant should cry less; if the parent offered a bottle, the infant should take the bottle. As with attention-seeking and directing overtures, the infant with ASD responded to the same proportion of helping overtures as his siblings. Unlike attention-seeking and directing overtures, however, the similarity in response rates was at a high rate of responsiveness for all infants: All three infants responded to most (or all) of these helping overtures. (See Table 8).

Responsiveness to Weak/Non-specific Overtures

Weak/Non-specific overtures were those that made a low demand on the infant for a response and that did not project a specific response. For example, when the mother said, “Tootle-oodle” to an infant who was pushing a toy truck, her overture did not make the same demand as when she called the infant’s name to get his attention; furthermore, the infant could respond in a number of different ways to this overture, including smiling, wiggling, pushing the truck faster, or laughing. Although responses to these overtures were not specifically tailored to the overtures themselves, for the analysis, the one behavioral requirement was that the infant had to direct his or her gaze towards the parent during or after the overture. (Note that there were subtle differences for what constituted a response to each separate kind of weak/non-specific overtures, but each one included, at minimum, a gaze component.)

Whole age range. Across the entire age range, the infant with ASD responded to significantly fewer of these overtures than his siblings did ($\chi^2_{(1,\, N\, =\, 253)}$ = 9.323; p < .001), whose response proportions were statistically the same as each other ($\chi^2_{(1,\, N\, =\, 167)}$ = 0.975; *n.s.*). (See Table 9a.)

Separate age ranges. At 6-8 months and at 9-11 months, the infant with ASD responded to the same number of overtures as his siblings did. However, at 12-15 months, the infant with ASD responded to only a third of these overtures (.34), whereas his siblings responded to .73 and .79 of them. This difference was statistically significant ($\chi^2_{(1,\, N\, =\, 98)}$ = 14.682; $p < .001$).

Greeting, playful, conversational, and rewarding overtures. There were four different weak/nonspecific overtures, all of which made little demand and projected an unspecified response: greeting overtures, playful overtures, conversational overtures, and rewarding overtures. With the whole age range included, the infant with ASD was significantly less responsive than his siblings to three of these types of overtures (greeting, playful, and conversational) but he was equally responsive to rewarding overtures. At the earliest age range, the infant with ASD responded to a significantly fewer greeting and conversational overtures than his siblings did and the same proportion of playful and rewarding as they did. At 9-11 months, there were no differences in the response proportions among the infants at any of the functions. At 12-15 months, the infant with ASD responded to significantly fewer playful, conversational, and rewarding overtures, and his siblings responded equally to each. However, dividing overtures by age, function, and infant meant that sometimes there were very few overtures, making it difficult to interpret the significant vs. not significant results. (See Tables 9b-9e)

Responsiveness to No Pull/Non-specific Overtures (Narrative Overtures)

Some overtures made no demand for a response from the infant and projected no specific response. In these, the parent narrated the infant's actions and directed the narration to the infant (e.g., by using the pronoun "you" or using exaggerated prosody). When the parent said, "look at you, standing" to a standing infant, or "oh-oh" to an infant who slipped, there was no demand for the infant to respond, and virtually any behavior could count as a response. For the analysis, the one behavior we required for us to characterize the infant's behavior as a response was for the infant to look towards the parent after the narrative overture began.

Whole age range. Across the whole age range, the infant with ASD responded to significantly fewer narrative overtures (.47) than his siblings (.66 and .67). This difference was significant ($\chi^2_{(1, N = 153)} = 4.730$; $p < .05$). (See Table 10.)

Separate age ranges. At 6-8 months, the infant with ASD responded to fewer narrative overtures (.60) than his siblings did (.85 and .76), but this difference was not quite statistically significant ($\chi^2_{(1, N = 50)} = 2.381$; $p < .10$, *n.s.*). At 9-11 months, the infant with ASD responded to half of the narrative overtures he received. His brother responded to 8 of the 11 narrative overtures that he received at this age range, and his sister responded to 8 of the 10 that she received. Compared to his siblings, the infant with ASD was significantly less responsive ($\chi^2_{(1, N = 41)} = 3.029$; $p < .05$), and his siblings' response proportions were not significantly different from each other ($\chi^2_{(1, N = 21)} = 0.153$; *n.s.*). At 12-15 months, the infant with ASD responded to .27 of the parents' narrative overtures. His siblings each responded to about half of the ones they received. Again, this difference was significant ($\chi^2_{(1, N = 62)} = 2.733$; $p < .05$), and the difference between the proportions of the two siblings was not significant ($\chi^2_{(1, N = 47)} = 0.171$; *n.s.*).

Responses to Name as Part of the Overture

Many overtures included the infants' names. Because researchers have reported the dependent measure "response to name", I located all of the overtures that had an infant's name included (e.g., "hi [name]," "way to go [name]," or "[name], don't steal her toy"). Whether an overture included an infant's name was a formal property, not a functional one; that is, name overtures served many different functions. The three previous examples serve three different functions: greeting, rewarding, and directing. The analysts had evaluated infant responses to each overture according to the function of that overture. The parents included the infant's names in 201 overtures; the infant responses were analyzable for 167 of these.

Whole Age Range. All three infants responded to about 2/3 of the overtures that included their names; that is, the infant with ASD responded to the same proportion of these overtures as his siblings did ($\chi^2_{(2, N = 167)} = 0.664$; *n.s.*). (See Table 11.)

Separate Age Ranges. At each of the three age ranges, the infant with ASD responded to the same proportion of overtures that included his name as his siblings did. In this analysis, the dependent measure "response to name" did not differentiate between the infant with ASD and his siblings.

Responses to Instrumental (non-social) Actions

Instrumental actions were non-social behaviors that the parents used for practical tasks that involved the infant, for example, feeding the infant with a spoon or setting the infant down onto the floor. When parents did not talk to the infant while doing these actions, they served only an instrumental function. For infant behaviors to be responses to these actions, the infant had to display cooperation in accomplishing the task that the parent had projected in the actions. For example, if the parent offered the infant food on a spoon, then an infant response would be to eat what the parent had offered; if the parent was putting the infant down on the floor, an infant response would be to extend his or her legs and arms to settle smoothly onto the floor. Analyzing infant responses to instrumental actions was a way of checking whether the infant with ASD was able to co-ordinate his actions with the parents in a non-social setting.

We found 50 instrumental actions in the home video data: The parents directed 18 of them to the infant with ASD, 10 to his brother, and 22 to his sister. All three infants responded to all of the instrumental actions they received. In other words, the infant with ASD was equally able to display an ability to coordinate his behaviors to accomplish the joint project that the parent had proposed in non-social actions. We can infer from this that the infant with ASD was as able as his siblings to co-ordinate his behaviors with his mother or father. (Note that because these actions were non-social, I did not include them in the response results to social overtures.)

Summary of Comparison of Infant Responsiveness to Overture Functions

From 6 to 11 months of age, the infant with ASD displayed almost the same level of responsiveness as his siblings. The notable exception was with narrative overtures: Even at the early age ranges, he was less responsive than his siblings to these overtures. This difference approached significance at 6-8 months, and at 9-11 months, it was significant.

From 12 to 15 months old, the infant with ASD was significantly less responsive than his siblings on many more types of overtures. However, he continued to respond cooperatively to all instrumental actions and most of the helpful overtures. It seems that when overtures had a strong demand (i.e., attention-seeking and directing overtures) and the projected response was specific, the infant with ASD was not distinguishable from his siblings at any age. Although he was not highly responsive to strong/specific overtures, all three infants were not highly responsive to these overtures. The infant with ASD responded to overtures that included his name as often as his siblings did. The infant with ASD was significantly less responsive compared to his siblings when the parents' social overtures made less of a demand for a response and when they did not project a specific kind of response (i.e., playful, conversational, rewarding, and narrative overtures).

Sustained Sequences of Interaction

Sometimes the parents and infants participated in longer, consecutive sequences of several projective pairs; that is, the parent made an overture, the infant responded, then the parent made another overture to the same infant, that infant responded again, and so on. I called any sustained sequences of two or more overture-response (O-R) pairs a *string*, and the length of the string was the number of O-R pairs it included. The following is an example of a short (two-part) string, from when the infants were about 9 months old. The mother was sitting on the couch filming the infants who were on the floor. One of the infant boys crawled over and looked up towards her, and she directed him to come closer, by saying to him, “come up and see mummy?” He looked away and then towards her again, then crawled closer and used the couch and her legs to pull himself into a standing position next to her (O-R pair 1). He looked up and smiled, and his mother said “hello,” after which he looked away and then right back at her while wiggling a little bit (O-R pair 2). Another example is a six part string from when the infants were approximately 10 months old. The string consisted of six overture-response pairs, and it was approximately 20 seconds long. One of the infant boys was sitting in a toy car that was on springs, which allowed him to bounce the car (and thus himself) up and down a little bit. The infant’s mother was filming him while talking to him. The string began with him facing towards his mother. She said, “Hi [name],” but he didn’t have a chance to respond before she said, “Bounce, bounce, bounce,” which was a directive asking him to bounce in his car. He began to bounce (O-R pair 1). She said, “yeah, bounce, bounce, bounce,” which was a reward for his bouncing. He looked at her during the overture, then looked away while continuing to bounce a little bit (O-R pair 2). He looked back towards his mother, but not directly at her while he bounced in his car. Meanwhile, she directed a narrative overture to him by saying, “bounce, bounce, bounce.” He then stopped bouncing and looked directly at her (O-R pair 3). Suddenly, he looked up towards the sky, and his mother said, “[name]” to get his attention. He looked right back at her (O-R pair 4) and she whispered “bounce, bounce” and he began to bounce again while looking at her (O-R pair 5). She rewarded him again by saying, “yeah,” after which he looked away and then looked back at her (O-R pair 6).

My formal definition for a string was two or more consecutive O-R pairs directed towards one infant that were not more than 10 seconds apart. O-R pairs counted as consecutive even if they were separated by overtures that were later deemed not analyzable (e.g., if the infant did not have time to respond) or if they were separated by an instrumental action. (Note that an infant response to an instrumental action did not increase the length of the string.) I located all of the strings for each infant and gave the infant a score for each string that corresponded to its length (i.e., the number of O-R pairs).

My hypothesis was that the infant with ASD, if he participated in any strings, would have shorter strings than his siblings. I used a one-tailed, independent samples t-test to test differences in the mean length of strings, comparing the mean length of strings for the infant with ASD to the mean length of the strings of his siblings combined.

Table 12a shows the raw data for the string results for the whole age range. All three infants participated in the same number of strings. However, the mean string length for the infant with ASD was 2.54 and the mean string length for his siblings was 3.20. This difference was statistically significant ($t_{(78)} = 2.40$, $p < .01$). Tables 12b- 12d show the data for each age range separately. At the two earlier age ranges, all three infants participated in the same number of strings, and the mean string length of the infant with ASD compared to the mean string length of his siblings was not significantly different. However, at the oldest age range, the infant with ASD appeared to be participating in fewer strings (4) compared to the number his brother (7) and sister (11) participated in. Furthermore, his mean string length appeared to be shorter ($M = 2.25$) than his siblings' ($M = 3.44$). This difference approached significance ($t_{(20)} = 1.63$, $p = .060$ (one-tailed)).

When separated by age range, the *n* may have become too small to measure for statistical significance. Even so, the results suggest that the two infants without ASD participated in increasingly longer O-R sequences as they got older, but the infant with ASD participated in fewer strings that were also shorter. The graph at this age range displays the change in string length over time (see Figure 3).

Pre-overture behaviors

The projective pairs in the previous analyses did not happen in a vacuum. The infant had, of course, been doing something immediately before the parent initiated a projective pair by making an overture. I had two related questions about the effects of the infant's pre-overture behaviour: (1) When the infant had been attending to the agent (i.e., looking at the parent) before the overture, did the infant tend to respond or not respond to the overture? (2) When the infant had been otherwise engaged (i.e., involved in an activity that did not include the parent), did the infant tend to respond or not respond to the overture? Therefore, in their analysis of what an infant had been doing before the parent made an overture, the analysts noted whether the infant had been *attending to the agent* of the overture (i.e., looking at the parent making the overture), had been *otherwise engaged* (i.e., actively engaged in an activity that did not involve the parent), or had been *potentially available* (neither attending the agent nor otherwise engaged). In order to answer the above two questions, I analyzed only the two levels at the outer ends of the pre-overture variable (attending and otherwise engaged), leaving out the more ambiguous (potentially available) middle level.

I found that what the infant with ASD had been doing before the overture influenced his likelihood of responding in precisely the same direction as it influenced one or both of his siblings: For all three infants, if they had been looking at the agent when the overture began, they were significantly more likely to respond; if they had been otherwise engaged, they were likely not to respond. The detailed results are in Appendix K.

Dividing the results by age revealed the only exception to this pattern. In the two earlier age ranges, the infant with ASD responded in the same contexts as his siblings (i.e., each infant tended to respond if that infant had been attending to the agent before the overture began and tended not to respond if that infant had been otherwise engaged before the overture began). In the oldest age range (12-15 months), although his siblings continued to respond in this same pattern, the infant with ASD responded to only a third of the overtures that the parent directed to him, regardless of what he had been doing before the parent directed the overtures to him. That is, whether this infant had been looking at the parent or otherwise engaged did not influence his likelihood of responding: In each case, he responded to only a third of the overtures he received. I will return to this finding in the next section.

Summary of social responsiveness of the infant with ASD

In contrast to the previous sections, in which I compared the responsiveness of the infant with ASD to his siblings, this final section summarizes his own pattern of social responsiveness without reference to his siblings.

Responsiveness to overtures over the age ranges

See Figure 4 for a graphical representation of this infant's responsiveness to overtures over time. Across the full age range analyzed, the infant with ASD responded to all instrumental actions; that is, his ability to coordinate his behaviors with his parents in non-social contexts did not change over time. Similarly, this infant responded to almost all of the helping overtures that he received from 9 months to 15 months (there were no video examples for him in the 6-8 month age range). His stable, high rate of responsiveness to instrumental actions and helping overtures is in sharp contrast to his decreasing levels of responsiveness to all other overtures. At 6-8 and 9-11 months, the infant with ASD responded to a relatively high proportion to all other types of overtures (i.e., strong/specific, weak/nonspecific, and narrative). Then, at 12 months, this infant responded to only about a third of these overtures. In other words, although he responded very well to these overtures early on, there was a progressive decline in his responsiveness after 12 months. Thus it was not the case that his social abilities were measurably compromised from the beginning of these home videos; rather, the interactive skills that he had been using successfully early on began to disappear after 12 months. There is no obvious answer to why his responsiveness to some types of overtures declined at 12 months, nor to why this decline in his social behavior did not appear in his responsiveness to instrumental actions or to helping overtures. Note that there was no parallel increase in the social demands of the overtures as analysed here: For all overture functions, the behavioral definitions for infant responses did not change across the three age ranges (e.g., regardless of whether the infant was 6 months old or 15 months old, a response to a playful overture was always that the infant had to look at the agent of the overture and smile, nothing more). The decline in social responsiveness may be suggestive of a changing neurological condition. If so, it is curious that his ability to coordinate his behaviors with his parents in other contexts (i.e., instrumental actions and helping overtures) was unaffected.

Sustained sequences of interaction

The infant with ASD sometimes participated in several consecutive, successful overture-response pairs, which I called *strings*. As can be seen in Figure 5, at 6-8 months he participated in 10 interactive sequences longer than a single projective pair, and at 9-11 months, he participated in 12. In both age ranges, he was able to produce strings that were 2, 3, and even sometimes 4 turns in length. (For a string to have a length of 4, the infant would have had to successfully respond to 4 consecutive overtures.) At 12-15 months, he participated in fewer strings altogether (only 4 during this age range), and these strings tended to be shorter. In other words, at this age, he could sometimes (but not often) participate in an interactive sequences that were more than one turn long, but even then, after two successful overture-response pairs, he did not respond again.

Pre-overture Behaviors and their Relation to Responses over time

In addition to the decline in his responsiveness to social overtures and the decline in his participation in interactive strings, the infant with ASD showed a change in the relation between his behavior before an overture and his responsiveness to the overture. From 6 to 8 months, when the parent had timed an overture to when the infant with ASD had been looking at the parent, this infant was very likely to respond; when the parent had timed the overture to when this infant had been engaged in a different activity, he was not likely to respond ($\chi^2_{(1, N = 24)} = 7.407$; $p < .01$). At 9-11 months, he showed precisely the same pattern ($\chi^2_{(1, N = 28)} = 6.152$; $p < .05$). However, at 12-15 months, this relationship changed. It made no difference whether the parent timed the overture to when he had been attending to the parent or had been engaged in a different activity ($\chi^2_{(1, N = 22)} = 0.282$; *n.s.)*. In both contexts, he responded to only about a quarter to a third of the overtures he received. (See Appendix K and Figures 6a and 6b). Again we see a change in the social patterns that he had established in the earlier age ranges.

Responsiveness to different kinds of overtures at 12-15 months

Because there seems to be a pattern of change at 12 months, this section will delve into this infant's responsiveness to the different overture functions during the 12 to 15 month age range. The infant with ASD responded at least half of the time to four kinds of parent actions: instrumental actions (6 responses to 6 instrumental actions), helping overtures (4 responses to 5 helping overtures), greeting overtures (6 responses to 11 greeting overtures), and overtures that included his name (6 responses out of 12 overtures). (See Table 13). As mentioned previously, his ability to respond to all instrumental overtures indicated that he was able to coordinate his actions with others in non-social settings. That is, he was able to accomplish joint activities with his parents, such as when they moved him or they fed him. His responsiveness to over half of the helping and greeting overtures indicates that he was also able to coordinate his behaviors in some social settings. Interestingly, these two kinds of overtures shared one unique quality: Both helping and greeting overtures were ones that had been initiated by infants. With helping overtures, the infant had requested help with something; with greeting overtures, the infant had looked over to the parent, which initiated the parent's "hello." Perhaps those instances when he had initiated contact marked occasions when the infant with ASD was already tuned in to or focused on social interaction with his parents. This, in turn, could have made it more likely that he would respond to his parent's overture. In addition, including his name as part of any of these overtures enhanced the predictability of his responsiveness. In contrast, he responded to half (or less than half) of the remaining overtures; he did not respond at all to attention-seeking overtures in this age range. It is worth noting that. with attention-seeking overtures, the infant was by definition not initiating contact (the overture was serving the function of getting his attention). Thus, at this age range, this infant had been “otherwise engaged” prior to each attention-seeking overture, and he responded to none of them. This pattern of responsiveness has some implications for assessment and intervention, which will be discussed in Chapter Six.

Contexts of success

Any context in which the infant with ASD was even slightly more likely to respond suggests a promising opportunity for positive intervention. The results of the above analyses suggest four situations for successful interaction with the infant with ASD. First, in these data, any time the infant with ASD had initiated contact (as with helping and greeting overtures), he was more likely to respond. This finding suggests that these occasions could provide an opportunity for the parents to make more overtures and that perhaps if he received extra overtures at times when he had initiated contact, his responsiveness might increase. Second, because he was always successful at coordinating his behaviors in non-social settings, parents could take these as opportunities to create some social interaction. Third, including his name as part of the overture seemed to increase the likelihood that he would respond. Fourth, given the results of the string analysis, it might be prudent for a parent not to make too many additional overtures after the infant had responded to one or two of them successfully. Thus rather than ending a few successful overture-response pairs with one unsuccessful one, a parent could finish, or punctuate, a short interaction with his success.

CHAPTER SIX: DISCUSSION

This dissertation had two main objectives. The first purpose was to develop an analytic method for using home video to investigate infant social responsiveness. The method had to preserve the temporal and interpersonal relationship between parental and infant behaviors in a dyadic unit of analysis. The analysis developed here began with the location of all parental social actions towards infants (i.e., overtures). Once the analysts had located these overtures, they used the form and immediate social context of each overture to identify its functions. The identification of overture functions provided criteria by which analysts could then evaluate infant behaviors (i.e., whether there was a response or not). In Study I, the analysts identified overture functions on an ad hoc, overture-by-overture basis; that is, there was no pre-determined list of functions. In Study II, there were pre-determined functions: the rules set out eight different social functions (and a non-social one), which the analysts used to reliably identify the functions of all 811 parental overtures. These overtures served the following functions: The parents could use them (1) to seek an infant's attention, (2) to direct the infant to do something, (3) to help an infant who had requested help, (4) to greet an infant, (5) to play with the infant, (6) to pretend to have a "conversation" with the infant, (7) to reward an infant for good behavior, or (8) to narrate to the infant what the infant was doing or what was happening in the infant's immediate environment. (9) Other parental actions had an instrumental rather than a social function; e.g., sometimes the parents moved the infants or gave them objects or food without talking to them. In both studies, regardless of how specifically the analysts characterized each overture's function, the parent and infant behaviors formed pairs of meaningfully related acts, called projective pairs. That is, a parental social action projected what the infant should do in response. For example, if the function of an overture was to seek an infant's attention, the projected infant response was for the infant to look towards the parent. The measure of infant responsiveness was therefore whether the infant's behavior matched what the overture had projected. The more often an infant's behaviors matched the parental overtures, the higher the proportion of social responsiveness by that infant. This method of relating parental overtures to infant responses provided a systematic, comprehensive exploration of the breadth of infant social responsiveness in a variety of settings and situations. The high inter-analyst agreement indicated that all stages of analysis were reliable, and the results were quantifiable and amenable to statistical testing.

The second objective of this dissertation was to apply the above method to the analysis of interactions between an infant with ASD and his parents. Specifically, the purpose was to compare this infant's social responsiveness to the responsiveness of his two typically-developing siblings. The results of both studies indicated that the social deficit associated with ASD was both apparent and quantifiable before this infant was 15 months old. There were four main findings. (1) The results of Study I revealed that the infant with ASD was significantly less socially responsive than his siblings, and Study II replicated this finding. (2) Study II also refined these results, showing that this infant's *profile* of responsiveness (i.e., to the nine different functions of parental actions) differed in some respects from the profiles of his siblings. He was as responsive as they were to parental instrumental actions and to three kinds of social overtures (helping, attention-seeking, and directing). He was less responsive than they were to social overtures that were more ambiguous in nature (such as to playful, conversational, or narrative overtures). (3) Successful interactions for the infant with ASD (i.e., ones in which he responded) tended to be when he had initiated the social contact with the agent of the overture. For example, if he had been looking towards his parent when that parent made an overture, he was far more likely to respond. This infant also appeared to be more responsive to overtures that included his name. (4) The responsiveness of the infant with ASD changed over time. Whereas at 6-11 months he responded to a relatively high proportion of overtures, at 12-15 months, he responded to approximately a third of them.

Revisiting the Theoretical Framework

At the beginning of this dissertation, I presented a set of four contrasting methodological choices as a way of introducing the underlying theoretical framework. Here I will return to those choices in order to show the influence of each of these theoretical choices on the method. One example from the home video data will provide a concrete illustration of the direct influence of my theoretical preferences on my method. The 15 second example is an excerpt from when the infants were almost 7 months old. The mother filmed the infant girl in her crib in the morning, just after the infant woke up. The mother whispered six short overtures, and the infant responded to five of them. Just before the mother made the first overture, the infant was lying on her side in the crib, looking up at her mother. The analysts' decisions for overture functions and infant responses are in square brackets.

Mother 1: "Good morning" [greeting overture]

Infant 1: *Continues to look at her mother; she smiles a bit, moves her legs, and vocalizes* [response: adds new behaviors while maintaining gaze]

Mother 2: “Yeah, good morning” [rewarding overture]

Infant 2: *Continues to look at her mother but doesn’t move, other than to very gradually stop smiling* [no response: no change in behavior]

Mother 3: “Let’s say hi to your brother, he’s waking up too” [narrative overture]

Infant 3: *Continues to look at her mother and kicks leg once at the beginning of the overture and then again at the end of it; starts to smile again* [response: adds new behaviors while maintaining gaze]

Mother 4: “Yeah” [narrative overture]

Infant 4: *Continues to look at her mother while smiling, then wiggles her whole body and grabs her sheepskin mattress cover* [response: adds new behaviors while maintaining gaze]

Mother 5: “Yeah” [narrative overture]

Infant 5: *Looks away from her mother and moves whole body as she tries to roll over; while trying to roll over, she looks back up towards her mother again* [response: looks away, looks back]

Mother 6: “Yeah” [narrative overture]

Infant 6: *Continues to look at her mother in her original position (did not succeed in rolling over); kicks her leg and vocalizes* [response: adds new behaviors while maintaining gaze]

A Social Perspective

The first theoretical choice was to decide which perspective the method should use to guide the analysts' interpretations of observable behaviors. I took a social perspective rather than one that would focus the analysts on inferring the infants' internal processes. Thus the method was designed to discover how behaviors fit into their immediate social context rather than how those behaviors indicated what the infant might be perceiving, thinking, or feeling. In the above example, I interpreted the infant's two smiles as social displays that the infant directed towards her mother with her gaze; I did not infer from the smiles that the infant was expressing or experiencing happiness at her mother's greeting. Seeking social explanations did not necessitate the denial of internal processes: Obviously infants have perceptions, thoughts, and feelings. But rather than using their behaviors as a means to infer the infants' internal processes, I looked at how those behaviors functioned in the infants' immediate social context. Therefore, in this example, the focus would be on the precise timing of the infant's smiles, especially in relation to the infant's mother's overtures. Her smiles, along with her gaze, were social responses to two of her mother's overtures.

A more far-reaching assertion in the introduction was that the social meaning of infants' actions was of sufficient interest for this dissertation. That is, the value of the analysis of behaviors did not depend on any "deeper" extrapolation to the infants' perceptual, cognitive, or emotional systems. The complex, systematic pattern of results supported the assertion that a social exploration of observable behaviors was fruitful in and of itself. Moreover, these results might be of interest to researchers who focus on infants' mental or neurological processes. Why did the infant with ASD lose some of his social abilities at 12 months? This infant's social environment did not provide sufficient explanation for his decreasing social abilities. The analysis showed that the social demands did not change for this infant at 12 months, and it showed that the parents continued to make similar kinds of social overtures to all three infants. Therefore, we can ask whether the change in his social responsiveness may be related to changes in brain function or perception at around 12 months. Although the answer to this question would require a different focus and a different method than the one used here, the present results have generated a much more specific question to ask.

Selected Behaviors

The second choice was whether I would analyze all behaviors or only selected behaviors. For this dissertation, I decided to narrow the focus to a carefully defined selection of parental and infant behaviors. There were practical advantages to selecting behaviors. For example, in Study II, analyzing everything would have required frame-by-frame analysis of all visible and audible adult and infant behaviors for 6 hours of videotape. Such an undertaking would not only be tremendously time-consuming, it would produce a deluge of data that would undoubtedly obscure any underlying systematicity. Furthermore, because infant responsiveness was the focus of interest, there was little sense in doing frame-by-frame analysis during those periods when the infants were not potentially interacting with anyone. My selection strategy decreased the amount of analyzable data considerably and focused the analysis precisely on moments of potential interaction. The analysis method started with the adult behaviors and focused on only those times when a parent directed an unambiguously social action towards one visible infant. Many adult actions did not fit this behavioral criterion and therefore dropped out of the data set. Then the analysis focused on only those infant behaviors occurring during the few seconds that straddled the overtures. Because there were only 811 overtures, this strategy alone reduced the duration of the data in Study II to about 40 minutes.

Beyond these practical considerations, an articulated plan for selecting behaviors reduced the data conceptually. It contributed a necessary set of criteria for deciding which aspects of infant behaviors would justify careful examination and evaluation. Even in the seconds immediately after an overture, it was not necessary to analyze or precisely describe the infant's exact movements or vocalizations; instead, the analysis could focus on those elements that would be relevant in the projective pair. The above excerpt provides an example. After overtures 1, 2, 3, 4 and 6, the infant maintained her gaze towards her mother. According to the rules of analysis, if the infant maintained agent-directed gaze, then she would have to add new behaviors to indicate a social response; that is, maintaining gaze alone was not sufficient to count as a response. After overtures 1, 3, 4 and 6, this infant did add new behaviors; therefore, she responded to these overtures. The analysis did not require that the analysts note precisely how the infant moved her arms, legs, head and torso (e.g., the direction of movement or rotation of each). Such an analysis would be needlessly time consuming, and it was not necessary. Instead, the analyst asked: Did the infant's behavior change? If so, was the change predictable, given the function of the overture? These behavioral criteria for infant responses thus focused the analysts' attention on the broadest aspects of the infant's behavior. It was neither necessary nor desirable to analyze all of the infant's behaviors, even when analysis was limited to just those seconds during and after an overture.

A Dyadic Unit of Analysis

The third choice was to decide between a monadic or a dyadic unit of analysis. I chose to use a dyadic unit of analysis, which meant that each of my dependent measures reflected the temporal and functional relationship between pairs of parental and infant behaviors. In the above example, a monadic analysis would have focused on the infant's behaviors without reference to the actions of her mother: The infant looked towards her mother for most of the 15 seconds. She smiled, she moved her legs and vocalized, she smiled again, she wiggled and grabbed her sheepskin rug; she tried unsuccessfully to roll over, then she kicked her legs and vocalized again. From a monadic perspective, these wiggles and smiles could easily be random, uncontrolled movements devoid of any social meaning. Alternatively, using a dyadic unit of analysis reveals the timing of these infant behaviors in relation to the mother's actions. The wiggles, smiles, and vocalizations were closely timed with the mother's overtures. They were also necessary for a social exchange, because unbroken gaze alone would not have indicated to her mother that the infant was actively involved in the social interaction. The dyadic unit of analysis preserved social meaning and import of the infant's behaviors. This microanalysis revealed a systematic relationship between parent and infant behaviors; it also revealed that an infant with ASD did not participate in these social exchanges as often as his siblings did. Because this infant did look at his parents often and did smile often, it is likely that any method that ignored the temporal and functional relationship between his behaviors and his parent's overtures would render his emerging social deficit invisible.

A Functional Approach

The fourth choice was whether to categorize behaviors by their form or by their function. As with the previous methodological choices, this one proved to be essential to the results obtained here. For example, analysing the overtures by function required that the analysts examine each overture's immediate context in order to decide how that overture was functioning at that particular moment in the interaction. It was only by careful discriminations among overture functions that I found that the infant with ASD was very good at responding to some of them and not very good at responding to others. Furthermore, many overtures with a similar form were actually serving different functions. For example, many overtures included an infant's name. But we found that these overtures were often serving different social functions. Using overture functions, analysts evaluated infant behaviors after the "name" overtures and found that the infant with ASD responded no differently than his siblings to these overtures. In other words, when I selected only those overtures that included infants' names (regardless of function), there was no differences in responsiveness between the infant with ASD and his siblings. In fact, his responsiveness to these overtures, even at 12-15 months, was still the same as his siblings'. Although the overtures' similarity in form became a useful focus for that particular analysis, the overtures' diverse set of functions obtained the results necessary to reveal the results.

Collaborative Theory and Microanalysis

In the introduction, I asserted that these four assumptions are compatible with a broader, contemporary theory of communication, namely, Collaborative Theory (H. Clark, 1996). According to this theory, the meaning of the participants' behaviors in an interaction depends on the timing and meaning of *each other's* actions. No behaviors have intrinsic meaning in the abstract. I also borrowed the concept of projective pairs from the collaborative theory of communication (H. Clark & Krych, 2004). In a projective pair, one person's utterance or action projects the actions of the subsequent person's utterance. Applied to these data, parental overtures projected particular responses from the infants.

Furthermore, I stated that the method of microanalysis, defined as the moment-by-moment analysis of sequences of behaviors in communication, was most suited to undertaking this project. Without the frame-by-frame ability to focus that microanalysis affords, I would not have been able to observe and analyze those sequential moments of interaction that were often invisible in real time.

Parent-Infant Interaction: Congruence with Previous Studies

Even to the casual observer, a parent and infant interacting together look like they are engaged in a conversation. They take turns, they watch each other and smile, and even their tiniest movements seem full of nuanced interpersonal meaning. Indeed, some researchers have characterized these pre-verbal interactions as dialogues or conversations (Bateson, 1975; E. V. Clark, 2003; e.g., Jaffe et al., 2001; Jaffe et al., 1973; Newson & Newson, 1975), and qualitative descriptions of videotaped interactions highlight the richness and complexity of these exchanges (e.g., Brazelton et al., 1974; Bruner, 1983; Danon-Boileau, 2007; St Clair et al., 2007; Stern, 1974).

However, as pointed out in Chapter Two, quantifying the subtleties of these interpersonal exchanges has proved to be elusive to microanalytic researchers. For example, many researchers reduced their scope to how mothers and infants coordinate a single form of behavior, such as their gaze (e.g., Stern, 1974) or their vocalizations (e.g., Jaffe et al., 2001; Stern & Gibbon, 1979; Stern et al., 1975). Although these studies demonstrated mother-infant coordination of these specific behaviors, they could not reveal the functional combinations of numerous behaviors that mothers and infants use in interaction (e.g., gaze, vocal tone, facial display, bodily movements). Some microanalytic investigations focused on the frame-by-frame progression of a wider range of behaviors, but these investigations produced voluminous data, which the researchers reduced to higher-order constructs, such as synchronous change (e.g., Condon & Sander, 1974a, 1974b; Feldman & Eidleman, 2004) or sequential coordination of movements (Beebe & Gerstman, 1984; Brazelton et al., 1974; Cohn & Tronick, 1987; Jaffe et al., 2001; Stern & Gibbon, 1979; Stern et al., 1975; Stern, 1974).

This dissertation is indebted to these previous studies in several respects. First, the characterization of mother-infant interaction as a dialogue provided a methodological and conceptual target, and the qualitative accounts of these interactions provided concrete, descriptive inspiration. My goal was to develop a quantitative analysis that preserved the essential qualities of these characterizations and descriptions. The analysts' initial decisions were qualitative, taking context, form, and meaning into account. For example, deciding on the function of an overture required that the analyst consider the form of the overture (e.g., the parent's words, actions, and tone of voice), the immediately previous context (which included the previous overtures and the infant's current activities), and the ongoing, overall context (e.g., was the infant being naughty or did the interaction have a playful quality?). In this way, the analysis preserved much of the complexity of the data. Second, the previous studies that focused on only one type of behavior (such as when a mother and an infant look at each other) still provided an important finding, namely, that these behaviors can be temporally coordinated. Third, previous studies demonstrated a significant caveat. Concentrating analysis on form alone was either limiting (if the researchers chose only a single type of behavior) or overwhelming (if they chose all or even just several). Thus the development of the present method built on an expectation of parent-infant coordination and reciprocity, but it focused, not on form, but on a functional analysis that preserved the social, interpersonal meaning of those behaviors.

The conversation-like structure of early mother-infant exchanges is more than a mere curiosity. These sequences of interaction can provide the framework, structure, and practice that scaffold later language learning (e.g., Bateson, 1975; Bruner, 1983, 1985; E. V. Clark, 2003; Jaffe et al., 1973; Schaffer, 1977; Sugarman, 1984). In the home videos analyzed here, the infant with ASD was less able to participate in these early prototypes of conversation. This deficit was apparent both in simpler, two-part exchanges (i.e., projective pairs) and in extended sequences of interactions (i.e., strings of projective pairs). Without this language scaffold in place, his ability to acquire language may have been compromised. In addition, at all ages analyzed, he was less adept at responding to narrative overtures, which often functioned to label verbally what the infant was doing at that moment (e.g., “you’re jumping,” or “you found a new hiding place for the clothing?”). Narrative overtures were the most frequent ones in these data, constituting over a quarter of all overtures, and they may have provided an interactive focus for learning vocabulary and syntax. Infants who display social engagement by responding to these overtures might be more likely to acquire the bits and pieces of language that narrative overtures offer. Indeed, infant social engagement can make a significant difference for very early, phonetic development of language (Kuhl et al., 2003). Therefore, besides losing out on the general opportunity that social interactions afforded as the foundation for later language development, this infant may have not benefited from the more specific opportunity of engaging in narrative overtures. These findings suggest that the social deficit of ASD might precede and exacerbate the language deficits.

Early identification of ASD

An important focus of research about ASD is the attempt to discover how its various characteristics manifest in infancy. Knowing which behaviors predict later diagnosis can lead to developing methods for earlier screening and assessment. Home videos of infants later diagnosed with ASD provide a retrospective window into the infancy of these children; they provide researchers with an invaluable record of these infants' behaviors. In Chapter Two of this dissertation, I reviewed the retrospective video studies that used home videos to discover early social behaviors associated with ASD in infancy. I had argued that social behaviors should be studied in reference to their social context, which would include, at minimum, the infant and one other person. Such an analysis would require a dyadic unit of analysis that would encompass the behaviors of both participants, and several of the retrospective video studies included quantitative measures that were dyadic (Baranek, 1999; Colgan et al., 2006; Mars et al., 1998; Osterling & Dawson, 1994; Osterling et al., 2002; Trevarthen & Daniel, 2005; Werner & Dawson, 2005; Werner et al., 2000). Unfortunately, only one of the dependent measures from these studies was sufficiently similar to one of my measures to warrant a detailed discussion here. In the next section, I compare the results for this measure, "response to name," which is the proportion of times an infant responded to his or her name being called.

Response to Name

Six studies analyzed the extent to which infants responded to their name, comparing infants with ASD to typically developing infants (Baranek, 1999; Mars et al., 1998; Osterling & Dawson, 1994; Osterling et al., 2002; Werner & Dawson, 2005; Werner et al., 2000). (See Table 1.) Recall (from Chapter Five) that the findings of these studies were surprisingly contradictory with each other: Half found that infants with ASD were not as responsive as typically developing infants (Osterling & Dawson, 1994; Osterling et al., 2002; Werner et al., 2000), and half found that they were equally responsive (Baranek, 1999; Mars et al., 1998; Werner & Dawson, 2005). In the present study, the infant with ASD was as responsive as his typically developing siblings when parental overtures included his name.

It is worth speculating about why the results for this variable are so contradictory. Differences in responsiveness could not have been due to differences in infants' ages. If it were, one might expect the earlier age ranges to show that the infants with ASD were equally responsive and the later age ranges to show that they were significantly less responsive. But, as shown in Table 1, the pattern of results in the seven studies (including this dissertation) does not match this logic. Nor could the contradictory results be entirely attributed to different social contexts; for example, perhaps the infants with ASD were less responsive to their name in less familiar social contexts. Three of the previous studies used data from first birthday parties, which is a less familiar context for infants (Osterling & Dawson, 1994; Osterling et al., 2002; Werner & Dawson, 2005), and three used data from more general contexts (Baranek, 1999; Mars et al., 1998; Werner et al., 2000), as did mine. There seemed to be a trend: In two out of the three studies from first birthday parties, the infants with ASD were less responsive. In three out of the four studies from other, more varied contexts, there was no significant difference between the responsiveness of infants with ASD and the typically developing infants. But this relationship is only suggestive, and it did not completely account for the contradictory findings.

One alternative explanation has more to do with the analysis procedures than the participants or their context. It is possible that the researchers' operational definitions for "response to name" were sufficiently different from each other that the methods would not replicate. Unfortunately, the authors of these papers did not provide operational definitions in their articles. A transparent relationship between the procedures used to elicit results and the results themselves is of more than academic importance; it is clinically relevant. Presumably those who design tools to assess ASD in infancy depend on the results of research projects for the development of their tests (e.g., Bryson, Zwaigenbaum, McDermott, Rombough, & Brian, 2008). If the operational definitions are not available, then they cannot assist clinicians in their assessments.

Implications and Further Directions

Research

Although investigating social responsiveness is of interest for understanding infant social development in particular, as mentioned in Chapter Two, researchers have implicated infant social responsiveness as the origin for other areas of development (e.g., emotional, cognitive, and language). Similarly, although one of the fundamental deficits associated with ASD is a disturbance in the ability to interact socially, ASD is also characterized by deficits in communicative behaviors and delayed language development (American Psychiatric Association, 2000; World Health Organization, 1993). Thus research focused on understanding the earliest social characteristics of this disorder might also be addressing the origin of some of these other deficits. That is, an understanding of the social expression of ASD in infancy might contribute a great deal to our understanding of this disorder more generally.

This dissertation focused on developing a method for analyzing infant social responsiveness. The implementation of the method was able to reveal not only that an infant with ASD was less responsive in general, but also that he became significantly less responsive over time, specifically after one year of age. However, the data were from only one family, and that family was atypical because the infant with ASD was one of a set of triplets. Clearly, based on this research alone, it is not possible to make strong assertions about the appearance and development of the social characteristics associated with ASD in infancy. However, the two studies in this dissertation could be the first steps in a longer program of research aimed at a more comprehensive understanding of these social characteristics. Now that I have developed a viable method, it is possible to focus further research on its replication and application to various settings.

The next step would be to replicate with home videos from other families. If the objective were to maintain the advantage that triplets afforded (i.e., providing more homogeneous data), families with twins or triplets in which one infant was later diagnosed with ASD would be the ideal participants. However, assuming that twins or triplets are completely analogous to singleton infants may be problematic. For example, one quarter of all overtures in the data here included infant names, which may have been a particularly high number due to the fact that the parents were addressing one infant out of three possible infants. If a family had only one infant, would they include the infant’s name in the overtures as often as the family did here? Would a single infant be more responsive to all overtures simply because it would be clear that he or she was the only possible recipient of the parental overtures? Although twin or triplet data have some advantages, restricting the research program to these families might interfere with generalizability.

Aside from sampling issues, the method developed here would not necessarily require changes before being used with new data. If replication were the purpose of those investigations, it would be best to keep the definitions and procedures as they are. But the method could also be the foundation for other analyses. The fundamental structure of the analysis (i.e., locating projective pairs) is a template amenable for other investigations. Therefore, after replication, the next step in a program of research might be to adapt the method to address other research questions. For example, one could look at responsiveness of infants to other adults, to siblings, or to other infants. Alternatively, once the present method located and analyzed projective pairs, it would be possible to identify some of the contextual influences on responsiveness. The results from Study II suggest some possibilities. The pre-overture analysis revealed that the infant with ASD was more responsive when he was already looking at the parent, which was one way that an infant could initiate social contact. However, initiating social contact might not be limited to looking at the parent. It would be worth investigating other possible behaviors that infants might use to initiate social contact, such as walking towards the parent or orienting themselves towards the parent. Other contextual influences on responsiveness might also be of interest, such as the time of day, the activities the infant is doing, the number of infants or other children in the room, or the proximity of the infant to the parent. Any number of situational factors that might affect the projective pairs could provide possibilities for additional investigations.

Another direction for further research would be to include the nonverbal aspects of overtures and study their relationship to infant responsiveness, which was impossible with these data. Recall that the parents were typically off-screen, so their facial displays and gestures were not visible to the analysts, although they would have been visible to the infant. In addition, the parent making the overture was often simultaneously filming the infants, so there was presumably a camera obscuring part of the parent's face. A fuller understanding of infant responsiveness would be gained by deliberately gathering data in which a visible parent was making the overtures (e.g., instructing a different adult to do the filming). Thus, spontaneous and more structured home videos could balance each other's advantages and disadvantages. The former has the distinct advantage of being unbiased, both because parents probably start filming the home videos before they suspect any difference in their infant and because the videos represent relatively natural, unstructured interactions. It has the further advantage that it is obvious when the infant makes eye contact with the parent who is filming. Because much of the analysis here is based around the timing of infant gaze, this is a crucial benefit to home videos. The latter, more task-oriented filming procedure, could only occur after diagnosis, but it would provide enough control and structure to ensure that the parents were visible. However, ascertaining precisely when the infant has made eye contact with the on-screen parent (i.e., who is not filming) is very difficult. Each method would yield a rich source of data, but the choice depends on the questions that the researcher wants to ask. One interesting possibility would be to conduct a study using both sources of data; that is, participating families could contribute both their home videos and also participate in semi-structured videos. Then researchers could begin to explore the actual differences between methods rather than simply hypothesizing about them.

Implications for Assessment and Diagnosis

The results of this research project have implications for assessment techniques. First, the ability to do frame-by-frame analysis of the videos revealed subtle processes that occurred too quickly to see in real time. I have had the fortunate opportunity to share this research with various groups of clinicians, and we have found the frame-by-frame examination of home videos to be quite enlightening and inspiring. Our discussions have suggested that current assessment techniques would be greatly enhanced if clinicians could videotape their assessment interactions and use the videotape as part of their scoring protocol. The video would not serve as a replacement for the real-time, first-person experience the clinician has while interacting with the infant. The clinician would still rely on his or her intuitions and experience. However, during assessment, the clinician could focus on the interaction itself and not so much on recording and evaluating it in real time. Later, the videotape would provide a valuable, additional resource for closer, frame-by-frame examination and evaluation. In the test that Bryson et al. (2008) are developing for identifying ASD in infants (AOSI), they routinely videotape the clinical assessments to assist them with their rating of the infant’s behaviors during the activities in the interactions.

Second, home videos can supplement clinical evaluations by providing an additional source of data for assessment. Although a detailed clinical protocol affords a controlled clinician-infant interaction and well designed presses to elicit behaviors of interest, it does not provide the clinician with information about how the infant is behaving at home, in a familiar, uncontrolled setting. A detailed analysis of a family's home videos can provide a piece of the picture that clinicians can integrate with their more structured evaluations.

Third, whether applied to videotaped clinical assessments or home videos, the projective pairs framework proposes the specific interactive moments on which a clinician might focus in order to analyze infant social behaviors. Rather than attempting to analyze all of the infant's behaviors, the clinician could select only those seconds immediately following social overtures, thus conducting a detailed exploration of the functional relationship between the social overtures and the infant's behaviors. Using projective pairs could be a valuable framework for evaluating the infant's social behaviors.

Implications for Intervention

Whereas research that aims to enhance assessments would focus on identifying the social deficits associated with ASD in infancy, research that aims to enhance interventions would focus on identifying the intact strengths and social skills that an infant is using. Deficits tend to be identified in order to categorize infants diagnostically; for example, research focused on improving assessment would need to find deficits that are common to infants with ASD for the assessment to be useful for diagnosing the disorder. Strengths, on the other hand, might be best identified on a case-by-case basis, especially if their identification is to be useful for subsequent intervention.

Therefore, I will focus the discussion here on the one case that I analyzed. I will suppose that the infants are 15 months old, that the analysis I conducted was part of a clinical assessment of the triplets, and that my task is to provide information and recommendations to this family. I will write as though I am addressing the parents directly. My recommendations presuppose that I have already told the parents what social overtures are and how we did the analysis. Here is my hypothetical written report:

> First, the analysis of your overtures to the three infants indicated that you were directing your social actions towards all three infants in exactly the same way. That is, it wasn't the case that you directed fewer or more overtures to [name], whom our clinical team has diagnosed with ASD. Furthermore, you offered all three infants a wide variety of social opportunities, and all three infants received similar proportions of the different functions of overtures (e.g., playful, attention-seeking). I am providing this initial feedback in order to reassure you that there was nothing on the home videos that would suggest that there is any way in which your social actions towards [name] were different from those that you directed towards the other two infants.
>
> Second, I would like to remind you that although [name] is less responsive than his siblings are, he was not completely unresponsive: From one year of age until your most recent home videos (at 15 months), he responded to approximately 1/3 of the overtures. It is important for you to keep this in mind so that you avoid interpreting [name's] difference in responsiveness as a global indication that he is not responsive at all. I point this out to reinforce that his social behavioral deficit is not absolute and complete; it is a matter of degree. He can be responsive, and he often is.
>
> Third, I will be showing you some videos of those times when you and [name] were interacting successfully (i.e., when he was responding to you socially). While you watch, I will direct your attention to the quality of his responses, and I would like you to note, in particular, that [name's] behavioral responses are enthusiastic and warm. You'll see in your home videos that he often smiled in response to you and he often made eye contact with you. When he responded, he appeared to be happy and

involved in his interactions with you. I hope that you will be inspired by his wholehearted responses and work towards seeing if you can help them to happen with more frequency in the future. In order to give you some concrete suggestions to increase his responsiveness, I will identify some specific characteristics associated with when he was most responsive. I hope that by recognizing these contexts, you will be able to consciously construct them more often at home.

I would recommend the following: (A) [Name] was more responsive to your social overtures when he was already looking at you. You might consider how you can capitalize on those moments in the future. In other words, any time he looks towards you might be an opportunity for social interaction. You might also benefit from deliberately creating this context by positioning yourselves directly in [name's] line of vision when you would like to interact with him. This might require that you move towards him and get down on your hands and knees to get your face exactly where he is looking. Although this might feel strange at first, it might increase the probability that he will respond to you. (B) [Name] was very responsive when you responded to his requests for assistance. These situations might provide additional social opportunities. Whenever you help him with something, you could direct one or two extra social overtures to him, again preferably in his line of vision. (C) When you used his name while interacting with him, he was more likely to respond. Therefore, I would encourage you to say his name often when you are interacting with him. Also, narrative overtures (the one where you tell him what he is doing, like saying "you're jumping" when he is jumping) are ones that might be important for helping him to learn language. Unfortunately, these overtures are ones that he tended not to respond to. Therefore, you might consider including his name whenever you make a playful comment to him about what he is doing.

I would guess that there are other things that you have noticed yourselves that he seems to respond to (e.g., perhaps you've noticed that

> he is more responsive when you vary your tone of voice more). Go with the same principle underlying my recommendations. If it seems to work, do it more often! Finally, the results of one of our analyses suggests that, at present, [name] might not participate in long sequences of interaction. I would therefore encourage you to focus your social interactions with him to only a few overtures at a time. Once he has responded to one or two, it might be best to stop for a moment and wait for another opportunity later. That way you are ending with a successful interaction.

In short, the research in this dissertation could lead to innovations in intervention. It provides a foundation for developing a method that clinicians could use to make recommendations that are tailored to each infant's strengths and that are congruent with what the parents are already doing. These recommendations might increase the frequency with which parents interact successfully with their infant and might act as a scaffold for the infant to learn new social behaviors. This approach is congruent with the Marte Meo program (www.martemeo.com), but I found no published, peer-reviewed scientific evidence supporting this method specifically. It may be that the research approach developed here will be helpful for providing such evidence.

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Table 1

Results from quantitative social dyadic papers.

	Paper and (infants' age in months)							
Dependent variable	Werner et al., (2000) (8-10)	Baranek (1999) (9-12)	Colgan et al., (2006) (9-12)	Trevarthen & Daniel (2005) (11)	Osterling & Dawson (1994)[a] (12)[b]	Osterling et al., (2002) (12)[b]	Werner & Dawson (2005) (12)[b]	Mars et al., (1998) (12-30)
Response to name	ASD < TD	ASD = TD (response) ASD > TD (prompts needed)	-	-	ASD < TD	ASD < TD	ASD = TD	ASD = TD
Follows verbal directions	-	-	-	-	ASD = TD	-	-	ASD < TD
Participates in social games	-	-	-	-	-	ASD < TD	-	ASD = TD
Socially engaged	-	-	-	-	-	-	-	ASD < TD
Imitates verbalizations	-	-	-	-	-	-	-	ASD < TD
Gestures	-	-	ASD = TD (frequency) ASD < TD (variety)	-	-	-	-	-
Rhythmic	-	-	-	ASD < TD	-	-	-	-

synchrony								
Gaze aversion	-	ASD = TD	-	-	-	-	-	-
Social Touch aversion	-	ASD > TD	-	-	-	-	-	-

[a]No means reported for DV's in this paper

[b]Data from infants' first birthday party

Table 2

Study I: Infant response proportions (response frequencies over number of overtures)

	ASD infant	Non-ASD infant (female)	Non-ASD infant (male)
Number of responses to overtures	20	30	36
Total overtures received	45	42	51
Social responsiveness Proportion	0.44	0.71	0.71

Note. The proportions represent the number of responses divided by the number of opportunities for a response (i.e., *overtures*) to that infant.

Table 3

Study I: Chi-square statistics comparing infants' proportions of social responsiveness

		Hypotheses comparisons	
Age range	Main effect	ASD infant to two non-ASD siblings	Non-ASD female to Non-ASD male
All ages	$X^2_{(2, N=138)} = 9.09$*	$X^2_{(1, N=138)} = 9.09$**	$X^2_{(1, N=93)} = 0.01$
11-12 months	$X^2_{(2, N=112)} = 4.54$	$X^2_{(1, N=112)} = 4.52$*	$X^2_{(1, N=75)} = 0.02$
13-15 months	$X^2_{(2, N=26)} = 6.99$*	$X^2_{(1, N=26)} = 6.52$*	$X^2_{(1, N=18)} = 0.64$

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

Table 4.

Study II: Number of overtures directed towards each infant at each age range

	Male infant with ASD	Male infant without ASD	Female infant without ASD
6-8 months	81	77	103
9-11 months	99	55	83
12-15 months	87	95	131
TOTAL	267	227	317

Table 5.

Study II: Distribution of overture functions

		Separate age ranges		
	Whole age range	6-8 months	9-11 months	12-15 months
Attention-seeking	75 (.092)	40 (.153)	14 (.059)	21 (.067)
Directing	101 (.125)	18 (.069)	34 (.143)	49 (.157)
Helping	38 (.047)	7 (.027)	11 (.046)	20 (.064)
Greeting	140 (.173)	57 (.218)	37 (.156)	46 (.147)
Playful	60 (.074)	14 (.054)	19 (.080)	27 (.086)
Conversational	51 (.063)	17 (.065)	13 (.055)	21 (.067)
Rewarding	60 (.074)	14 (.054)	25 (.105)	21 (.067)
Narrative	223 (.275)	71 (.272)	64 (.270)	88 (.281)
Instrumental action	50 (.062)	18 (.069)	17 (.072)	15 (.048)
Not analyzable	13 (.016)	5 (.019)	3 (.013)	5 (.016)
Total	811	261	237	313

Table 6

Study II: Infant responses to all social overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[1]	105/188 (.56)	115/162 (.71)	142/215 (.66)	$\chi^2_{(2, N = 565)} = 9.249$; $p < .01$	$\chi^2_{(1, N = 565)} = 8.269$; $p < .01$	$\chi^2_{(1, N = 377)} = 0.808$; *n.s.*
6-8 months[2]	40/63 (.63)	41/57 (.72)	42/64 (.66)	$\chi^2_{(2, N = 184)} = 1.028$; *n.s.*	$\chi^2_{(1, N = 184)} = 0.487$; *n.s.*	$\chi^2_{(1, N = 121)} = 0.556$; *n.s.*
9-11 months[2]	45/67 (.67)	34/41 (.83)	38/52 (.73)	$\chi^2_{(2, N = 160)} = 3.216$; *n.s.*	$\chi^2_{(1, N = 160)} = 2.084$; *n.s.*	$\chi^2_{(1, N = 93)} = 1.272$; *n.s.*
12-15 months[1]	20/58 (.34)	39/63 (.62)	62/100 (.62)	$\chi^2_{(2, N = 221)} = 13.040$; $p < .001$	$\chi^2_{(1, N = 221)} = 13.040$; $p < .001$	$\chi^2_{(1, N = 163)} = 0.0001$; *n.s.*

[1]The infant with ASD is significantly less responsive than his siblings, and his non-ASD siblings are similarly responsive.
[2]There were no significant differences on these overtures.

Table 7a

Infant responses to Strong/Specific overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[2]	21/38 (.55)	27/47 (.57)	20/47 (.43)	$\chi^2_{(2, N = 132)} = 2.387$; *n.s.*	$\chi^2_{(1, N = 132)} = 0.300$; *n.s.*	$\chi^2_{(1, N = 94)} = 2.085$; *n.s.*
6-8 months[2]	8/11 (.73)	12/21 (.57)	7/15 (.47)	$\chi^2_{(2, N = 47)} = 1.765$; *n.s.*	$\chi^2_{(1, N = 47)} = 1.372$; *n.s.*	$\chi^2_{(1, N = 36)} = 0.385$; *n.s.*
9-11 months[3]	11/18 (.61)	8/9 (.89)	4/11 (.36)	$\chi^2_{(2, N = 38)} = 5.721$; $p < .05$	$\chi^2_{(1, N = 38)} = 0.005$; *n.s.*	$\chi^2_{(1, N = 20)} = 5.690$; $p < .01$
12-15 months[2]	2/9 (.22)	7/17 (.42)	9/21 (.43)	$\chi^2_{(2, N = 47)} = 1.229$; *n.s.*	$\chi^2_{(1, N = 47)} = 1.217$; *n.s.*	$\chi^2_{(1, N = 38)} = 0.011$; *n.s.*

[2]There were no significant differences on these overtures.
[3]The infant with ASD is as responsive as his siblings, and his siblings have significantly different response proportions.

Table 7b.

Infant responses to Attention-seeking overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[2]	11/21 (.52)	10/25 (.40)	9/19 (.47)	$\chi^2_{(2, N = 65)} = 0.720$; *n.s.*	$\chi^2_{(1, N = 65)} = 0.484$; *n.s.*	$\chi^2_{(1, N = 44)} = 0.239$; *n.s.*
6-8 months[2]	5/8 (.63)	9/17 (.53)	5/10 (.50)	$\chi^2_{(2, N = 35)} = 0.304$; *n.s.*	$\chi^2_{(1, N = 35)} = 0.282$; *n.s.*	$\chi^2_{(1, N = 27)} = 0.022$; *n.s.*
9-11 months[2]	6/9 (.67)	1/1 (1.00)	1/3 (.33)	$\chi^2_{(2, N = 13)} = 1.733$; *n.s.*	$\chi^2_{(1, N = 13)} = 0.325$; *n.s.*	$\chi^2_{(1, N = 4)} = 1.333$; *n.s.*
12-15 months[3]	0/4 (.00)	0/7 (.00)	3/6 (.50)	$\chi^2_{(2, N = 17)} = 6.679$; $p < .05$	$\chi^2_{(1, N = 17)} = 1.121$; *n.s.*	$\chi^2_{(1, N = 13)} = 4.550$; $p < .05$

[2]There were no significant differences on these overtures.
[3]The infant with ASD is as responsive as his siblings, and his siblings have significantly different response proportions.

Table 7c

Infant responses to Directing overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[3]	10/17 (.59)	17/22 (.77)	11/28 (.39)	$\chi^2_{(2, N = 67)} = 7.283$; $p < .05$	$\chi^2_{(1, N = 67)} = 0.041$; *n.s.*	$\chi^2_{(1, N = 50)} = 7.215$; $p < .01$
6-8 months[2]	3/3 (1.00)	3/4 (.75)	2/5 (.40)	$\chi^2_{(2, N = 12)} = 3.225$; *n.s.*	$\chi^2_{(1, N = 12)} = 2.000$; *n.s.*	$\chi^2_{(1, N = 9)} = 1.103$; *n.s.*
9-11 months[3]	5/9 (.56)	7/8 (.88)	3/8 (.38)	$\chi^2_{(2, N = 25)} = 4.282$; *n.s.*	$\chi^2_{(1, N = 25)} = 0.116$; *n.s.*	$\chi^2_{(1, N =16)} = 4.267$; $p < .05$
12-15 months[2]	2/5 (.40)	7/10 (.70)	6/15 (.40)	$\chi^2_{(2, N = 30)} = 2.400$; *n.s.*	$\chi^2_{(1, N = 30)} = 0.240$; *n.s.*	$\chi^2_{(1, N =25)} = 2.163$; *n.s.*

[2]There were no significant differences on these overtures.
[3]The infant with ASD is as responsive as his siblings, and his siblings have significantly different response proportions.

Table 8

Infant responses to Helping overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[2]	8/9 (.89)	7/7 (1.0)	11/11 (1.0)	$\chi^2_{(2, N = 27)} = 2.077$; *n.s.*	$\chi^2_{(1, N = 27)} = 2.077$; *n.s.*	*Cannot calculate*
6-8 months	No overtures	2/2 (1.0)	2/2 (1.0)	*Cannot calculate*	*Cannot calculate*	*Cannot calculate*
9-11 months	4/4 (1.00)	5/5 (1.00)	No overtures	*Cannot calculate*	*Cannot calculate*	*Cannot calculate*
12-15 months	4/5 (.80)	5/5 (1.00)	4/4 (1.00)	$\chi^2_{(2, N = 14)} = 1.938$; *n.s.*	$\chi^2_{(1, N = 14)} = 1.938$; *n.s.*	*Cannot calculate*

[2]There were no significant differences on these overtures.

Table 9a

Infant responses to Weak/Non-specific overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[1]	50/86 (.58)	54/67 (.81)	74/100 (.74)	$\chi^2_{(2,\ N\ =\ 253)} = 10.16$; $p < .005$	$\chi^2_{(1,\ N\ =\ 253)} = 9.323$; $p < .001$	$\chi^2_{(1,\ N\ =\ 167)} = 0.975$; *n.s.*
6-8 months[2]	20/32 (.63)	17/22 (.77)	20/29 (.69)	$\chi^2_{(2,\ N\ =\ 83)} = 1.324$; *n.s.*	$\chi^2_{(1,\ N\ =\ 83)} = 0.923$; *n.s.*	$\chi^2_{(1,\ N\ =\ 51)} = 0.433$; *n.s.*
9-11 months[2]	20/25 (.80)	18/21 (.86)	21/26 (.81)	$\chi^2_{(2,\ N\ =\ 72)} = 0.290$; *n.s.*	$\chi^2_{(1,\ N\ =\ 24)} = 0.098$; *n.s.*	$\chi^2_{(1,\ N\ =\ 16)} = 0.201$; *n.s.*
12-15 months[1]	10/29 (.34)	19/24 (.79)	33/45 (.73)	$\chi^2_{(2,\ N\ =\ 98)} = 14.911$; $p < .001$	$\chi^2_{(1,\ N\ =\ 98)} = 14.682$; $p < .001$	$\chi^2_{(1,\ N\ =\ 69)} = 0.287$; *n.s.*

[1]The infant with ASD is significantly less responsive than his siblings, and his non-ASD siblings are similarly responsive.
[2]There were no significant differences on these overtures.

Table 9b

Infant responses to Greeting overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[1]	26/40 (.65)	18/22 (.82)	34/43 (.79)	$\chi^2_{(2, N = 105)} = 2.974$; *n.s.*	$\chi^2_{(1, N = 105)} = 2.917$; $p < .05$	$\chi^2_{(1, N = 65)} = 0.069$; *n.s.*
6-8 months[1]	13/21 (.62)	10/12 (.83)	11/12 (.92)	$\chi^2_{(2, N = 45)} = 4.198$; *n.s.*	$\chi^2_{(1, N = 45)} = 3.973$; $p < .05$	$\chi^2_{(1, N = 24)} = 0.381$; *n.s.*
9-11 months[2]	7/8 (.88)	4/5 (.80)	8/11 (.73)	$\chi^2_{(2, N = 24)} = 0.616$; *n.s.*	$\chi^2_{(1, N = 24)} = 0.505$; *n.s.*	$\chi^2_{(1, N = 16)} = 0.097$; *n.s.*
12-15 months[2]	6/11 (.55)	15/20 (.75)	4/5 (.80)	$\chi^2_{(2, N = 36)} = 1.704$; *n.s.*	$\chi^2_{(1, N = 36)} = 1.657$; *n.s.*	$\chi^2_{(1, N = 25)} = 0.055$; *n.s.*

[1]The infant with ASD is significantly less responsive than his siblings, and his non-ASD siblings are similarly responsive.
[2]There were no significant differences on these overtures.

Table 9c

Infant responses to Playful overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[1]	7/17 (.41)	10/16 (.63)	12/16 (.75)	$\chi^2_{(2, N = 49)} = 4.012$; *n.s.*	$\chi^2_{(1, N = 49)} = 3.494$; $p < .05$	$\chi^2_{(1, N = 32)} = 0.582$; *n.s.*
6-8 months[2]	1/3 (.33)	0/1 (.00)	4/7 (.57)	$\chi^2_{(2, N = 11)} = 1.397$; *n.s.*	$\chi^2_{(1, N = 11)} = 0.244$; *n.s.*	$\chi^2_{(1, N = 8)} = 1.143$; *n.s.*
9-11 months[3]	5/5 (1.00)	2/3 (.67)	8/8 (1.00)	$\chi^2_{(2, N = 16)} = 4.622$; $p < .05$	$\chi^2_{(1, N = 16)} = 0.485$; *n.s.*	$\chi^2_{(1, N = 11)} = 2.933$; $p < .05$
12-15 months[1]	1/9 (.11)	8/12 (.67)	0/1 (.00)	$\chi^2_{(2, N = 22)} = 7.292$; $p < .05$	$\chi^2_{(1, N = 22)} = 5.594$; $p < .01$	$\chi^2_{(1, N = 13)} = 1.733$; *n.s.*

[1]The infant with ASD is significantly less responsive than his siblings, and his non-ASD siblings are similarly responsive.
[2]There were no significant differences on these overtures.
[3]The infant with ASD is as responsive as his siblings, and his siblings have significantly different response proportions.

Table 9d

Infant responses to Conversational overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[1]	2/8 (.25)	14/16 (.88)	14/19 (.74)	$\chi^2_{(2, N=43)} = 10.125$; $p < .01$	$\chi^2_{(1, N=43)} = 9.673$; $p < .01$	$\chi^2_{(1, N=35)} = 1.302$; *n.s.*
6-8 months[1]	0/2 (.00)	6/8 (.75)	3/5 (.60)	$\chi^2_{(2, N=15)} = 3.750$; *n.s.*	$\chi^2_{(1, N=15)} = 3.462$; $p < .05$	$\chi^2_{(1, N=13)} = 0.325$; *n.s.*
9-11 months[2]	0/2 (.00)	2/2 (1.00)	2/4 (.50)	$\chi^2_{(2, N=8)} = 4.000$; *n.s.*	$\chi^2_{(1, N=8)} = 2.67$; *n.s.*	$\chi^2_{(1, N=6)} = 1.500$; *n.s.*
12-15 months[1]	2/4 (.50)	6/6 (1.00)	9/10 (.90)	$\chi^2_{(2, N=20)} = 5.098$; $p < .05$	$\chi^2_{(1, N=20)} = 4.804$; $p < .05$	$\chi^2_{(1, N=16)} = 0.640$; *n.s.*

[1]The infant with ASD is significantly less responsive than his siblings, and his non-ASD siblings are similarly responsive.
[2]There were no significant differences on these overtures.

Table 9e

Infant responses to Rewarding overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[3]	15/21 (.71)	12/13 (.92)	14/22 (.63)	$\chi^2_{(2, N=56)} = 3.480$; *n.s.*	$\chi^2_{(1, N=56)} = 0.055$; *n.s.*	$\chi^2_{(1, N=35)} = 3.517$; $p < .05$
6-8 months[4]	6/6 (1.00)	1/1 (1.00)	2/5 (.40)	$\chi^2_{(2, N=12)} = 5.600$; $p < .05$	$\chi^2_{(1, N=12)} = 4.000$; $p < .05$	$\chi^2_{(1, N=6)} = 1.200$; *n.s.*
9-11 months[2]	8/10 (.80)	10/11 (.91)	3/3 (1.00)	$\chi^2_{(2, N=24)} = 1.060$; *n.s.*	$\chi^2_{(1, N=24)} = 0.882$; *n.s.*	$\chi^2_{(1, N=14)} = 0.294$; *n.s.*
12-15 months[1]	1/5 (.20)	1/1 (1.00)	9/14 (.64)	$\chi^2_{(2, N=20)} = 3.781$; *n.s.*	$\chi^2_{(1, N=20)} = 3.300$; $p < .05$	$\chi^2_{(1, N=15)} = 0.536$; *n.s.*

[1]The infant with ASD is significantly less responsive than his siblings, and his non-ASD siblings are similarly responsive.
[2]There were no significant differences on these overtures.
[3]The infant with ASD is as responsive as his siblings, and his siblings have significantly different response proportions.
[4]This significant difference is not in the predicted direction.

Table 10

Infant responses to Narrative overtures.

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[1]	26/55 (.47)	27/41 (.66)	37/57 (.65)	$\chi^2_{(2,\ N\ =\ 153)} = 4.739$; $p < .05$	$\chi^2_{(1,\ N\ =\ 153)} = 4.730$; $p < .05$	$\chi^2_{(1,\ N\ =\ 98)} = 0.009$; *n.s.*
6-8 months[2]	12/20 (.60)	11/13 (.85)	13/17 (.76)	$\chi^2_{(2,\ N\ =\ 50)} = 2.623$; *n.s.*	$\chi^2_{(1,\ N\ =\ 50)} = 2.381$; *n.s.*	$\chi^2_{(1,\ N\ =\ 30)} = 0.305$; *n.s.*
9-11 months[1]	10/20 (.50)	8/11 (.73)	8/10 (.80)	$\chi^2_{(2,\ N\ =\ 41)} = 3.148$; *n.s.*	$\chi^2_{(1,\ N\ =\ 41)} = 3.029$; $p < .05$	$\chi^2_{(1,\ N\ =\ 21)} = 0.153$; *n.s.*
12-15 months[1]	4/15 (.27)	8/17 (.47)	16/30 (.53)	$\chi^2_{(2,\ N\ =\ 62)} = 2.905$; *n.s.*	$\chi^2_{(1,\ N\ =\ 62)} = 2.733$; $p < .05$	$\chi^2_{(1,\ N\ =\ 47)} = 0.171$; *n.s.*

[1]The infant with ASD is significantly less responsive than his siblings, and his non-ASD siblings are similarly responsive.
[2]There were no significant differences on these overtures.

Table 11

Infant responses to overtures that included the name

	Responses/opportunities (proportion)			Statistical comparisons		
Infants' age	Male infant with ASD	Male infant without ASD	Female infant without ASD	Omnibus comparison: Any differences among proportions	Complex comparison: infant with ASD to TD infants	Simple comparison: TD male and TD female
Whole age range[2]	29/43 (.67)	25/41 (.61)	50/83 (.60)	$\chi^2_{(2, N = 167)} = 0.664$; *n.s.*	$\chi^2_{(1, N = 167)} = 0.658$; *n.s.*	$\chi^2_{(1, N = 124)} = 0.006$; *n.s.*
6-8 months[2]	10/15 (.67)	14/21 (.67)	14/25 (.56)	$\chi^2_{(2, N = 61)} = 0.715$; *n.s.*	$\chi^2_{(1, N = 61)} = 0.162$; *n.s.*	$\chi^2_{(1, N = 46)} = 0.545$; *n.s.*
9-11 months[2]	13/16 (.81)	6/7 (.86)	10/18 (.55)	$\chi^2_{(2, N = 41)} = 3.617$; *n.s.*	$\chi^2_{(1, N = 41)} = 1.402$; *n.s.*	$\chi^2_{(1, N =25)} = 1.990$; *n.s.*
12-15 months[3]	6/12 (.50)	5/13 (.38)	26/40 (.65)	$\chi^2_{(2, N = 65)} = 3.106$; *n.s.*	$\chi^2_{(1, N = 65)} = 0.288$; *n.s.*	$\chi^2_{(1, N = 53)} = 2.846$; $p < .05$

[2]There were no significant differences on these overtures.
[3]The infant with ASD is as responsive as his siblings, and his siblings have significantly different response proportions.

Table 12a

String length: Whole age range

	Infant		
Number of overture-response pairs in string	Male infant with ASD	Male infant without ASD	Female infant without ASD
2	14	11	10
3	10	4	11
4	2	3	6
5	0	4	0
6	0	3	1
7	0	0	1
Total	26	25	29
Mean string length	M = 2.54 (SD = 0.65)	M = 3.20 (SD = 1.34)	

Difference between ASD and non-ASD is significant: $t_{(78)} = 2.40$, $p < .01$ (one-tailed)

Table 12b

String length: 6-8 months

	Infant		
Number of overture-response pairs in string	Male infant with ASD	Male infant without ASD	Female infant without ASD
2	4	3	4
3	5	1	4
4	1	1	2
5	0	3	0
6	0	1	0
7	0	0	0
Total	10	9	10
Mean string length	M = 2.70 (SD = 0.67)	M = 3.21 (SD = 1.27)	

Difference between ASD and non-ASD is not significant: $t_{(27)} = 1.18$, $p = .125$ (one-tailed)

Table 12c

String length: 9-11 months

	Infant		
Number of overture-response pairs in string	Male infant with ASD	Male infant without ASD	Female infant without ASD
2	7	5	4
3	4	2	2
4	1	1	1
5	0	0	0
6	0	1	1
7	0	0	0
Total	12	9	8
Mean string length	M = 2.50 (SD = 0.67)	M = 2.94 (SD = 1.34)	

Difference between ASD and non-ASD is not significant: $t_{(27)} = 1.04$, $p = .153$ (one-tailed)

Table 12d

String length: 12-15 months

	Infant		
Number of overture-response pairs in string	Male infant with ASD	Male infant without ASD	Female infant without ASD
2	3	3	2
3	1	1	5
4	0	1	3
5	0	1	0
6	0	1	0
7	0	0	1
Total	4	7	11
Mean string length	M = 2.25 (SD = 0.50)	M = 3.44 (SD = 1.42)	

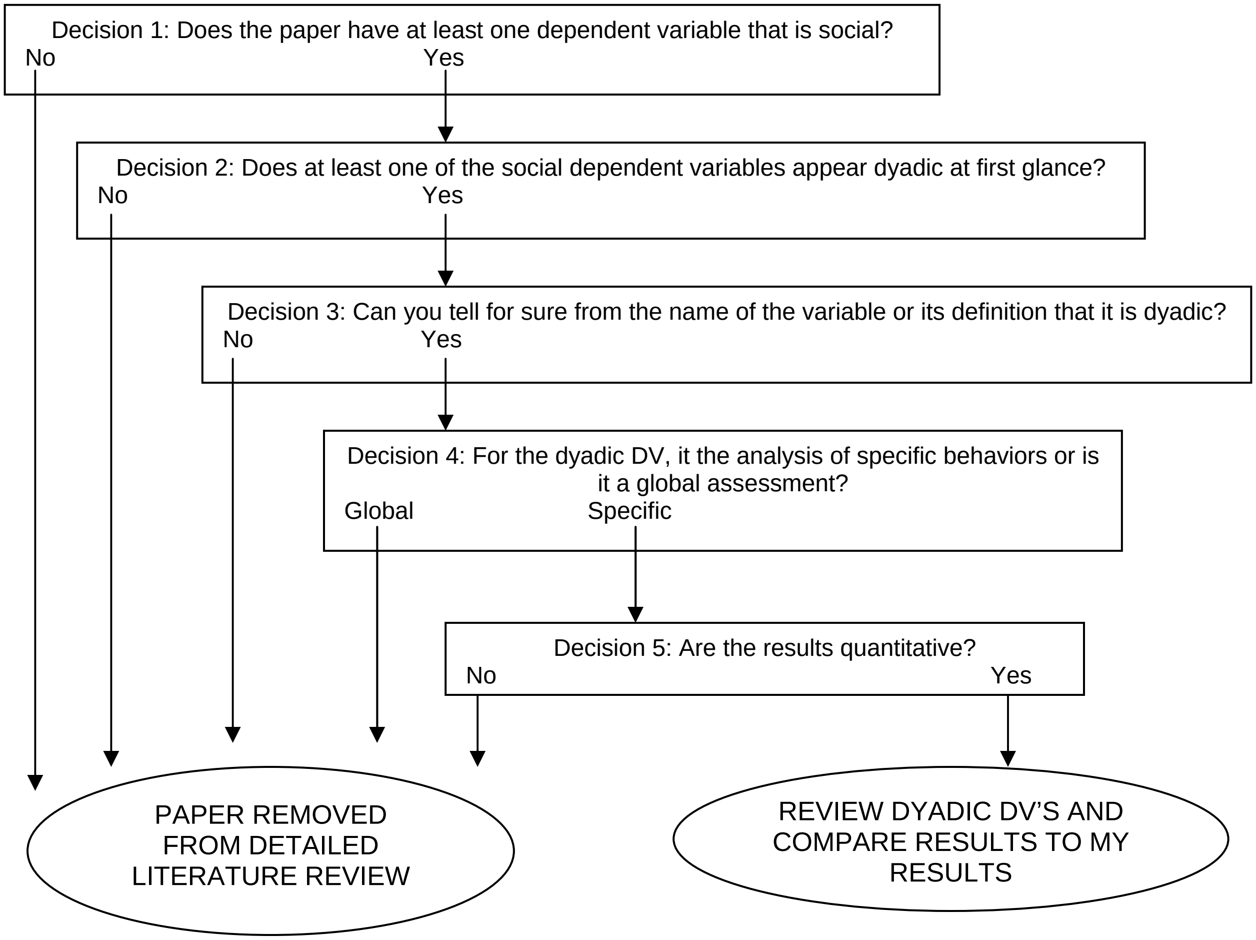
Difference between ASD and non-ASD is not significant: $t_{(20)}$ = 1.63, p = .060 (one-tailed)

Table 13

Infant with ASD responsiveness to overture functions at 12-15 months old (in order of decreasing responsiveness)

Overture functions	Response proportion	Raw scores
Instrumental	1.00	6/6
Helping	0.80	4/5
Greeting	0.54	6/11
Conversational	0.50	2/4
Directing	0.40	2/5
Narrative	0.27	4/11
Rewarding	0.20	1/5
Playful	0.11	1/9
Attention-Seeking	0.00	0/4

Figure 1. Home video paper selection



Papers removed at each decision:

Decision 1	Baranek et al., 2005; Burford et al., 2003; Eriksson & de Chateau, 1992; Lösche, 1990; Maestro et al., 2002; Massie, 1977; Rosenthal et al., 1980; Teitelbaum et al., 1998
Decision 2	Maestro et al., 1999; Maestro et al., 2005
Decision 3	Adrien et al., 1991; Massie, 1978
Decision 4	Adrien, Barthélémy et al., 1992; Adrien et al., 1993; Zakian et al., 2000; Receveur et al., 2005, Bernabei & Camaioni, 2001; Bernabei et al., 1998; Maestro et al., 2001
Decision 5	Danon-Boileau, 2007; St Clair et al., 2007

Which papers are left?

Baranek, 1999; Colgan et al., 2006; Mars et al., 1998; Osterling & Dawson, 1994; Osterling et al., 2002; Trevarthen & Daniel, 2005; Werner & Dawson, 2005; Werner et al., 2000

Figure 2. Summary of Overture Functions

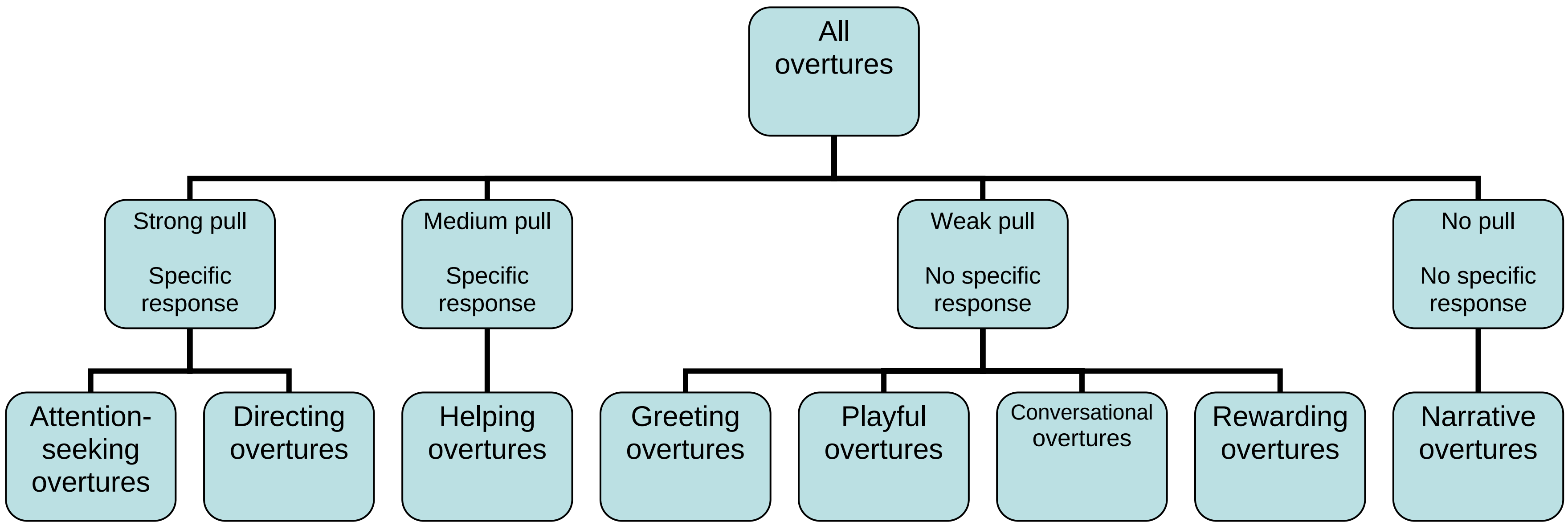


Figure 3. Average Length of Strings at each age range

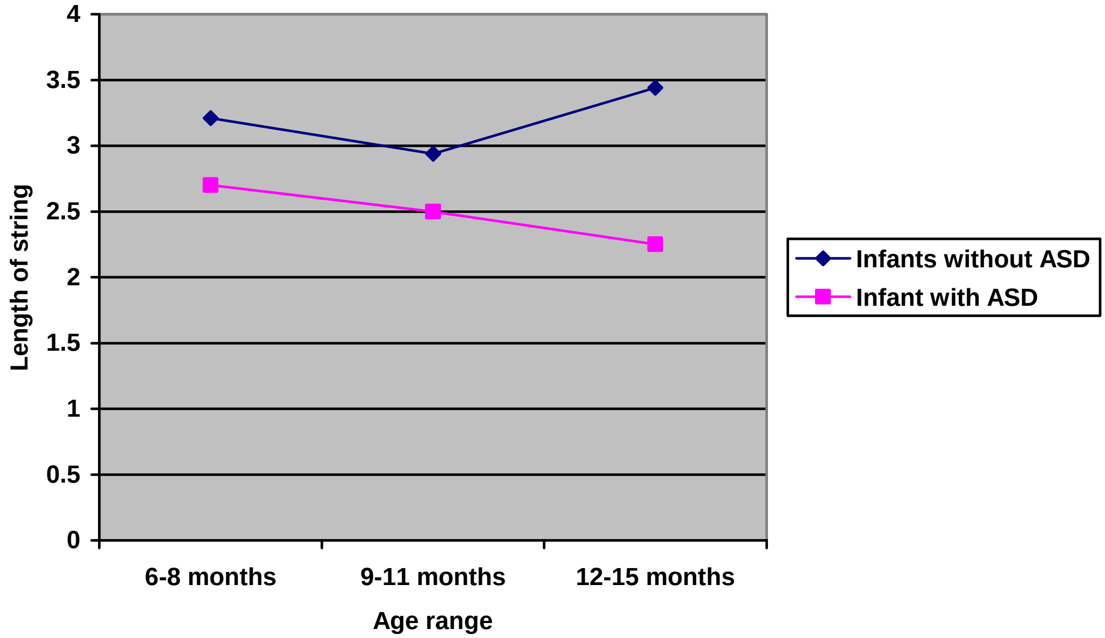


Figure 4. Infant with ASD: Responsiveness to overtures over time

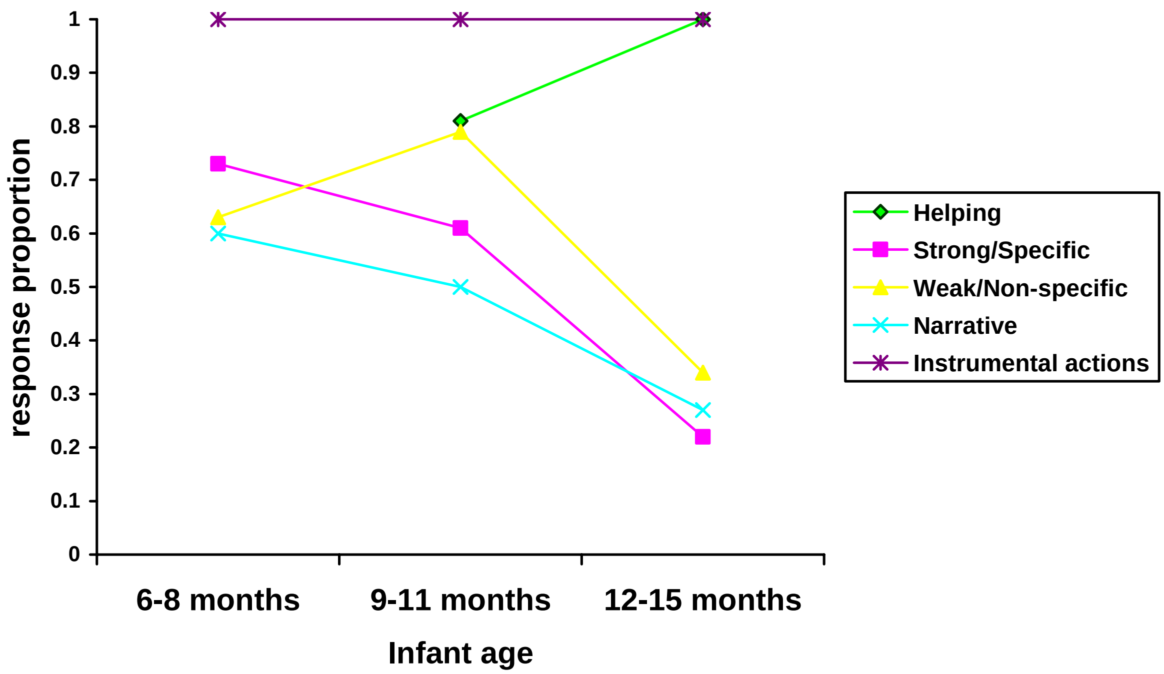


Figure 5. Infant with ASD: Number and length of strings

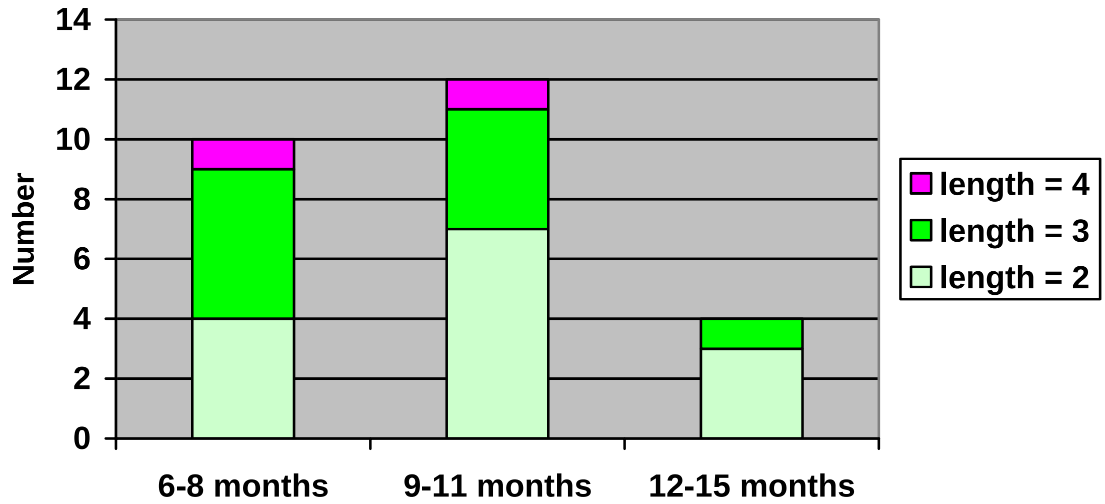


Figure 6a. Infant with ASD: Responsiveness to overtures when attending agent

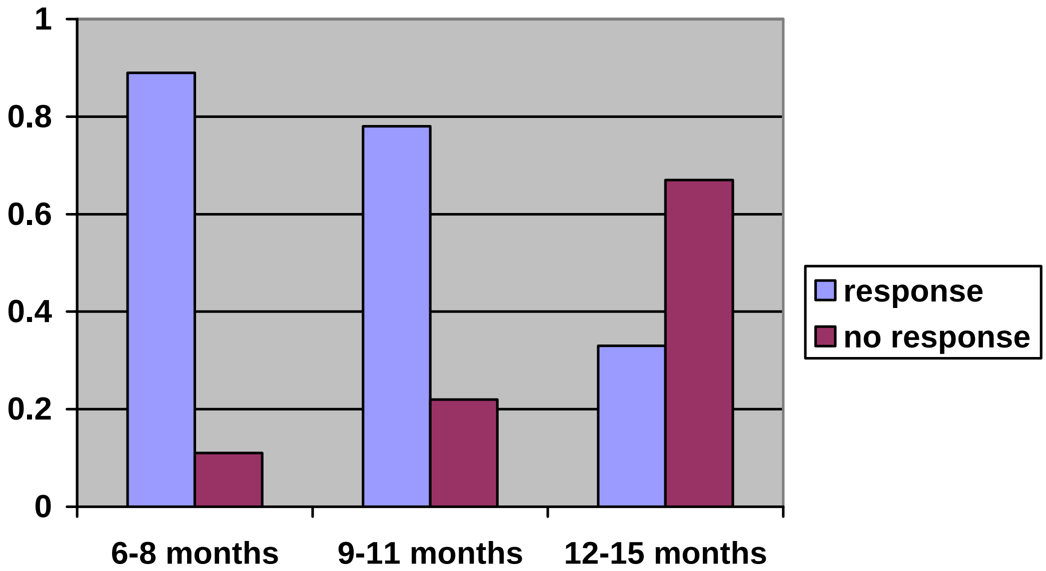
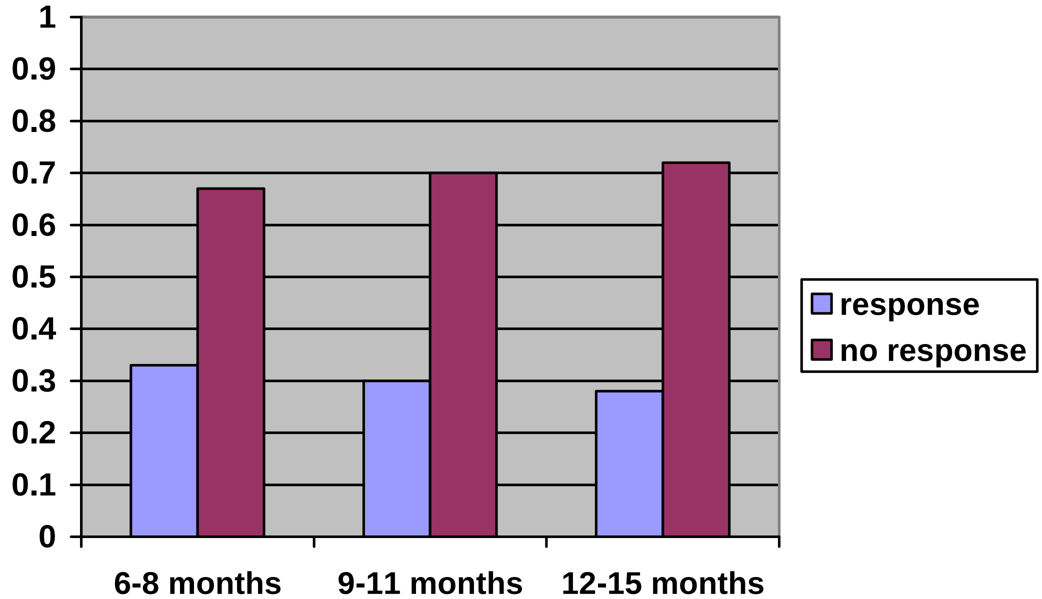


Figure 6b. Infant with ASD: Responsiveness to overtures when otherwise engaged



Appendix A: Forms for Ethics

PARTICIPANT CONSENT FORM

You are being invited to participate in a research study called:

"Early Signs of Autism: An investigation of social reciprocity using retrospective data from home videos of triplets"

Who is conducting this study?

Dr. David Batstone
(Principal Co-Investigator)
Registered Psychologist,
Queen Alexandra Centre for Children's Health
Vancouver Island Health Authority
David.Batstone@viha.ca

Dr. Mary Anne Leason
(Principal Co-Investigator)
Registered Psychologist,
Queen Alexandra Centre for Children's Health
Vancouver Island Health Authority
Mary.Leason@viha.ca

Jennifer Gerwing
(Principal Co-Investigator)
Ph.D. Candidate
(Psychology)
Department of Psychology
University of Victoria
jjg@uvic.ca

How can I contact the investigators?

Jennifer Gerwing is a doctoral student in the department of Psychology at the University of Victoria and you may contact her by phone (727-6573) or by email (jjg@uvic.ca) if you have any questions. You may also contact Dr. Leason or Dr. Batstone.

As a graduate student, Jennifer is conducting research as part of the requirements for a degree in Psychology, which is being conducted under the supervision of Dr. Janet Bavelas. If you have any questions or concerns at any time during this study, you may contact Dr. Bavelas by phone (479-7675) or by email (bavelas@uvic.ca) to seek further information and/or clarification about the study and/or your role in it.

This research is being funded by the VIHA Child, Youth and Family Health Program Research Advisory Committee, and Queen Alexandra Foundation for Children.

What is the purpose of this study?

The purpose of this project is to investigate pre-diagnostic characteristics of autism spectrum disorders (ASD) in infancy by analyzing social reciprocity in parent-infant interactions in the home movies that you generously volunteered for research purposes. The proposed research builds on the very promising findings of our earlier, pilot project in which our "blind" analysis revealed that as early as 9 months, your son with ASD exhibited measurably reduced overall social reciprocity to the parents compared to your other two children We were encouraged that your son with ASD was responding socially some of the time. The objectives of this project are to investigate the precise conditions in which he was (and was not) socially responsive and to compare these patterns of reciprocity with the responses of his siblings.
.
Research of this type is important because deriving the features of these dyadic interactions that are most salient for detecting differences between your son with ASD and your other two children when they were infants could be informative for earlier detection of ASD. Perhaps more importantly, identifying the context of successful as well

as unsuccessful interactions will provide a valuable, innovative starting point for intervention at a very early age.
.

If I participate, what will I be asked to do?

If you agree to voluntarily continue to participate in this research, your participation will include (1) allowing us to analyze the videos, (2) filling out a Permission to View form (example attached) once we have the video inventoried, and (3) meeting with one of us periodically before upcoming professional presentations (e.g., conferences or seminars) to view our presentation and consider whether you would like to give permission for specific video examples to be shown. You will have the opportunity to give or withhold permission on the Permission for Presentation form (also example attached).

Will participating put me at any risks or inconvenience me in any way?

There are no known or anticipated risks to you by participating in this research. However, participation in this study may cause some inconvenience to you. It may take time to read consent forms, permission to view forms, and permission for presentation forms. It may also take time to meet with researchers before presentations, but note that this activity is optional (See Permission for Presentation form), that is, you can indicate your level of permission without meeting with us, if you wish.

Are there any potential benefits to me or to society?

A potential benefit of this study is gaining a better understanding of the early patterns of strengths and weaknesses in reciprocal social interactions seen in children with autism spectrum disorders. This could lead to earlier diagnosis, more effective interventions, and possibly better outcomes for children. This study could benefit VIHA through its potential for contributing to the development of better diagnostic tools and more efficient and effective treatments for autism spectrum disorders. Whereas other studies have focussed primarily on the deficits in social skills seen in these children, this proposed study has the potential to better identify the strengths and skills these children are using naturally. This knowledge could contribute to development of interventions which would better “play to the strengths” of these children, and hopefully maximize their gains in treatment. Results could be better outcomes for children and perhaps cost savings in therapy time. You may benefit from the study through interactions with us (the researchers), viewing presentations, and reading any publications. You will have the opportunity to share your experiences when the triplets were infants and to direct our attention to key moments or to explain some of the behind the scenes activities. In this way, you will be able to have a direct impact on the course of the research and will also learn more about how the research is conducted and how we obtain and present our findings.

Will the information from the videos be anonymous and confidential?

The primary data for this study will be your home videos. We cannot make them anonymous.
We will, however, implement the following procedures to protect your data and make it as confidential as possible.

1. When you have had a chance to see the video(s), we will give you a form ("Permission to View") where you can indicate exactly how we can and cannot use the video in subsequent research. We will respect your wishes as reported on that form. This form will be kept separate from the videotaped data.
2. Your name will not be on the primary data (i.e., the videotapes), nor on any secondary data (i.e., the analysis sheets and data files). We will be using pseudonyms. It is possible that your name is spoken on the video, thus potentially jeopardizing your anonymity. We will not be able to erase the audio track where your name is said, but we will (a) only use that excerpt as a videotaped example in a presentation with your explicit permission, and (b) automatically replace your name with a pseudonym in the transcription.
3. The videotapes we create, including digitized data on DVD, will be kept in a locked office at QACCH or at University of Victoria. While we are using the digital files of the data, we will put them in a password-protected laptop or computer. When we are finished with analysis, we will remove the files from the hard drive of our computer and return the videos (both VHS and DVD copies) to you.
4. All video material and details of the analyses will be kept separate from clinical files.

However, even with these procedures, if anyone were familiar with your family and saw the video (e.g., at a conference), the identity of your family would not be confidential.

In addition, even if video is not shown and all examples of the analysis are described in text, the anonymity of your family cannot be completely assured for the following reason: Triplets are by themselves uncommon, and a set of triplets where one has ASD and the other two do not is even more rare. As Victoria is not a large community, your family may be identifiable simply by describing the situation and knowing the location of the researchers.

Can I change my mind about participating?

Your participation in this research must be completely voluntary. If you do decide to participate, *you may withdraw at any time without any explanation and without any consequences*. If a single member of your family withdraws, that individual's actions obviously cannot be deleted from the video, but they will not be anlayzed nor will any video when they are present be used as conference examples. If you choose to withdraw as a family, we will stop analysis and return the home videos to you.

How will you use the information in the videos?

It is anticipated that the results of this study will be shared with others in the following ways.

1. Jennifer Gerwing may be using some of the data in her doctoral dissertation, and whether this includes examples of the actual videos is up to you.
2. Jennifer Gerwing, Dr. Leason, and Dr. Batstone may present data from this analysis at scholarly meetings (i.e., seminars or conferences) and/or they may submit for publication to a professional journal.

Will I have any say as to how you use the videos?

As mentioned previously, once we have them inventoried, we will give you the opportunity to view the videos. When you have had a chance to see them and ask questions, we will give you a form (Permission to View). On the form, you will have the opportunity to say exactly how we can use the videos (e.g., for analysis only, for conference presentations, etc.).

When we would like to give a conference presentation, we will give you another form (Permission for Presentation) that will give you the opportunity to view the video examples in the context of our analysis and findings and within the context of the purpose and location of the presentation venue.

We consider you to be the owners of the home videos. Thus the primary data (i.e., all VHS or DVD copies of your videos) will be returned to you in 3 years. At this time, we will delete our own digital copies of the video. The secondary data (i.e., the results of the analysis) will not be destroyed. The secondary data will be completely anonymous, and we need to keep it if it is part of a doctoral dissertation or publication.

If I have concerns about this study at any time, is there someone other than the investigators whom I can contact?

In addition to being able to contact one of the investigators at the above phone numbers, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting Dr. Richard Keeler (the Associate Vice-President, Research at the University of Victoria) at 472-4545. If you have any concerns about your rights or treatments as a research participant, you may contact the VIHA representative, Dr. Peter Kirk, by phone at 370-8620.

Your signature below indicates that (1) you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers, and (2) you have had the opportunity to discuss this matter with your children and they agree to participate as well.

______________________	______________________	______________
Name of Participant	*Signature*	*Date*
______________________	______________________	______________
Name of Participant	*Signature*	*Date*

A photocopy of the signed consent form will be returned to you by mail.

Permission to View Form

Project title: Early identification of autism spectrum disorder in parent-baby interactions

Investigators:

Dr. David Batstone (Principal Co-Investigator) Registered Psychologist, Queen Alexandra Centre for Children's Health VIHA David.Batstone@viha.ca	Dr. Mary Anne Leason (Principal Co-Investigator) Registered Psychologist, Queen Alexandra Centre for Children's Health VIHA Mary.Leason@viha.ca	Jennifer Gerwing (Principal Co-Investigator) Ph.D. Candidate (Psychology) Department of Psychology University of Victoria jjg@uvic.ca

The mpg files made from your videos will be kept in a locked filing cabinet at QACCH or at the University of Victoria and will be labeled without your name. When the video files are being used for analysis, they are on a password-protected computer. Although none of the files include your name or any identifying information, they are not anonymous to anyone who knows you or would recognize you. With that in mind, please indicate below the way(s) we can use the videotapes you provided for this study. You can select some and not others—or none at all. Any of the principal investigators listed above can answer questions you may have about these options.

Note that circling "yes" or "no" on this page indicates your level of permission for *all of the excerpts*. Should you prefer to designate your level of permission for each excerpt individually, or should you wish to exclude particular excerpts from the permission you have indicated on this page, please do so in the attached inventory of the video.

1. Dr. Batstone, Dr. Leason, Jennifer Gerwing, and research assistant(s) working specifically on this project may view and analyze the videotape:	**yes**	**no**
2. Excerpts from the videotapes may be included as examples for a presentation for *other parents who have children with autism spectrum disorder* (e.g., for presentations for parent resource groups):	**yes**	**no**
3. Excerpts from the videotapes may be included as examples for a presentation to *professional audiences* ***inside Canada*** (e.g., at a seminar or conference):	**yes**	**no**
4. Excerpts from the videotapes may be included as examples for a presentation to *professional audiences* ***outside Canada*** (e.g., at a seminar or conference):	**yes**	**no**
Note that it is possible, if we cross the Canada/US border, for US Customs and Immigration to seize our computers for security purposes. In this situation, they will have access to the anonymous data on our computer, including videotaped data. Although your name will not be linked to the files in any way, it is still your image. We will ensure that when attending conferences outside Canada, that the videotaped data on our computers only includes participants who have agreed to accept this risk by circling "yes" in the right hand column for option (4).		
5. Excerpts from the videotapes may be included as examples at *Jennifer's doctoral dissertation presentation*:	**yes**	**no**
6. "Snapshots" from the videotapes may be included as still photos in a journal article:	**yes**	**no**
7. I have circled "**no**" to each statement above, and by circling "yes" in the space at the right, I am confirming that *I do not want my participation in the videotape to be analyzed or included in any presentation*:	**yes**	**no**

Name: ____

Participant Signature: ______________________________________ **Date:** _______________

Name: ____

Participant Signature: ______________________________________ **Date:** _______________

A photocopy of the signed consent form will be returned to you by mail.

Instructions for the inventory:

The next eight pages are an inventory of the video you volunteered from when your children were 6-9 months old, 9-12 months old, and 12-16 months old.

The columns in the table are the following:

The “excerpt name” is the filename attached to each individual episode of video, and it is based on the date the video episode was filmed. As you watch your video, the episodes should occur in the order listed.

The next two columns are the length of each episode and a brief description of the events in the episode.

Whether each child is in the video episode is indicated in the next three columns.

We have excluded several episodes for various technical or ethical reasons. These episodes are included in your inventory, but we have crossed them out so that you know that they are excluded. The reasons for exclusion are listed in the next column. Usually we exclude episodes because there are other people besides your immediate family in them. Because we do not have permission from these other people, we are not analyzing these episodes.

Please use the inventory if you would like to:

(a) designate your level of permission for each excerpt individually, or
(b) indicate any specific excerpts you would like to exclude from your permission
indicated on page one of this package (Permission to View form).

Indicate your permission by using the final 6 columns of the table.

Each column is numbered according to the same levels of permission on the first page of the package (e.g., “1” corresponds to “use for analysis”).

By writing a “Y” OR leaving a cell blank, you are indicating that you give permission for us to use that particular episode for that particular use.

By writing an “N” in a cell, you indicate that you DO NOT want us to use that episode for that level. For example, if, for episode “3.23.2000 episode 1” you wrote an “N” in column 4, we would know that you do not want us to use examples from that episode in conferences we attend outside of Canada.

Please contact Jennifer Gerwing by phone (home 383-6748; office 727-6573) or by email (jjg@uvic.ca) if you have any questions.

Permission for Presentation

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Section one: to be completed by researchers: Presentation title:
____

Presentation venue (e.g., conference, seminar): __________________ and location:____________________
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A) If you choose NOT to view the presentation, please check one of the following two options:

☐ "I have NOT viewed the presentation, and I give permission for the videos it includes to be shown at the above venue"

☐ "I have NOT viewed the presentation, and I DO NOT give permission for the videos it includes to be shown at the above venue"

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We are proposing that the presentation you viewed be shown at the above venue. We included the video examples because you had previously indicated your permission for this use. However, we would like to give you another opportunity to review the inclusion of video both (1) within the context of the presentation and findings, and (2) within the context of the location and purpose of the presentation venue.

"I indicate my level of permission for the video examples to be used for the purpose of the presentation venue. This permission is granted within the context of the presented results, the purpose of the presentation venue, and its location" (please check one):

☐ "I give permission for you to show all of the examples"

☐ "I give permission to show some examples and not others"

☐ "I DO NOT give permission for you to show any of the examples"

If you indicated that you would like us to show some examples and not others, please indicate which examples we should exclude:

Name: ____

Participant Signature: ____________________________________ **Date:** ______________

Name: ____

Participant Signature: ____________________________________ **Date:** ______________

A copy of this consent will be left with you, and a copy will be taken by the researcher

Appendix B: Clips from Study I

Study I excerpt name	Length of excerpt (in seconds)	*Study II* file name	Infants' approximate age	Activity/context
9-12:1	152	8.16.2000 episode 21	11 months	on the patio playing quietly
9-12:2	67	8.20.2000 episode 23	11 months	in kitchen playing around a hanging curtain
9-12:3	178	9.10.2000 episode 29	12 months	In living room playing with a truck
9-12:4	61	9.11.2000 episode 31	12 months	In kitchen after opening birthday presents
9-12:5	96	9.12.2000 episode 32	12 months	In bathtub all infants trying to stand up
12-16:1	85	9.21.2000 episode 36	12 months	babies climbing on a couch
12-16:2	67	9.24.2000 episode 39	12 ½ months	In bathtub playing with faucet and dripping water
12-16:3	107	9.30.2000 episode 40	12 ½ months	getting photos taken on the truck
12-16:4	61	10.17.2000 episode 47	13 months	Running in the living room being tickled by mother
12-16:5	95	10.31.2000 episode 49	13 ½ months	boys on couch with bottles
12-16:6	44	11.12.2000 episode 52	14 months	Grandfather bouncing baby and putting on headband
12-16:7	53	12.10.2000 episode 17	15 months	Babies playing with sets of mittens

APPENDIX C: MANUAL FOR STUDY I

Definitions, Rules, and Analysis sheets for

- Stage 1: Visibility analysis
- Stage 2a: Overture location
- Stage 2b: Overture division
- Stage 3: Response analysis

Stage 1: Is the baby visible?

Purpose: to limit further analyses to those times when the baby is visible

Materials: Require Stage 1 timeline, which is two pages, one for each half minute.

Procedures:

1. Gather the number of timeline sheets you'll need based on the length of the clip (two sheets per minute)
2. Mark start and end of the action in the clip (where filming starts and ends) with a vertical line in the appropriate spot across the three horizontal lines. Note exact times.
3. Label the sheets with the name of the clip (.mpg filename), the minute (0,1,2), date of analysis, and your name.
4. Write a description on your sheet that will differentiate among the three babies. If you can name them, do so.
5. Add page numbers (X) as well as the total number of pages (Y) (page X of Y)

Analysis:

Decide, for each baby, whether that baby is visible or not visible.

- Whenever the baby is not visible, write in the exact start and end times and squiggle out the line for that period of time for that baby.
- If you can't tell which baby you are looking at, note it on the sheets. This period of time should not count as a baby being visible or not visible and will ultimately have to come out of the analysis.
- Ignore occurrences of the baby being off screen for extremely short periods of time (e.g. <3 frames).
- **Photocopy finished sheet for use in Stage 2a**

Quantitative aspect of analysis:

- Use an Excel sheet to calculate the times each baby is visible. (This may be just a check to see that each baby is on film roughly the same amount of time.)

Identifying Overtures: Autism Project QACCH

Clip name:___________ Minute: _____________ Date:_______________ Analyst: ______________ p. __ of __

Baby 1:________________________ Baby 2:____________________________ Baby 3:____________________________

1

0 .50 1 1.50 2 2.50 3 3.50 4 4.50 5 5.50 6 6.50 7 7.50 8 8.50 9 9.50 10

2

0 .50 1 1.50 2 2.50 3 3.50 4 4.50 5 5.50 6 6.50 7 7.50 8 8.50 9 9.50 10

3

0 .50 1 1.50 2 2.50 3 3.50 4 4.50 5 5.50 6 6.50 7 7.50 8 8.50 9 9.50 10

1

10 10.50 11 11.50 12 12.50 13 13.50 14 14.50 15 15.50 16 16.50 17 17.50 18 18.50 19 19.50 20

2

10 10.50 11 11.50 12 12.50 13 13.50 14 14.50 15 15.50 16 16.50 17 17.50 18 18.50 19 19.50 20

3

10 10.50 11 11.50 12 12.50 13 13.50 14 14.50 15 15.50 16 16.50 17 17.50 18 18.50 19 19.50 20

1

20 20.50 21 21.50 22 22.50 23 23.50 24 24.50 25 25.50 26 26.50 27 27.50 28 28.50 29 29.50 30

2

20 20.50 21 21.50 22 22.50 23 23.50 24 24.50 25 25.50 26 26.50 27 27.50 28 28.50 29 29.50 30

3

20 20.50 21 21.50 22 22.50 23 23.50 24 24.50 25 25.50 26 26.50 27 27.50 28 28.50 29 29.50 30

Identifying Overtures: Autism Project QACCH
Clip name:___________ Minute: _____________ Date:_______________ Analyst: ______________ p. __ of __
Baby 1:________________________ Baby 2:____________________________ Baby 3:____________________________

1

30 30.50 31 31.50 32 32.50 33 33.50 34 34.50 35 35.50 36 36.50 37 37.50 38 38.50 39 39.50 40

2

30 30.50 31 31.50 32 32.50 33 33.50 34 34.50 35 35.50 36 36.50 37 37.50 38 38.50 39 39.50 40

3

30 30.50 31 31.50 32 32.50 33 33.50 34 34.50 35 35.50 36 36.50 37 37.50 38 38.50 39 39.50 40

1

40 40.50 41 41.50 42 42.50 43 43.50 44 44.50 45 45.50 46 46.50 47 47.50 48 48.50 49 49.50 50

2

40 40.50 41 41.50 42 42.50 43 43.50 44 44.50 45 45.50 46 46.50 47 47.50 48 48.50 49 49.50 50

3

40 40.50 41 41.50 42 42.50 43 43.50 44 44.50 45 45.50 46 46.50 47 47.50 48 48.50 49 49.50 50

1

50 50.50 51 51.50 52 52.50 53 53.50 54 54.50 55 55.50 56 56.50 57 57.50 58 58.50 59 59.50 60

2

50 50.50 51 51.50 52 52.50 53 53.50 54 54.50 55 55.50 56 56.50 57 57.50 58 58.50 59 59.50 60

3

50 50.50 51 51.50 52 52.50 53 53.50 54 54.50 55 55.50 56 56.50 57 57.50 58 58.50 59 59.50 60

Stage 2a: Identifying Overtures to babies in all clips

Purpose: to find all the episodes (i.e., periods of time) for each baby when an adult overtly directs his or her behavior towards the baby

Operational definition: An *overture* is a period of time where one or more adults are making some sort of social contact (verbal and/or nonverbal) with one baby.

- **Examples of verbal overtures**: Calling the baby's name, saying something specific about the baby's situation "oh what a beautiful boy", making vocalizations to that baby…
  - E.g., 9-12:5, overture 6 "Did your face go into the water, a little bit?"
  - E.g., 12-16:2, overture 11 "oh [name]"
- **Examples of nonverbal overtures**: Touching; smiling; giving the baby something; reaching out; playing with baby; moving baby…
  - E.g., 12-16:1, overture 9- father picks up baby and puts him on the couch
- **Overtures are often simultaneously verbal and nonverbal**
  - E.g., 9-12:5, overture 5- mother says "monkeyhead" playfully while touching baby's head with a toy
- **Additional criterion:**
  - If the baby is not visible, do not record the overture.
  - Overtures to all three babies should not be included- only record ones that are directed to one baby
  - The baby must be able to somehow experience the behavior for it to be considered an overture. That is, whatever the behavior is, only record it if the baby could see, hear, or feel it. (E.g., if the adult is behind the baby and reaching out towards him or her, it should not be considered an overture.)
  - Sometimes a candidate overture occurs in only one modality (i.e., only words or only a touch), which can make it difficult to classify as an overture or not. For detailed rules and a decision tree to use for consistent classification in these cases, see the document: "detailed rules and decision trees for identifying overtures".

Procedures:

1. Use photocopied sheets from Stage 1 of the analysis.
2. Watch clip first from beginning to end once or twice to familiarize yourself with the context and activities. This is especially important if you have not seen this excerpt before (e.g., you are not the analyst who did the visible vs. not visible analysis).
3. If you are a different analyst than the one who did visible vs. not visible, write your name on the photocopied analysis sheet.

Analysis:

- Using the above definitions and criteria for overtures (and decision tree, if necessary), record above the timeline where the overture episode begins and ends (note exact times).
- Connect the two times with a double line.
- Write above the double line what the overture is (e.g., if it is words, write the exact words, if it is touching, write touching, etc.) What you record here does not have to be exact and complete- it is more of a reference for later stages.
- The overture episode may be sustained for a period of time. You should break it into separate overtures based on any gaps in time (even if they are less than a second). Keep in mind that in Stage 2b, the analysis will serve to divide them based on additional criteria, so only divide them based on temporal gaps.
- If there is an additional overture from a second adult, include it in the same place. Again, it will be separated and divided later.
- When you are done, number the overtures on that sheet, preferably in another color. Then enter your overtures into a “dividing overtures analysis sheet” that you will use in Stage 2b. Each numbered overture should be there, with the brief descriptions and exact times.

Additional Guidelines for Stage 2a:
Detailed Rules for Identifying "One-Modality" Overtures

Most candidate overtures are a combination of modalities (i.e., words/vocalizations and actions) integrated into a meaningful social act towards a baby. Usually when they are integrated, and especially when seen in context, it is very clear that the adult is trying to engage with one of the babies. When the adult is using more than one modality, you will likely not need a decision tree.

Sometimes, however, a candidate overture will occur in only one modality (e.g., a single touch, a few words, or a glance), and each of these modalities has characteristics that can include or exclude the action as an overture, according to our particular definition. For one-modality candidate overtures, therefore, there are two types of decisions: One for **actions** and one for **words and vocalizations.** Although these distinctions are somewhat artificial, they may be helpful in cases where you are not sure whether to consider the adult's behavior an overture.

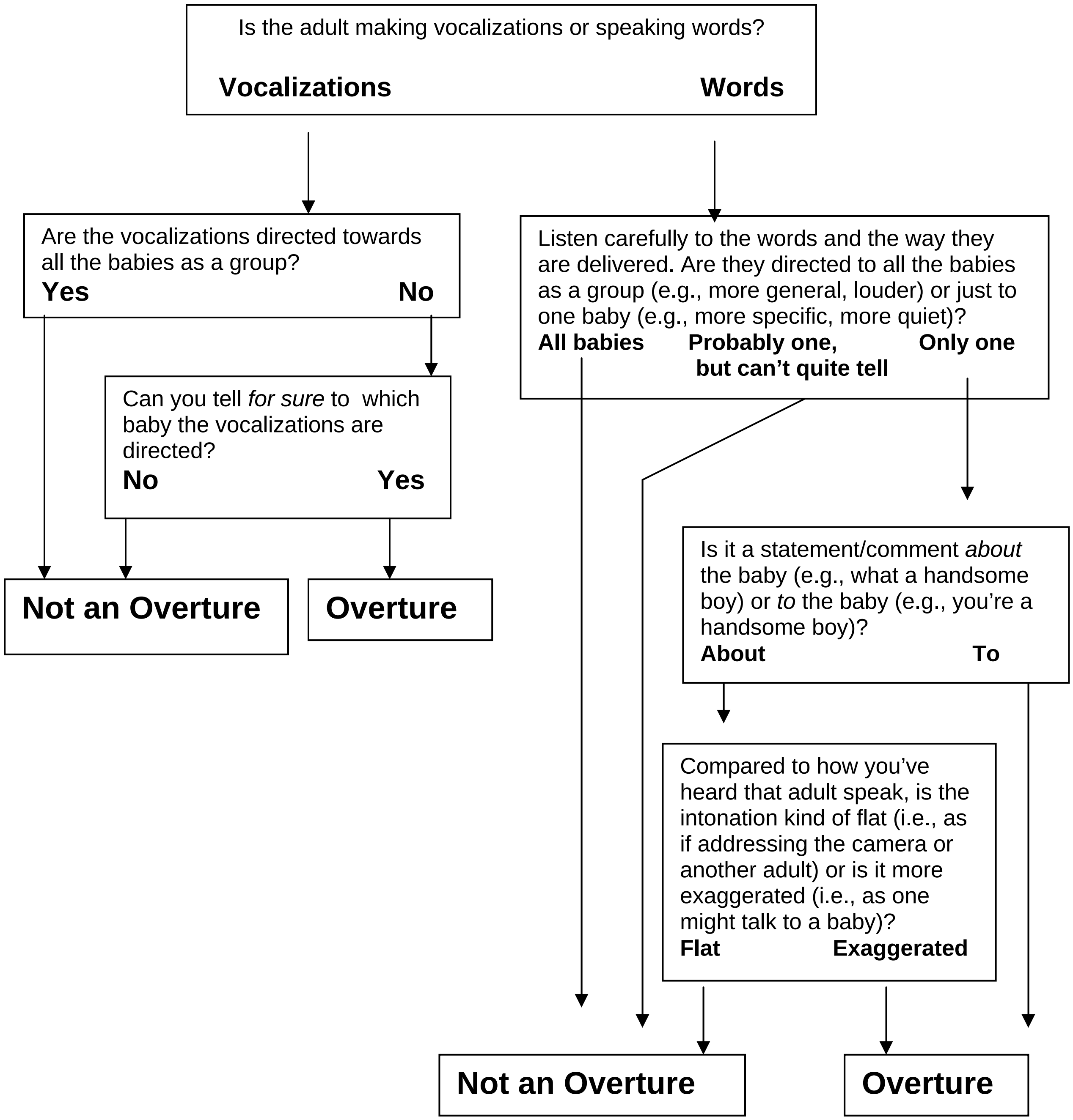
Overtures Decisions: Actions

Candidate action…	**OVERTURE**	**NOT AN OVERTURE**
Looking at baby, attempting to make eye contact*	If it is exaggerated (stylized) and it is something the baby can see	If the baby cannot see it
Touching the baby	Only if the adult is doing some touching that represents a change (e.g., short episodes of touching-repeated OK)	If the adult is touching the baby the whole time (e.g., holding the baby)
Almost touching the baby	If and only if… • the baby *can see* the almost-touching • AND it is clearly a part of the ongoing interaction (e.g., teasing by touching, touching, almost touching-as with tickling…)	• If the baby cannot see the almost touching; • OR if the adult's action is anticipatory, that is, it is preparation for a touch that might be necessary (e.g., to keep the baby from falling)
Touching or moving objects around the baby	If and only if… • the object action is directed towards only one baby • AND that baby can experience (i.e., see, hear, or feel) the adult acting with that object • AND the object action is an	• If the object action pertains to all babies; • OR if the baby to whom it is directed cannot experience (i.e., see, hear, or feel) it; • OR if the object

	integral part of the interaction (e.g., waving mittens towards a baby as an offering)	action is incidental to the interaction (e.g., moving a book or toy to get it out of the way).

*You probably will not be able to see if the adult and baby actually make eye contact, but sometimes an adult seems to try to make eye contact by purposefully moving his or her head around to orient towards the child.

Overtures Decisions: Words and Vocalizations



Stage 2b: Dividing Overtures to babies in all clips

Purpose- Many overtures are in fact more than one happening consecutively. The purpose in this Stage is to divide the overtures by changes in the *adult's* behavior. (It is *absolutely essential* that we do not use the baby's behavior as criteria for dividing overtures.)

Procedures:

1. You should be the same analyst who did Stage 2a for this excerpt.
2. Use filled in "dividing overtures analysis sheet" from Stage 2a of the analysis for the excerpt.

Analysis: For each overture, divide based on the following, hierarchical criteria:

Identifying Source:
Is the overture more than one adult's contact?

- If no, go on to Identifying Functions
- If yes, divide by adult and treat each adult's overture separately- make note of the time where the two divide and go on to Identifying Functions *for each adult's overture*

Identifying Functions:

Functions of overtures can be very different. For examples, some appear to be functioning to have fun, some are just statements to the baby of what is happening, some are directives to the baby to do something. The purpose of this distinction is not to identify particular functions per se, it is instead to divide the overture if the adult seems to be varying the function of the overture part way through it. [If the functions of overtures become of interest, we would have to make clear distinctions.] You don't need to reliably label the overture as fulfilling one particular function or another, just divide it if it seems to be serving very different needs.

- E.g., 9-12:5, overture 4 is divided based on function. Part of the overture (4a) appears to be instrumental (the mother is moving the baby into a sitting position) and part of it (4b) is fun (she is touching the baby with a toy and making a fun noise).

Identify what you think the adult is trying to accomplish with the overture.

Does the function change during the overture?

- If no, go on to Identifying mode
- If yes, divide by function and treat each function separately. Make note of the time when the two divide and go on to Identifying Mode *for each separate function*

(See Appendix DD for detailed rules and definitions of separate functions of overtures)

Identifying Modality:

The function of an overture can be accomplished using different modalities of communication. If the adult wants to get the baby's attention, he can do so verbally ("here, here, here") and nonverbally (touching hand). For this analysis, actions with objects can be considered nonverbal. You should divide the overture if there is a clear distinction between one modality and another and if the adult uses those modalities consecutively.

- E.g., 12-16:2, overture 6 is partly nonverbal (touching baby) and partly verbal ("no, no, no")

Also divide if part of the overture is all one modality, and the other part is two.

- E.g., 9-12:4, overture 7 is divided based on modality. The first part (7a) is verbal ("mmm"), the second (7b) is nonverbal + verbal (moving the box while saying, "you want it?"), and the third part (7c) is verbal ("it's a box").

Do not divide if the modalities are presented simultaneously.

- E.g., 12-16:4, overture 3 is verbal ("I've got you!") and nonverbal (tickling) simultaneously.

Is the overture more than one modality?

- If no, go on to Identifying Escalation of Modalities
- If yes, are the modalities simultaneous? (E.g., touching and speaking at the same time)
    - If no, they must be consecutive. Divide by modality, make note of the exact time where they divide, and go on to Identifying Escalation of Mode(s) for each Modality.
    - If yes, they go on to Identifying Escalation of Modalities

<u>Identifying Escalation of Modalities</u>:

Each particular modality of contact might get stronger, there will usually be a break (even a tiny one) before it does. Verbal contact might get repeated in a louder tone (e.g., [name], look what daddy has. [NAME]?). Nonverbal might get repeated more strongly (e.g., dangling mittens, then dangling and shaking them more vigorously). *Repetition alone is not enough for dividing* (e.g., "here, here, here", if not getting louder each time, should not be divided).

Does the section of overture repeat and escalate?

- If no, you are done dividing this section.
- If yes, divide and make note of the new time. (If escalation occurs more than once, be sure to divide each time) Then you are done dividing this section.

When finished dividing, keep the number of the overture the same (e.g., 3), but label each subdivision of the overture with a letter (e.g., 3a, 3b, 3c, etc). This makes it much easier to look back and forth for reference from analysis sheets for 2a and 2b.

Create a "divided overtures" document for each clip, carefully making note of all the times and reasons why you divided them. These sheets will be data on their own, they will also provide some of the necessary information for Stage 3 of the analysis.

What is needed for Stage 3 of analysis:

Fill in a blank Stage 3 analysis sheet for each clip. It should include:

1. The clip name
2. The baby's name for each number
3. The exact times for each overture, a description of each overture, and to which baby the overture is directed. (All of this should – for accuracy- be copied and pasted directly from the analysis sheets typed up after Stage 2b.)

STAGE 2b: Dividing overtures Date:___________________
Analyst:_______________________
clip name: _______________________
baby 1:________________ baby 2:___________________ baby 3:_____________________

Ov#	baby	time	
1			
		Source	
		Function	
		Modality	
		Escalation	
2			
		S	
		F	
		M	
		E	
3			
		S	
		F	
		M	
		E	
4			
		S	
		F	
		M	
		E	

Stage 3: Identifying and categorizing baby behaviors after overtures

Purpose: To note baby's behaviors immediately preceding and following each overture to compare them to each other (is there a change?) and the overture itself (is the change related to the adult's behavior?). The purpose is to see if we can identify sequences of behaviors where the baby responded appropriately to an overture. (This is our measure of social reciprocity.)

Operational definitions: A change in the baby's behavior is defined as a change between the baby's behavior before and after the overture. "After" here is defined as the period of time between the onset of the overture to about a second after it is completed.

A change in behavior should be considered related to the overture if it seems like a response a baby might make to that overture.

- Try to keep the option of the behavior being related as open as possible. If the behavior seems to fit at all into what you might expect, categorize it is related. It should be hard for a baby to make a change in behavior after an overture that is completely unrelated to the nature of the overture.
- E.g., Related: 9-12:1, overture 2 is the mother saying "oh, you falling down?". The baby's behavior following this is to start to cry. Crying seems like a related response to attention from the mom after falling off a toy.
- E.g., Related: 9-12:1, overture 12 is the mother saying "yeah, oh, soft and cuddly Madeline". The baby's behavior following this overture is to roll over, look at the mom and smile.
- E.g., Not related: 9-12:3, overture 23 is the mother saying "you're trying to move along, little one?". The baby's change in behavior is to go from bobbing up and down on the seat of his toy to not bobbing up and down anymore, which stops him from moving. This doesn't seem like a response to his mother's statement- it seems like the opposite.
- E.g., Not related: 12-16:4, overture 3 is the mother tickling the baby and saying, "I got you!". The baby's behavior after this is to stop laughing and get up. This also seems like the opposite of what you might expect.

Note: It is possible (but not ideal), at this stage of the analysis, that analysts will find an overture that previous analysts missed. These should be added and inserted into the summaries of the previous analyses- but they should not necessitate that other numbers are changed. Previous numbering has been 1, 2, 3a, 3b, etc. If a new overture is added, label it with the preceding number plus a decimal (e.g., 4.5). Thus the unique number for each overture in each clip will indicate if it is single, if it has been divided, or if it was added later.

Procedures and analysis:

1. Identifying changes in behavior:
    a. Watch the excerpt to get an idea of what each baby is doing and the context of the whole interaction

b. Select part of excerpt stipulated by adult overture times and watch that selection plus about a second before and afterwards to see what baby does before and after the overture.
c. Note the baby's behaviors immediately before and then after the start of the overture (behaviors during and after are relevant). Write down a brief description of these behaviors in the appropriate columns on the analysis sheet.
    i. There may be another overture to that baby right away, so make sure that the behavior you are describing occurs *before* the next overture.
    ii. If you can't see whether there is a change in behavior because the baby goes offscreen, write NOT VISIBLE in that column and put a dash in the next two columns.
    iii. If excerpt ends or there is a transition in the excerpt before you can see anything, write CLIP ENDS and put a dash in the next two columns.
    iv. If the next overture begins before there is a chance for the baby to respond, write NO TIME and put a dash in the next two columns.
d. Make a decision as to whether the baby's behavior during and immediately after the overture has changed from before it. Changes you should look for are actions such as (but not limited to) the following:
    i. redirecting gaze, a whole body reaction (e.g., increased wiggling, kicking), a facial reaction (e.g., smile), an escalation or de-escalation in ongoing activity, or a new action.
    ii. Write a "Y" in the "is there a change?" column if you think there is a change.
    iii. Write an "N" in the "is there a change?" column if you think there is <u>not</u> a change and put a dash in the "is the change related" column
e. Get reliability for this decision (number of agreements over the number of decisions) and resolve any disagreements before proceeding to the next stage.

2. <u>Identifying if there is a relationship between overture and changes in behavior</u> (i.e., categorizing changes in behavior).
    a. This column may already have some cells crossed off with a dash (because there was no opportunity to see a behavior, there was no time for the baby to respond, or the baby did not respond).
    b. Wherever you have decided that there is a change in the baby's behavior (indicated by a "Y" in the previous column, decide if the changed behavior is related in any way to the adult's overture.
    c. Get reliability for this decision (number of agreements over the number of decisions) and resolve any disagreements before finishing this stage.

Identifying overtures: Autism project QACCH **STAGE 3: Babies' behaviors before & after overtures**
Date:_____________________________ Analyst: ____________________________
clip name: _____________________
baby 1**:** _______________ baby 2:______________ baby 3:_______________

Ov#	baby	baby's behavior before	Time (ms)	description	baby's behavior following			
					Briefly describe	Is there a change? (Y/N)	If so, is change related to adult's overture? (Y/N)	Categorize ?

SUMMARY TABLE

BABY	# of related changes	# of overture - NOTIME
1		
2		
3		

Appendix D: Inter-rater reliability from Study I

Triplet project, May 12, 2006
Reliability scores and procedures:

Random selection of excerpts: I assigned each of the 23 minutes of data a number. Then I obtained three random permutation sets of the numbers 1-23. We planned to compare our independent analyses on 5 minutes of data for each stage of the analysis (visibility; overtures; responses). We planned ahead of time which 5 minutes we would do for each stage, then used any left over minutes for training before doing reliability.

Note that because reliability was high for all measure, the results are based on the first analyst's (my) original data. Although we resolved disagreements in principle, I did not change my original results. If I were doing the analysis again, I would do reliability on an ongoing basis from stage to stage and data would reflect the resolved decisions.

Stage 1: Visibility.

Visibility agreement calculated second by second:
groups 9-12:3 (1st minute); 9-12:4 (1st minute); 9-12:5 (1st minute); 12-16:1 (2nd minute); 12-16:4 (1st minute)

Agreement on three infants overall:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	do not agree	19	2.5	2.5	2.5
	agree	755	97.5	97.5	100.0
	Total	774	100.0	100.0	

Agreement on female infant without ASD:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	do not agree	10	3.9	3.9	3.9
	agree	248	96.1	96.1	100.0
	Total	258	100.0	100.0	

Agreement on male infant with ASD:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	do not agree	4	1.6	1.6	1.6
	agree	254	98.4	98.4	100.0
	Total	258	100.0	100.0	

Agreement on male infant without ASD:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	do not agree	5	1.9	1.9	1.9
	agree	253	98.1	98.1	100.0
	Total	258	100.0	100.0	

Stage 2: Adult overtures.

We conducted inter-rater reliability for judging whether there is an overture or not for each baby. The procedures included several stages.

2A: LOCATING OVERTURES

First, both analysts located all overtures and represented them on each baby's timeline in the approximately correct position but without writing exact onset and offset times. The overtures here indicated that we knew an adult was directing a social behavior (or behaviors) towards one baby. Agreement would be on whether there was something happening at that time, but not on the exact times of the event. When comparing timelines, we checked on differences that were more than a second because a difference of that magnitude suggested that one analyst was seeing something that the other one was not.

We calculated our agreement at this stage in two ways: second-by-second agreement (which is potentially very inflated) and episode agreement (a more conservative and stringent measure).

Second-by-second agreement:

Overture general location agreement calculated second by second:
groups 9-12:3 (3rd minute); 9-12:5 (2nd minute); 12-16:4 (1st minute); 12-16:5 (2nd minute); 12-16:6 (1st minute)

Agreement on three infants overall:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	18	4.1	4.1	4.1
	1.00	425	95.9	95.9	100.0
	Total	443	100.0	100.0	

Agreement on female infant without ASD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	5	3.5	3.5	3.5
	1.00	137	96.5	96.5	100.0
	Total	142	100.0	100.0	

Agreement on male infant with ASD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	8	5.7	5.7	5.7
	1.00	132	94.3	94.3	100.0
	Total	140	100.0	100.0	

Agreement on male infant without ASD

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	.00	5	3.1	3.1	3.1
	1.00	156	96.9	96.9	100.0
	Total	161	100.0	100.0	

Episode agreement:
Second, we used a more stringent calculation based only on the overtures we each located. This calculation was not based on time, but instead it was based on each episode during which an analyst saw an overture, and whether the other analyst agreed at that time that there was an overture. We counted it as an agreement even if during a certain period, one analyst saw two overtures and one saw only one.

To calculate this agreement, I used Excel. I numbered each analyst's overtures chronologically. Then I entered the two analysts' decision on each overture episode.

For example:

Jennifer	Patricia	Agree	
1	1	yes	Jennifer saw a period of time as being one overture, Patricia saw two. Counts as two agreements.
1	2	yes	
2	3	yes	agree
3	4	yes	agree
no	5	no	disagree: Patricia saw something and Jennifer didn't see it (or disagreed that it was an overture)

Reliability calculated this way was = 80.6%.

Here is the Excel file:

Clip	Jennifer's number	Patricia's number	agree?	opportunities for agreement	
9-12:5 (1)	1	1	1	1	
	2	2	1	1	
	3	no	0	1	
	4	3	1	1	
	5	4	1	1	
	no	5	0	1	
	no	6	0	1	
	6	7	1	1	
	6	8	1	1	
	7	9	1	1	

12-16:4 (0)	1	1	1	1	
	2	2	1	1	
	3	3	1	1	
	4	4	1	1	
	no	5	0	1	
	5	6	1	1	
	no	7	0	1	
12-16:5 (1)	1	1	1	1	
	2	2	1	1	
9-12:3	1	1	1	1	
	2	2	1	1	
	3	3	1	1	
	4	4	1	1	
	5	5	1	1	
	6	6	1	1	
	7	7	1	1	
12-16:6	1	1	1	1	
	2	1	1	1	
	no	1	0	1	
	3	1	1	1	
	4	2	1	1	

We recorded the resolved decisions in a table and photocopied it for the next stage of analysis, which was dividing the overture episodes into individual overtures based on changes in the overture's agent, function, or modality, and escalation.

2B: DIVIDING OVERTURES

We each divided the overtures we had from our resolved decisions. Then we entered our answers into excel in the same format as for the second calculation of reliability in stage 2A.

We did the reliability for division analysis one step at a time in the following order: source; function; modality; escalation.

We used a random selection of excerpts, doing one minute from five of them.

We scored a point if we agreed on the number of divisions for that category.

For division by source, reliability was 100% (based on 39 overtures)
For division by function, reliability was 97.5% (based on 40 overtures)
For division by modality, reliability was 89.36% (based on 47 overtures)

Note that we didn't do reliability for escalation because we were running out of Patricia's hours and Stage 3 of the analysis was looming… I hope that is OK!

Stage 3: infant behaviors.

Agreement: Did baby make an observable behavioral response to overture?

Each analyst did 5 minutes of the data and judged whether the baby's behavior changed after the onset of the overture. If there wasn't time, recorded a dash instead of yes or no. Agreement was 84.74% based on 59 overtures.

clip	ov	onset time	which baby?	jennifer's decision	patricia's decision	agreement	opportunities for agreement
12-16:2(0)	1	2.11	Non-ASD male	y	y	1	1
	2	5	Non-ASD male	y	y	1	1
	3	8.3	Non-ASD male	y	y	1	1
	4	13.6	Non-ASD male	y	y	1	1
	5a	15.63	Non-ASD male	nt	nt	1	1
	5b	16.34	Non-ASD male	y	y	1	1
	6a	24.37	Non-ASD male	y	y	1	1
	6b	25.42	Non-ASD male	y	y	1	1
	7	28.06	Non-ASD male	y	y	1	1
	8a	32.87	Non-ASD male	y	y	1	1
	8b	35.6	Non-ASD male	y	y	1	1
	9	38.67	Non-ASD male	y	y	1	1
	10a	43.5	Non-ASD male	no	no	1	1
	10b	47.57	Non-ASD male	y	y	1	1
	10c	48.41	Non-ASD male	nt	nt	1	1
	10d	49.04	Non-ASD male	y	y	1	1
	10e	52.12	Non-ASD male	no	Left blank	0	1
	11	52.73	Non-ASD female	y	y	1	1
	12	55.76	Non-ASD male	y	y	1	1
clip	ov	onset time	which baby?	jennifer's decision	patricia's decision	agreement	opportunities for agreement
12-16:4(1)	5	1.09.45	Non-ASD female	y	y	1	1
	6a	1.13.56	Non-ASD female	y	y	1	1
	6b	1.14.49	Non-ASD female	y	y	1	1
clip	Ov	onset time	which baby?	jennifer's decision	patricia's decision	agreement	opportunities for agreement

9-12:3(0)	1a	5.52	ASD male	n	n	1	1
	1b	6.7	ASD male	n	n	1	1
	2a	11.03	ASD male	nt	nt	1	1
	2b	11.6	ASD male	y	y	1	1
	3a	13.19	ASD male	y	y	1	1
	3b	13.7	ASD male	y	y	1	1
	4	17.02	ASD male	y	y	1	1
	5	39.56	ASD male	n	n	1	1
	6a	43.11	Non-ASD female	nt	nt	1	1
	6b	44.18	Non-ASD female	n	y	0	1
	7	47.2	Non-ASD female	n	y	0	1
	8	49.13	Non-ASD female	y	y	1	1
	9	51.85	Non-ASD female	y	y	1	1
	10	56.1	Non-ASD female	n	nt	0	1
clip	Ov	onset time	which baby?	jennifer's decision	patricia's decision	agreement	opportunities for agreement
9-12:4(0)	1	32.49	ASD male	y	y	1	1
	2	34.72	ASD male	y	y	1	1
	3	37.47	ASD male	y	y	1	1
	5	41.66	ASD male	y	y	1	1
	6	45.57	ASD male	n	y	0	1
	7a	48.64	ASD male	nt	nt	1	1
	7b	49.49	ASD male	n	y	0	1
	7c	50.54	ASD male	nt	nt	1	1
	7d	51.44	ASD male	y	y	1	1
	8	53.13	ASD male	n	n	1	1
	9	57.94	ASD male	n	y	0	1
clip	Ov	onset time	which baby?	jennifer's decision	patricia's decision	agreement	opportunities for agreement
9-12:5(0)	1a	10	ASD male	y	y	1	1
	1b	11.93	ASD male	y	y	1	1
	2	13.4	ASD male	y	y	1	1
	3a	17.6	ASD male	nt	nt	1	1
	3b	18.44	ASD male	no	y	0	1
	4a	20.54	ASD male	no	no	1	1
	4b	26.7	ASD male	nt	nt	1	1
	4c	27.45	ASD male	no	no	1	1
	4d	28.63	ASD male	y	y	1	1
	5	32.7	Non-ASD female	no	y	0	1
	6	48.11	ASD male	y	y	1	1
	7	51.5	ASD male	no	no	1	1

Appendix E: Inventory Procedures and Results

INVENTORY PROCEDURES: Procedures used for figuring out which videos to include in analysis:
The files I refer to (.doc; .sav; etc. are all in the Video Inventory folder)

1. Digitized *all* VHS to .avi (using the video capture program "Broadway")
2. Saved *all* .avi files as separate episodes based on date stamp. If no date stamp, then used previous date and the next episode number. This resulted in 136 separate episodes (49 in 6-9 month range; 34 in 9-12 month range; and 53 in 12-16 month range).
3. Recorded total time of each episode as well as what is happening and which babies are in it.
    a. Recorded in Excel
    b. There is one sheet in the Excel file per age range
4. Kept track of episodes that included excerpts from pilot analysis
5. Removed the episodes with the following characteristics automatically:
    a. Ethical reasons:
        i. If they included adults or children other than the immediate family (i.e., two parents and three babies)
        ii. If episode seemed too personal (e.g., Christmas message to father's father) RARE
    b. Technical reasons:
        i. If recording quality was too dark or very poor for some other reason
        ii. If audio difficult to hear (e.g., if outside)
        iii. If no babies were in the episode (e.g., if camera left on accidentally or a clip of just parents) RARE
        iv. If episode duplicated another episode. (Only happened because I had two copies of VHS tapes.) RARE
6. Filenames, descriptions, times, and which episodes are excluded are recorded in word documents organized by age range
    a. Automatically removed episodes are in red font.
    b. Pilot data episodes are marked with an asterix*
7. It is also recorded in an SPSS file (all 136 episodes)
8. Then for all the episodes that had previously analyzed sections from pilot work, I removed the amount of time that had been previously analyzed. This shortened episodes to the amount that we could analyze for the formal analysis. (Note that no episodes in the 6-9 month age range were previously analyzed.)
    a. Recorded in Word document, which includes each excerpt's pilot labels and formal analysis label as well as the duration of removed times and remaining duration
9. Then I removed all episodes that were less than 20 seconds long (not enough context for analysis) (now down to 99 episodes)
10. The new list of episodes (with short ones gone and new times for episodes that included pilot data) is in an SPSS file.
11. I ran an "explore" in SPSS on the remaining 99 episodes to find the ones with lengths that were extreme outliers. There were 5 episodes that were (1 in 6-9 age range; 2 in 9-12 age range; 3 in the 12-16 age range). All of these were unusually long, and would take up a disproportionate amount of the data if included in their entirety.
12. I temporarily removed the 6 outlier episodes and found the maximum length of the remaining ones (500 seconds for 6-9 months; 283 seconds for 9-12 months; 307 for 12-16 months).
13. I shortened the 6 outliers to the maximum length of the other episodes in each age range. In the video files, the videos will run the maximum length from the beginning, that is, I will chop off the end of the long videos.
14. All 99 episodes that will be analyzed are listed in Excel file

Description of all home video data, 6-9 months

Excerpt name	length	description	Babies			Any reason to exclude automatically?	Other comments
			Infant 2	Infant 1	Infant 3		
3.23.2000 episode 1	1 min 8 sec	Babies in sleepers, one baby crying a lot	yes	yes	Yes	No	Very poor quality VHS
3.23.2000 episode 2 (no date stamp)	2 min 15 sec	Babies in clothes, one baby crying a lot…	yes	yes	Yes	No	Very poor quality VHS
3.24.2000 episode 3	2 min 26 sec	Cat putting up with babies, crying babies	yes	yes	Yes	No	Very poor quality VHS
3.25.2000 episode 4	40 sec	Babies in hats getting ready to go out.	yes	yes	Yes	No	Very poor quality VHS
3.25.2000 episode 5	1 min 17 sec	With other adults and children	yes	yes	Yes	Yes- other people	Very poor quality VHS
3.25.2000 episode 6	45 sec	Playing with a box	yes	yes	Yes	No	Very poor quality VHS
3.25.2000 episode 7	41 sec	Hickory dickory dock- more box stuff	?	?	?	Yes, only two babies	Very poor quality VHS and hard to tell which of the two babies are filmed…
3.29.2000 episode 8	32 sec	Babies with friend in front of TV	?	?	?	Yes- other people	Very poor quality VHS
3.29.2000 episode 9	58 sec	Babies in carseats	yes	yes	Yes	No	Very poor quality VHS
03.30.2000 episode 10 (no date stamp)	4 min 46 sec	Babies in sleepers, poor lighting, wiggling on black blanket on floor	Yes	?	?	Maybe- only two	Quality improved, probably problem with Hi-8 originals. Only two of the babies.
03.31.2000 episode 11	25 sec	Playing on the floor in their room	yes	yes	Yes	no	
03.31.2000 episode 12	11 sec	At the beach	?	?	?	Yes- only one baby	…and can't tell which one, and the baby is sleeping
04.02.2000 episode 13*	5 min 59 sec	In jolly jumpers, parents calling names	yes	yes	Yes	no	
04.03.2000 episode 14	46 sec	In highchairs	yes	yes	Yes		
04.04.2000 episode 15	1 min 1 sec	In highchairs with wooden spoon, book, toys	yes	yes	Yes	Yes, other adult	
04.08.2000 episode 16	8 sec	Outside in yard	?	?	?	Yes, other adult	
04.09.2000 episode 17	3 min 33 sec	Being fed in prams by dad and grandpa, then inside, Infant 1 standing	yes	yes	Yes	Yes, other adult	

04.10.2000 episode 18	3 min 47 sec	Playing with telephone outside crib and inside crib	yes	yes	Yes	no	
04.11.2000 episode 19	21 sec	On floor in bedroom				no	
04.11.2000 episode 20 (undated)	38 sec	Outside on blanket	yes	yes	Yes	Yes, other adult	But very briefly
04.12.2000 episode 21	36 sec	Tipped over cribs				No	
04.13.2000 episode 22	41 sec	Boys playing with toy on floor	no	yes	Yes	No	
04.18.2000 episode 23	2 min 23 sec	Baby in crib and in jolly jumper	yes	yes	Yes	No	
04.20.2000 episode 24	56 sec	More jolly jumpers	no	no	Yes	No	
04.22.2000 episode 25	8 min 20 sec	Cody and babies with big pink ball	yes	yes	Yes	No	
04.23.2000 episode 26	2 min 16 sec	Jolly jumper and music, dancing with dad	no	yes	Yes	No	
04.24.2000 episode 27	4 min 4 sec	Out on porch with balloons, backyard w Cody	yes	yes	Yes	No	
04.26.2000 episode 28	43 sec	Itsy bitsy spider	yes	yes	Yes	No	
04.29.2000 episode 29	2 min 23 sec	Infant 2 sleeping, Infant 1 in chair with balloon	yes	yes	No	maybe, only 2, one sleeping	But nice response from A to name
04.30.2000 episode 30	4 min 15 sec	On floor, crying, vocalizing, yawning, wiggling	yes	yes	Yes	No	
05.01.2000 episode 31	2 min 16 sec	All babies crying	yes	yes	Yes	No	
05.04.2000 episode 32	34 sec	Babies with toys in livingroom- and pillow	yes	No?	Yes?	No	Check about baby identity
05.09.2000 episode 33	1 min 51 sec	Rolling over and crawling around with Cody	no	yes	no	No	
05.12.2000 episode 34	1 min 2 sec	On patio with dad and cat	yes	yes	yes	No	
05.19.2000 episode 35*	8 min 9 sec	Bathtub with dad- their first real bath	yes	yes	yes	No	
05.21.2000 episode 36	1 min 12 sec	Infant 1 bouncing in car	yes	yes	no	Maybe, only 2 babies	
05.26.2000 episode 37	3 min 34 sec	In bedroom crawling on top of each other	yes	yes	yes	No	
05.27.2000 episode 38*	6 min 49 sec	Crawling around in pajamas	yes	yes	yes	No	
05.31.2000 episode 39	4 min 24 sec	In living room with Cody	yes	yes	yes	No	
06.02.2000 episode 40	2 min 2 sec	In t-shirts and diapers	yes	yes	yes	No	
06.03.2000 episode 41	1 min 58 sec	Interacting with other people	yes	yes	yes	Yes, other adults and child	Very cute, though!

06.04.2000 episode 42	53 sec	Experimenting with camera effects	?	?	?	Yes, playing with camera	And only one baby and can't tell which one
06.06.2000 episode 43	12 min 16 sec	Babies with curtain, toys, baskets…	yes	yes	yes	No	
06.10.2000 episode 44	43 sec	Playing with cat	yes	yes	Yes	No	
06.11.2000 episode 45	1 min 28 sec	Sitting at kitchen table with food on faces	yes	yes	Yes	No	Nice interactions with mother
06.12.2000 episode 46	39 sec	Baby in crib in dark room, then lighter	no	no	Yes	Yes- only one baby	Film of infant 3 standing in crib for the first time
06.13.2000 episode 47	38 sec	Jolly jumper and car- babies bouncing together	No	yes	yes	No	
06.16.2000 episode 48	2 min	Babies on pretty pillow, then crawling around and playing with things	yes	yes	yes	no	
06.16.2000 episode 49 (undated)	6 min 15 sec	Evening, quiet playing in slightly dark room	Yes?	Yes?	Yes?	Maybe- light quality poor	Hard to tell which baby is which, one baby in crib

*episode contains previously analyzed excerpt (although analysis not completed for this age group, so all excerpts might be OK)

Description of all home video data, 9-12 months

Excerpt name	length	description	Babies			Any reason to exclude automatically?	Other comments
			Infant 2	Infant 1	Infant 3		
6.19.2000 episode 1	2 minutes	Babies in sleepers, drinking from bottles	yes	yes (but not much)	yes (the most)	no	Doesn't look like a lot of overtures
6.20.2000 episode 2 (no date stamp)	21 minutes 43 sec	Crawling around at bedtime and mauling their dad	yes	yes	Yes	no	Fun interactions with dad
6.22.2000 episode 3	2 minutes 24 sec	Balloons in dimly lit kitchen	yes	yes	Yes	Yes- light quality poor	Don't think there are any infant-parent interactions either
6.23.2000 episode 4	33 sec	Getting clothes off of the change table	yes	yes	Yes	no	Don't think there are any interactions
6.28.2000 episode 5	1 minute 23 sec	Bath-time, lots of splashing	yes	yes	Yes	no	Check out the synchrony between infants 2 and 3! Check who is following whom…
6.29.2000 episode 6	42 sec	Eating pasta at the table	yes	yes	yes	no	no
6.30.2000 episode 7	37 sec	Kitchen activities	yes	yes	yes	no	no
7.02.2000 episode 8	4 minutes 33 sec	Blue rattle on infant 1's finger; attack of the killer babies	yes	yes	yes	no	Looks like lots of little interactions
7.04.2000 episode 9	1 minute 53 sec	Out on the patio, infant 2 standing; infant 1 bouncing	yes	yes	no	Maybe- no infant 3	Check if he is bouncing or if Leslie is
7.06.2000 episode 10	1 minute 32 sec	Sitting at table; burbling; "hi daddy"	yes	yes	yes	No	no
7.08.2000 episode 11	39 sec	Babies in living room	yes	yes	yes	No	Not many interactions
7.08.2000 episode 12 (no date stamp)	2 minutes 4 sec	Infant 3's diaper rampage and bedtime attack on mum	yes	yes	yes	No	No
7.09.2000 episode 13	46 sec	Babies in living room	yes	yes	yes	no	no
7.12.2000 episode 14	58 sec	Babies in laundry basket	yes	yes	yes	no	no
7.18.2000 episode 15	24 sec	Eating ice cream	yes	yes	yes	no	no
7.20.2000 episode 16	1 minute 54 sec	Babies in high chairs bouncing their cheerios	yes	yes	yes	no	Nice for comparison across babies
7.21.2000 episode	54 sec	Drinking water from someone	yes	yes	yes	Yes- other adult	No

17		else					
7.28.2000 episode 18	2 minutes 17 sec	Babies in play pen, lots of crying	yes	yes	yes	no	Lots of infant-infant interaction
8.01.2000 episode 19	6 minutes 56 sec	Babies playing in curtains in living room	yes	yes	yes	Maybe- quite dark	no
8.12.2000 episode 20	2 minutes 21 sec	Eating apples	yes	yes	yes	no	Can look at how babies ask for things
8.16.2000 episode 21*	18 minutes 40 sec	Out on the patio; infant 3 and infant 1 in box (aww excerpt)	yes	yes	yes	no	no
8.18.2000 episode 22	47 sec	Playing with cats in the kitchen	yes	no	yes	Maybe- no infant 1	No
8.20.2000 episode 23*	4 minutes 11 sec	In kitchen, walking, playing behind curtain (video babies excerpt)	yes	yes	yes	No	Note there is a small break in the middle
8.26.2000 episode 24	2 minutes 53 sec	Babies talking on the floor, “itsy bitsy spider”	yes	yes	yes	No	Look at gestures!
8.29.2000 episode 25	1 minute 23 sec	Babies in highchairs; boys crying	yes	yes	yes	No	Everyone looks tired and unhappy- doesn’t look like any interactions
9.01.2000 episode 26	3 minutes 25 sec	Boys on the table, infant 2 on dad’s lap watching teletubbies	yes	yes	yes	No	no
9.03.2000 episode 27	4 minutes 43 sec	Bouncing in crib; crawling all over each other	yes	yes	yes	no	Cute interactions with mum
9.09.2000 episode 28	7 minutes 25 sec	With the family (?) to celebrate first birthday	yes	yes	yes	Yes- other adults, children	Notice how babies are less themselves around lots of people
9.10.2000 episode 29*	3 minutes 6 sec	Infant 3 “don’t hit him on the head”	yes	yes	yes	no	Not much left after excerpt removed
9.10.2000 episode 30 (no date stamp)	4 minutes 17 sec	Babies in diapers, lots of squealing	yes	yes	yes	no	Hard to tell which baby is screaming
9.11.2000 episode 31*	2 minutes 41 sec	Birthday package from Grandma	yes	yes	yes	no	no
9.12.2000 episode 32*	1 minute 36 sec	In the tub; standing babies	yes	yes	yes	no	Nothing left once excerpt removed
9.16.2000 episode 33	3 minutes 11 sec	Another birthday party	yes	yes	yes	Yes- other adults, children	Notice how babies are less themselves around lots of people

9.17.2000 episode 34	2 minutes 48 sec	Out in the garden	yes	yes	yes	Yes- filmed from far away	Audio poor- but check out interactions with Cody

*episode contains previously analyzed excerpt

Description of all home video data, 12-16 months

Excerpt name	length	description	Babies			Any reason to exclude automatically?	Other comments
			Infant 2	Infant 1	Infant 3		
9.20.2000 episode 35	1 min 15 sec	Babies playing	yes	yes	Yes	no	no
9.21.2000 episode 36*	2 min 4 sec	Babies in the couch	yes	yes	Yes	no	Previously analyzed excerpt right at the beginning
9.22.2000 episode 37	1 min 26 sec	On couch watching TV, Can you walk to mummy?	yes	yes	Yes	no	Interesting reaction from Infant 2
9.24.2000 episode 38	1 min 8 sec	Babies in high chairs drinking milk from cups	yes	yes	Yes	no	no
9.24.2000 episode 39* (undated)	5 min 43 sec	Getting ready for bath, lining up at door, in bath	yes	yes	Yes	no	Here you can finally see how the tickling game started!!
9.30.2000 episode 40*	2 min	Infants 2 and 3 on truck, 3 and 1 later	yes	yes	Yes	no	no
10.03.2000 episode 41	5 min 7 sec	Eating in highchairs, very big mess!	yes	yes	Yes	no	no
10.06.2000 episode 42	1 min 20 sec	Kleenex everywhere, in kitchen	yes	yes	Yes	no	no
10.07.2000 episode 43	3 min 6 sec	In highchairs eating yoghurt, all over face	yes	yes	Yes	no	Divided where they forgot camera was on
10.07.2000 episode 44 (continuation of 43)	6 min 22 sec	Forgot camera was on	no	no	no	Yes- no babies	Just the cracker boxes and toys
10.15.2000 episode 45	33 sec	Walking into kitchen	yes	yes	yes	no	no
10.17.2000 episode 46	1 min 19 sec	Watching TV, exploring the living room	yes	yes	yes	no	No
10.17.2000 episode 47* (undated)	4 min 14 sec	Tickling episode in living room, naked babies	yes	yes	yes	no	Much longer than original clip
10.29.2000 episode 48	11 min 6 sec	Outside in garden playing with rocks, balls, car	yes	Yes	yes	No, but check audio	Check audio quality, might be OK
10.31.2000 episode 49*	2 min 50 sec	Boys on couch with empty bottles	yes	yes	yes	no	no
11.04.2000 episode 50	6 min 58 sec	Out in the field	yes	yes	yes	Yes- other adults	Very lovely scene, though
11.07.2000 episode 51	1 min 9 sec	Naked babies getting ready for bed	yes	yes	yes	no	
11.12.2000 episode 52*	2 min 9 sec	Handsome Infant 1 with headband	yes	yes	yes	Yes- other adult	Also previously analyzed
11.12.2000 episode 53	2 min 34 sec	Getting ready for bath, in	yes	yes	yes	maybe- other adult	But very brief, could be

(undated)		bath						edited out
11.12.2000 episode 1 (undated)	45 sec	Bathing	yes	yes	yes		Yes- just last 45 sec of episode 53	no
11.13.2000 episode 2	35 sec	Naked babies getting ready for a bath	yes	yes	yes		no	no
11.13.2000 episode 3 (undated)	2 minutes 52 sec	babies in housecoats, crying Infant 1	yes	yes	yes		Yes- no permission	No- although interesting reactions to name being called to get attention…
11.15.2000 episode 4	2 minutes 3 sec	Watching TV, playing with cups	yes	yes	yes		no	Not a lot of interactions mostly quiet playing
11.15.2000 episode 5 (undated)	9 sec	Dark room	?	?	?		Yes- too short, too dark	no
11.19.2000 episode 6	13 sec	Infant 2 brings blanket	yes	no	no		Yes- too short, only one baby	no
11.20.2000 episode 7	3 minutes 21 sec	Infants 3 and 1 unpacking box of clothes, Infant 2 & dad dancing	yes	yes	yes		no	Hard to tell boys apart at first
11.21.2000 episode 8	10 sec	Calling infant 3	no	no	yes		Yes- too short	Focused too much on Infant 3?
11.22.2000 episode 9	42 sec	Babies getting into diaper genie and watching TV	yes	yes	yes		no	Cute dog moment
11.26.2000 episode 10	38 sec	In highchairs, jumping up and down	yes	yes	yes		no	No
11.27.2000 episode 11	19 sec	Playing in curtain	yes	yes	yes		no	No
11.28.2000 episode 12	49 sec	Babies getting into Kleenex	yes	yes	yes		no	No
11.28.2000 episode 13	10 minutes 33 sec	Naked babies throwing clothes	yes	yes	yes		No	Too cute!
11.30.2000 episode 14	2 minutes 49 sec	Spaghetti all over babies; standing in highchairs	yes	yes	yes		no	Also extremely cute
12.03.2000 episode 15	41 sec	Going to park in buggy	yes	yes	yes		no	No
12.08.2000 episode 16	21 sec	Rubbing hands in oatmeal	yes	yes	yes		no	No
12.10.2000 episode 17*	3 minutes 52 sec	Blankie and bottle; mittens	yes	yes	yes		No	previous cut-off is interesting…
12.12.2000 episode 18	3 minutes 11 sec	Outside in little jackets, all in little vehicles; baby highway	yes	yes	yes		maybe- can't hear much	A little hard to tell boys apart because have same jackets
12.13.2000 episode 19	7 minutes 55 sec	Carrying around clothes, putting in cupboard	yes	yes	yes		no	No
12.15.2000 episode 20	1 minute 8 sec	Christmas message for father	yes	?	?		Yes- too personal	Interactions would also be strange
12.15.2000 episode 21	14 sec	Infant 2 pulling a toy; infant 3	yes	no	yes		maybe	no

(undated)		crying					
12.16.2000 episode 22	1 minute 20 sec	Rainbow then infant 2 with teddy	yes	yes	yes	no	No
12.17.2000 episode 23	2 minutes 14 sec	Playing in living room with family	yes	yes	yes	Yes, other adults	no
12.17.2000 episode 24	1 minute 2 sec	Listening to music	yes	no	no	Maybe, not enough babies	no
12.18.2000 episode 25	18 sec	Watching TV together	yes	no	yes	Maybe, not enough babies	no
12.19.2000 episode 26	22 sec	In box getting pushed around	yes	yes	No?	Maybe, not enough babies	no
12.21.2000 episode 27	50 sec	In bedroom, climbing on furniture	yes	yes	yes	no	No interactions?
12.24.2000 episode 28	2 minutes 19 sec	Pulling presents around	yes	yes	yes	Yes, other adult	Adult is not really visible or identifiable…
12.25.2000 episode 29	29 sec	Pulling chairs around	yes	?	?	No, but dark	Can hear another adult
12.27.2000 episode 30	11 sec	Cody sleeping	no	no	No	Yes, no babies	No
12.29.2000 episode 31	23 sec	Sitting at little table	yes	no	no	Maybe, not enough babies	No
01.01.2001 episode 32	1 minute 48 sec	Eating at highchair	yes	yes	yes	no	No
01.03.2001 episode 33	26 sec	Sitting at little table	yes	yes	yes	no	no
01.04.2001 episode 34	1 minute 52 sec	Infant 1 climbing shelf, babies at kitchen sink	yes	yes	yes	no	no

*episode contains previously analyzed excerpt

Summary by age

Birthday: September 12, 1999

Age range	Approximate age	Days							Month
6-9 months	6 months	12	13	14	15	16	17	18	March 03 (31)
	6 months, one week	19	20	21	22	23*	24	25	
	6 months, two weeks	26	27	8	29	30**	31	1	April 04 (30)
	6 months, three weeks	2	3	4	5	6	7	8	
	7 months	9	10	11	12	13	14	15	
	7 months, one week	16	17	18	19	20	21	22	
	7 months, two weeks	23	24	25	26	27	28	29	May 05 (31)
	7 months, three weeks	30	1	2	3	4	5	6	
	8 months	7	8	9	10	11	12	13	
	8 months, one week	14	15	16	17	18	19	20	
	8 months, two weeks	21	22	23	24	25	26	27	
	8 months, three weeks	28	29	30	31	1	2	3	June 06 (30)
	8 months, four weeks	4	5	6	7	8	9	10	
	9 months	11	12	13	14	15	16	17	
9-12 months	9 months, one week	18	19	20	21	22	23	24	
	9 months, two weeks	25	26	27	28	29	30	1	July 07 (31)
	9 months, three weeks	2	3	4	5	6	7	8	
	10 months	9	10	11	12	13	14	15	
	10 months, one week	16	17	18	19	20	21	22	
	10 months, two weeks	23	24	25	26	27	28	29	
	10 months, three weeks	30	31	1	2	3	4	5	August 08 (31)
	11 months	6	7	8	9	10	11	12	
	11 months, one week	13	14	15	16	17	18	19	
	11 months, two weeks	20	21	22	23	24	25	26	
	11 months, three weeks	27	28	29	30	31	1	2	Sept 09 (30)
	11 months, four weeks	3	4	5	6	7	8	9	
	12 months ONE YEAR	10	11	12	13	14	15	16	
12-16 months	12 months, one week	17	18	19	20	21	22	23	
	12 months, two weeks	24	25	26	27	28	29	30	
	12 months, three weeks	1	2	3	4	5	6	7	Oct 10 (31)
	13 months	8	9	10	11	12	13	14	
	13 months, one week	15	16	17	18	19	20	21	
	13 months, two weeks	22	23	24	25	26	27	28	
	13 months, three weeks	29	30	31	1	2	3	4	Nov 11 (30)
	13 months, four weeks	5	6	7	8	9	10	11	
	14 months	12	13	14	15	16	17	18	
	14 months, one week	19	20	21	22	23	24	25	
	14 months, two weeks	26	27	28	29	30	1	2	Dec 12 (31)
	14 months, three weeks	3	4	5	6	7	8	9	
	15 months	10	11	12	13	14	15	16	
	15 months, one week	17	18	19	20	21	22	23	
	15 months, two weeks	24	25	26	27	28	29	30	
	15 months, three weeks	31	1	2	3	4***	5	6	Jan 01 (31)
	16 months	7	8	9	10	11	12	13	
	16 months, one week	14	15	16	17	18	19	20	
	16 months, two weeks	21	22	23	24	25	26	27	

*first excerpt

**first useable excerpt

***last useable excerpt

APPENDIX F: MANUAL FOR STUDY II

Definitions, Rules, and Analysis sheets for

- Stage 1: Overture location
  - Definitions, rules
  - Additional guidelines and decision trees
  - Blank analysis sheet

- Stage 2: Overture Division
  - How to fill in analysis sheets
  - Overture functions: Guidelines
  - Overture functions: operational definitions
  - Hints for functions (form vs. function)
  - Decision tree for “name only” overtures
  - Summary table of functions
  - Blank analysis sheet

- Stage 3: Agent Visibility analysis: Modality feasibility analysis

- Stage 4: Response analysis
  - General definition
  - Specific definition for each overture type
  - Decision tree
  - How to make analysis sheets
  - Blank analysis sheet

- Stage 5: Pre-overture behaviors analysis
  - Definitions and rules
  - Decision tree
  - How to make analysis sheets
  - Blank analysis sheet

Stage 1: Locating Overtures to babies in all clips

Purpose: **to find all the episodes (i.e., periods of time) for each baby when an adult overtly directs his or her behavior towards the baby**

Operational definition: An *overture* is a period of time where one or more adults are making some sort of social contact (verbal and/or nonverbal) with one baby.

- **Examples of verbal overtures**: Calling the baby's name, saying something specific about the baby's situation "oh what a beautiful boy", making vocalizations to that baby…
  - E.g., 9-12:5, overture 6 "Did your face go into the water, a little bit?"
  - E.g., 12-16:2, overture 11 "oh [name]"
- **Examples of nonverbal overtures**: Touching; smiling; giving the baby something; reaching out; playing with baby; moving baby…
  - E.g., 12-16:1, overture 9- father picks up baby and puts him on the couch
- **Overtures are often simultaneously verbal and nonverbal**
  - E.g., 9-12:5, overture 5- mother says "monkeyhead" playfully while touching baby's head with a toy
- **Additional criterion:**
  - If the baby is not visible, do not record the overture.
  - Overtures directed to all three babies should not be included- only record ones that are directed to one baby
  - The baby must be able to somehow experience the behavior for it to be considered an overture. That is, whatever the behavior is, only record it if the baby could see, hear, or feel it. (E.g., if the adult is behind the baby and reaching out towards him or her, it should not be considered an overture.)
  - Sometimes a candidate overture occurs in only one modality (i.e., only words or only a touch), which can make it difficult to classify as an overture or not. For detailed rules and a decision tree to use for consistent classification in these cases, see the document: "detailed rules and decision trees for identifying overtures".

Materials:

Require timeline ("Template for babies"), which is two pages, one for each half minute. If you are using .avi files (i.e., if you are using Broadway), you need the timeline in frames; if you are using .mpg files (i.e., you are using Elan), you need the timeline in milliseconds.

Procedures:

1. Gather the number of timeline sheets you'll need based on the length of the clip (two sheets per minute). Make sure you know which sheet is the first half of the minute and which is the last half! ☺
2. Mark end of the action in the clip (where filming ends) with a vertical line in the appropriate spot across the three horizontal lines. Note exact time.
3. Label the sheets with the name of the clip (.mpg filename), the minute (0,1,2), date of analysis, and your name.
4. Write a description on your sheet that will differentiate among the three babies. Do not use their actual names, please only record them by number.* (Number in the alphabetical order of their names.)
5. Add page numbers (page X of Y)
6. Watch clip first from beginning to end once or twice to familiarize yourself with the context and activities.

Analysis:

- Using the above definitions and criteria for overtures (and decision tree, if necessary), record above the timeline where the overture episode begins and ends (note exact times).
- Connect the two times with a double line.
- Write above the double line what the overture is (e.g., if it is words, write the exact words, if it is touching, write touching, etc.) What you record here does not have to be exact and complete- it is more of a reference for later stages.
- If the overture includes the baby's name, just put [name] in the place of the actual name*
- The overture episode may be sustained for a period of time. You should break it into separate overtures based on any gaps in time (even if they are less than a second). Keep in mind that in Stage 2b, the analysis will serve to divide them based on additional criteria, so only divide them based on temporal gaps (i.e., periods of time where there is no overture occurring).
- If there is an additional overture from a second adult, include it in the same place. Again, it will be separated and divided later.
- When you are done, number the overtures on that sheet, preferably in another color. Number in the order that the overtures happen, regardless of which infant is the recipient.
- If you something looked like an overture, but then you decided that it wasn't based on a particular rule or aspect of the situation, then please make a note on the sheet. (E.g., "overture to two babies", or "mother talking to father"). This will help later if there is a disagreement or if the overture is questioned in a later analysis (i.e., the overture wasn't missed, someone saw it decided it wasn't an overture by the operational definition).

Agreement at this stage will be based on agreeing (1) that an overture is occurring, AND (2) to which infant the overture is directed

*We are avoiding writing baby names on the analysis sheets for ethical reasons.

Additional Guidelines for Stage 1: Detailed Rules for Identifying "One-Modality" Overtures

Most candidate overtures are a combination of modalities (i.e., words/vocalizations and actions) integrated into a meaningful social act towards a baby. Usually when they are integrated, and especially when seen in context, it is very clear that the adult is trying to engage with one of the babies. When the adult is using more than one modality, you will likely not need a decision tree.

Sometimes, however, a candidate overture will occur in only one modality (e.g., a single touch, a few words, just laughing, or a glance), and each of these modalities has characteristics that can include or exclude the action as an overture, according to our particular definition. For one-modality candidate overtures, therefore, there are two types of decisions: One for **actions** and one for **words, laughing, and vocalizations.** Although these distinctions are somewhat artificial, they may be helpful in cases where you are not sure whether to consider the adult's behavior an overture.

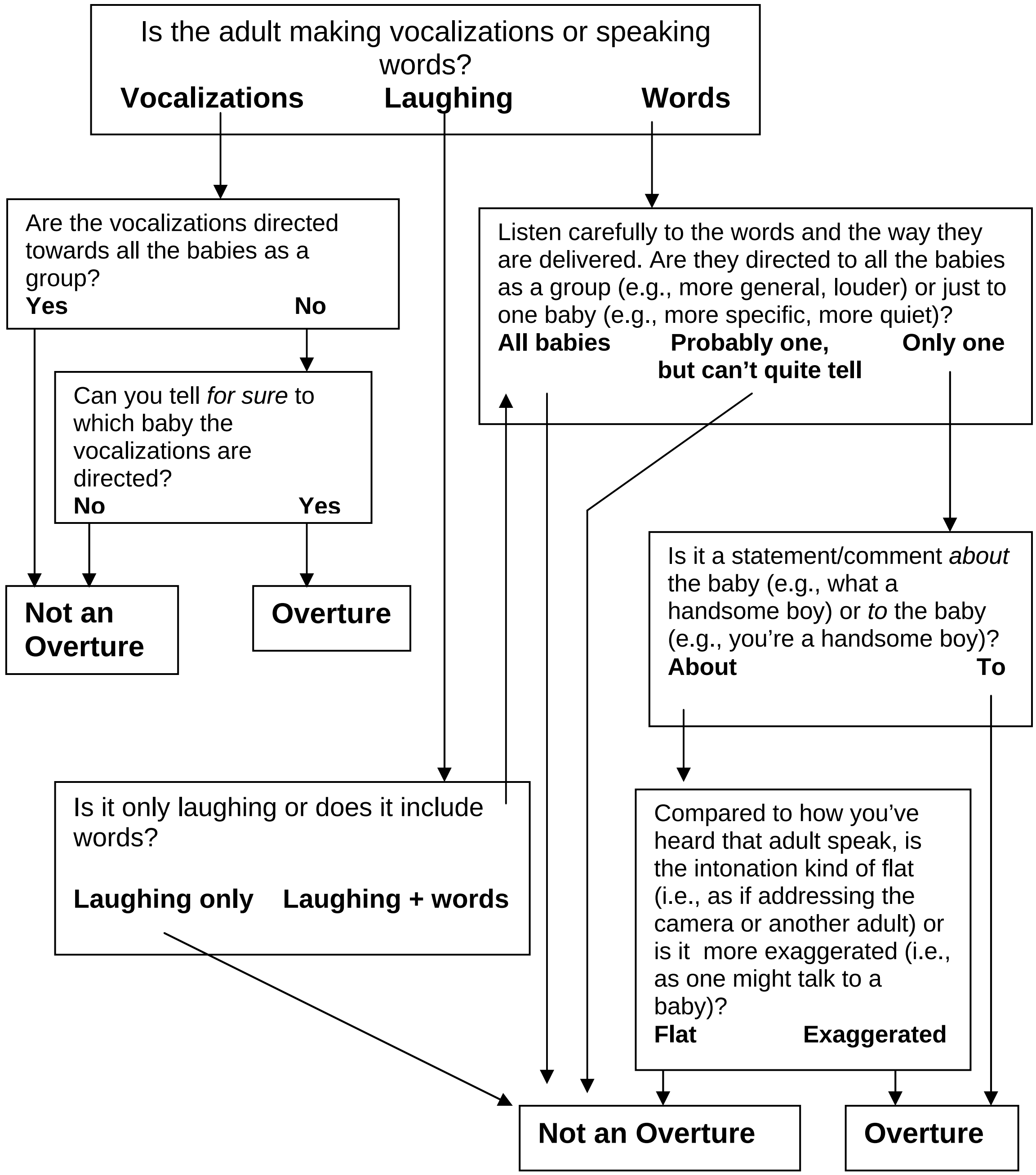
Overtures Decisions: Actions

Candidate action…	**OVERTURE**	**NOT AN OVERTURE**
Looking at baby, attempting to make eye contact*	If it is exaggerated (stylized) and it is something the baby can see	If the baby cannot see it
Touching the baby	Only if the adult is doing some touching that represents a change (e.g., short episodes of touching- repeated OK)	If the adult is touching the baby the whole time (e.g., holding the baby)
Almost touching the baby	If and only if… • the baby *can see* the almost-touching • AND it is clearly a part of the ongoing interaction (e.g., teasing by touching, touching, almost touching- as with tickling…)	• If the baby cannot see the almost touching; • OR if the adult's action is anticipatory, that is, it is preparation for a touch that might be necessary (e.g., to

		keep the baby from falling)
Touching or moving objects around the baby	If and only if… • the object action is directed towards only one baby • AND that baby can see the adult acting with that object • AND the object action is an integral part of the interaction (e.g., waving mittens towards a baby as an offering)	• If the object action pertains to all babies; • OR if the baby to whom it is directed cannot see it; • OR if the object action is incidental to the interaction (e.g., moving a book or toy to get it out of the way).

*You probably will not be able to see if the adult and baby actually make eye contact, but sometimes an adult seems to try to make eye contact by purposefully moving his or her head around to orient towards the child.

Overtures Decisions: Words and Vocalizations



Identifying Overtures (BLANK ANALYSIS SHEET)

Clip name____________________ Minute ________________ Date___________ Analyst ___________ p. __ of __

Baby 1___________________ Baby 2_____________________ Baby 3___________________________

1

0	.50	1	1.50	2	2.50	3	3.50	4	4.50	5	5.50	6	6.50	7	7.50	8	8.50	9	9.50	10

2

0	.50	1	1.50	2	2.50	3	3.50	4	4.50	5	5.50	6	6.50	7	7.50	8	8.50	9	9.50	10

3

0	.50	1	1.50	2	2.50	3	3.50	4	4.50	5	5.50	6	6.50	7	7.50	8	8.50	9	9.50	10

1

10	10.50	11	11.50	12	12.50	13	13.50	14	14.50	15	15.50	16	16.50	17	17.50	18	18.50	19	19.50	20

2

10	10.50	11	11.50	12	12.50	13	13.50	14	14.50	15	15.50	16	16.50	17	17.50	18	18.50	19	19.50	20

3

10	10.50	11	11.50	12	12.50	13	13.50	14	14.50	15	15.50	16	16.50	17	17.50	18	18.50	19	19.50	20

1

20	20.50	21	21.50	22	22.50	23	23.50	24	24.50	25	25.50	26	26.50	27	27.50	28	28.50	29	29.50	30

2

20	20.50	21	21.50	22	22.50	23	23.50	24	24.50	25	25.50	26	26.50	27	27.50	28	28.50	29	29.50	30

3

20	20.50	21	21.50	22	22.50	23	23.50	24	24.50	25	25.50	26	26.50	27	27.50	28	28.50	29	29.50	30

Identifying Overtures

Clip name___________________ Minute _______________ Date__________ Analyst __________ p. __ of __

Baby 1__________________ Baby 2____________________ Baby 3_________________________

1

30 30.50 31 31.50 32 32.50 33 33.50 34 34.50 35 35.50 36 36.50 37 37.50 38 38.50 39 39.50 40

2

30 30.50 31 31.50 32 32.50 33 33.50 34 34.50 35 35.50 36 36.50 37 37.50 38 38.50 39 39.50 40

3

30 30.50 31 31.50 32 32.50 33 33.50 34 34.50 35 35.50 36 36.50 37 37.50 38 38.50 39 39.50 40

1

40 40.50 41 41.50 42 42.50 43 43.50 44 44.50 45 45.50 46 46.50 47 47.50 48 48.50 49 49.50 50

2

40 40.50 41 41.50 42 42.50 43 43.50 44 44.50 45 45.50 46 46.50 47 47.50 48 48.50 49 49.50 50

3

40 40.50 41 41.50 42 42.50 43 43.50 44 44.50 45 45.50 46 46.50 47 47.50 48 48.50 49 49.50 50

1

50 50.50 51 51.50 52 52.50 53 53.50 54 54.50 55 55.50 56 56.50 57 57.50 58 58.50 59 59.50 60

2

50 50.50 51 51.50 52 52.50 53 53.50 54 54.50 55 55.50 56 56.50 57 57.50 58 58.50 59 59.50 60

3

50 50.50 51 51.50 52 52.50 53 53.50 54 54.50 55 55.50 56 56.50 57 57.50 58 58.50 59 59.50 60

<u>Stage 2: Dividing Overtures to babies in all clips</u>

<u>How to fill in "dividing overtures" analysis sheet</u>:

You will be doing 5 analyses on the same sheet. We will be checking reliability after each analysis.

1. The agent is who is doing the overture. It will either be the infants' mother or the infants' father. Should the overture be divided by *agent* (i.e., the mother does some of the overture and the father does some)?
    a. If you don't think so, circle N next to "by agent?"
    b. If you do think so, circle Y next to "by agent?"
        i. Put a vertical line through the agent row that extends as well through the function, modality, and new number rows for that overture.
        ii. Write the time where you think it should be divided in that overture's row in the times column.

2. Who is the overture's agent?
    a. Identify the agent (mother or father) for each overture, including the ones that were divided. Write your decision under the overture in the agent row

3. Should the overture be divided by *function*? (See OVERTURE FUNCTIONS definitions)
    a. Be sure to include all overtures, there might be more that one if some were previously divided by agent.
    b. If you don't think so, circle N next to "by function?"
    c. If you do think so, circle Y next to "by function?"
        i. Put a vertical line through the function row that extends as well through the modality and new numbers row for that overture.
        ii. Write the time where you think it should be divided in the times column.

4. What is the overture's function?
    a. Identify the function of each overture, including the ones that were divided. Write your decision under the overture in the function row.

5. Should the overture be divided by *modality*?
    a. Be sure to include all overtures, there might be more if some were previously divided by agent or function.
    b. If you don't think so, circle N next to "by modality?"
    c. If you do think so, circle Y next to "by modality?"
        i. Put a vertical line through the function row that extends as well through the new numbers row for that overture.
        ii. Write the time where you think it should be divided in the times column.

<u>For final overture identification</u>: (not for reliability, just reference)
Use overture's original number (e.g., "1"), add a letter prefix (e.g., "1a; 1b") to reflect the number of overture divisions.

Each overture should have a single agent and function.

OVERTURE FUNCTIONS: GUIDELINES

Part of the theoretical framework for this project is that each adult overture *projects* a range of expected behaviors from the infant. Each overture is like a proposal for the baby to do something. In other words, each overture is serving a particular function in the interaction.

To decide what the function of an overture is, you need to take into account what has been going on in the interaction as well as what the specific situation is. You'll also need to consider aspects of the overture itself. What is being said or being done? How is it being said? Given what is happening in the interaction (the context), what is the function of the adult's overture towards the baby?

Use the following guidelines, definitions, the overture itself, and its context, identify and note the function of the behavior. If the adult seems to be changing the function of the overture part way through it, divide the overture at the point where the function changes and label the two new overtures accordingly. *(Note that we will do reliability first on whether we agree that the overture should or should not be divided, and only then on the specific function of the overture.)*

Guidelines:

When doing this analysis, there are a few points about which to be very careful:

1. **The overture's function is not based on what the infant does after the overture:** The functions stipulated below are based on identifying what you think the overture is projecting, or what might be an expected response. Although it would therefore be tempting to use the baby's response (or not) as criteria for identifying the overture's function, it is important that you identify the function regardless of the baby's behavior following the overture. Sometimes babies will respond as expected, sometimes they won't. Their actual behavior following overtures is irrelevant at this stage of analysis.
2. **Function is not intention:** Do not confuse the *function* of the overture with the adult's *intentions*. Keep your analysis of function at the level of observable behaviors, particularly as the baby would be experiencing them (i.e., not at the level of the adult's intentions and motives). For example, when tickling, it may appear from your perspective that the adult intended the tickle to distract the baby from something else (i.e., you can infer that the adult has an ulterior motive). However, the function of the tickling, from the infant's point of view, is fun and playful. So tickling, in such a situation, should be considered fun and playful.
3. **Functional, not categorical:** Yes, there are categories stipulated below that we will try to assign to overtures, but these categories are not based

on physical properties of the overtures. They are based on identifying the function of each overture in the interaction. Utterances or actions can look the same but be serving different functions. For example, saying the baby's name could be part of a greeting OR it could be a way of getting the baby's attention. Poking a baby could be a teasing, playful action OR it could be a way of getting the baby's attention. An overture that looks like a directive on paper, when seen in context is actually playful. You must rely on the immediate context of the interaction to distinguish between the two. Just as it would be a mistake to consider a greeting an attempt to get the baby's attention, it would be a mistake to classify playful overtures as directing ones.

4. **Listen to adult's tone:** Not just the interactional context but the adult's tone is an indicator of function (e.g., it helps to differentiate between playful comments and directives). Tone can indicate whether or not a function has changed during the overture. For example, the adult might do two things that sound very similar (almost like a repeated melody). These tend to be serving the same function, even if they are different words (e.g., "aw, yeah"). Other times the adult might say things in two different ways. Be alert to abrupt finishes or contrasts in prosody as they tend to indicate that the utterance has changed function.
5. **Words might be important:** If you don't understand the words, and there are no other actions that would help to identify the overture's function, you should note that the function is "not analyzable".

The following four, broad characterizations of overtures differ in the amount of "pull" they have and the range of infant responses that might be appropriate. The first (A) has the strongest pull and predicts the most specific response, (B) has slightly less pull and less predictable responses. The last two (C and D) could be followed by a variety of behaviors, many of which could be predicted by the overture. They differ in that the last overtures (D) could easily and appropriately be followed by no response at all. Three of the broad categories are further subdivided into more specific, related overture functions.

OVERTURE FUNCTIONS: OPERATIONAL DEFINITIONS

<u>Overtures with a strong, specific pull (getting the baby to do something): (A)</u>

This set of overtures are ones that project the infant's behavior in a *specific* way. That is, they are a demand from the parent for the infant to change his or her behavior in a specific way. "Specific" here means that typically there would be *only one appropriate response* to these overtures. For example, if the overture is "[name], look at mummy", you could, regardless of what the infant actually does, infer that the specific *appropriate* response would be for the baby to look towards his or her mother.   If the overture was "sit down", the specific, appropriate response would be for the infant to sit.

Attention seeking (A1)

- *Attention seeking overtures* project the infant's orientation towards the adult.
- The baby might be oriented away from the adult, and the adult is doing something to get the baby to pay attention to him (or her) instead. Some examples:
    - Calling baby's name
        - Usually the name is the only content of the overture, and it is usually followed by a pause.
        - The presence of the baby's name in an overture is not enough for it to be considered attention seeking. [See greeting or directing or narrative for example]
    - Calling baby by a nickname (e.g., "baby"; "little boy") if the nickname is used to get baby's attention
    - Poking baby (not for fun, but to get his or her attention)
- If the baby's name is called before the rest of the overture, and the name flows into the rest of it, do not consider it as a separate overture (i.e., it should not be categorized as an attention seeking overture separately, categorize it with the rest of the overture).
- If there is a pause, then an additional overture, it is more likely that the function is attention seeking.

Directing (A2)

- This is telling the baby to do something
    - Can be to start a behavior (e.g., "come to mummy", "sit down")
    - Can be to stop a behavior (e.g., "stop hitting your brother", "don't touch the lens")
- *Directing overtures* can be somewhat serious, in that there appears to be an expectation of obedience or compliance.
    - Some overtures that seem like directing ones are actually comments (e.g., "oh don't come over, aw…" said in a playful tone does not project compliance.) [see narrative]
- (Note that they don't have to be serious, sometimes directing the baby to do something and meaning it can still be accompanied by laughing.)
- Directing overtures can be nonverbal (e.g., touching). *If the touch can be paraphrased as a command that the baby could reasonably fulfill, then it is probably a directing overture*.
    - E.g., touching a baby's hand to get him to move it off his sister could be paraphrased as "stop touching your sister". This touch would be a directing overture.
    - E.g., moving a baby onto the truck could not be paraphrased as a command: it would seem silly to say to a nine-month old baby "get on the truck". So this touching would not be a directive. [See instrumental]

<u>Other (A3)</u>

- You might see an overture that appears to be strong and specific, but does not seem to be a directing or attention-seeking overture. Just classify it as "other".

<u>Overtures that are for helping the infant (weaker but still specific pull): (B)</u>

- *Helping overtures* seem to be attempts to calm, sooth, or appease a baby. For example, if a baby is crying, the mother might say "S'okay", or the father might say "Oh baby boy".
- The overture seems to be an adult response to a need that the baby has expressed.
- The projected infant response to these overtures would be to calm down, stop crying, etc. Because the infant may have less control over the crying or being upset, these overtures should be considered as having a slightly different kind of pull than directives or attention seeking overtures.
- Sometimes helping overtures take the form of a question (e.g., "what's wrong?"). If the question seems to be in response to distress from the baby, then it should be considered a helping overture.
- When overtures are actions like giving the baby some food, or pushing the bottle towards him or her, they should be considered helping overtures only if they are in response to an observable behavior of the baby that indicated the need. Think of how you might paraphrase the action. For example, if the baby was crying and reaching for the bottle, and the overture is the mother pushing the bottle towards him: If it seems like you could paraphrase the action with "here you go", then it is probably a helping overture. If it is more like "take your bottle!", then it is probably a directing overture.
- When the overture actions are not in response to the infant's distress or request, they should not be considered this type of overture. [See <u>instrumental actions</u> or <u>directing</u> overtures, for example.]

<u>Overtures that predict diverse responses (weaker pull that isn't specific): (C)</u>

These overtures generally occur as part of an ongoing interaction. They have a weaker pull in the interaction (i.e., a response is not absolutely expected) and less predictable responses (i.e., a myriad of responses would be appropriate).

<u>Greeting (C1)</u>

- *Greeting overtures* look like a typical greeting (e.g., hi; hello)
- It may include the baby's name

- Might happen when baby is already looking at adult, but not necessarily.

Playful, whimsical (C2)

- Any motions, noises, etc. that appear to have no purpose but to play and for the infant and parent to *have fun together* (e.g., “tootle-ootle”, or “boop-de-doop” or blowing a raspberry to the baby)
- Can be playful touching, such as tickling, playfully poking, dripping water on baby.
- Can be playful actions with objects around the baby that aren’t serving any other function but to play.
- The overture can be an implicit invitation to interact playfully, as long as it isn’t already clearly categorized elsewhere.
- Playful overtures tend to initiate interaction (but they don’t have to).
- When they are nonsense words or little random noises, they can be generic, that is, they can be pretty much interchangeable (e.g., blowing a raspberry or saying boop-de-doop) could be exchanged without changing the meaning of the overture.

Conversational (C3)

- Sometimes the adult *acts as if* a dialogue is occurring and as if the baby used words to ask something or said something. The adult’s overture appears to be an answer to the baby. For example, after hearing the infant “say something”, the mother might say “that’s right, you do that”, or “Yeah, I agree completely”.
- *Conversational overtures* are somewhat rare, but they occur often enough to deserve being considered separate from other overtures.
- Not every interactive exchange is a conversational overture. Look for exchanges that look like a dialogue, even though the baby’s part isn’t actual words.
- For example, if the overture is “yeah”, listen to how it is said. If it is said as though the adult is saying “how cute”, then it is probably a narrative overture (see below). If it is said with a rising intonation, as though the baby just said something interesting, then it is probably a conversational one.

Rewarding (C4)

- If the overture is an explicit positive response to the baby doing something (either that the baby was supposed to do or that the baby did on his or her own) (e.g., sitting when asked to sit), then it is a *rewarding overture*.
- Some examples are “good girl”, or “thank you” or nodding in response to compliance.
- Other examples are “yes” when the baby shows the parent something.
- Rewarding overtures are always positive and must be preceded by the baby doing something to which the overture is referring.

<u>Overtures where a lack of response is an option (potentially neutral- no particular pull, no specificity): (D)</u>

These are overtures where no response from the infant would just as easily be predicted as a diverse range of responses. Don't make your decision based on a lack of response from the infant!!! Consider the overture, if you think the infant could just as easily do nothing after it, then it might have a narrative or instrumental function. Make sure, however, that you have ruled out all the C options first.

<u>Narrative (D1)</u>

- These are comments to baby that have a slightly narrative function (remember that exclusively narrative comments have been removed) as well as at least some interactive function.
  - Can be a statement about the current state of affairs ("it's a soft blankie, [name]"; "oh don't come over" said playfully);
  - an assessment of things ("oh oh" in response to a fall);
  - or an expression related to what is happening ("oh oh"; "aw")
  - or a personal response of the parent.
- Sometimes *narrative overtures* sound like questions. But make sure you can distinguish between different functions of questions.
  - If the adult already knows the answer to the question, then it is <u>narrative</u>. (E.g., "you dancing?" or "you jumping?" or "you got your bottle and blankie?")
  - However, if the question is about the baby's opinion or feelings (and can perhaps still be answered "yes"), then it is <u>conversational</u>. (E.g., "you like that?" or "you want a bottle?")
  - And if the answer to the question is an action that the parent is trying to get the child to do (as in "will you sit down?"), then consider it a <u>directing</u> overture.
- Sometimes little noises are narrative in function. They tend to be narratives when they are in response to something that the baby is doing, e.g., making a little scream or noise when the baby is rushing up to the parent.

<u>Instrumental (D2)</u>

- *Instrumental actions* seem to be only to accomplish something that has to be done and there doesn't appear to be any social interactive component to it.
- Typically instrumental actions occur in task-oriented situations, that is, situations where the parent has to perform a task involving the baby, such as feeding a baby, repositioning him or her, taking a toy that the baby is about to drop, etc.

- Usually instrumental actions have no words, if what you think is an instrumental action has words, make sure it wouldn't be better classified as a kind of social overture.
- If it is an action the involves touching the baby, the baby is almost treated as an object, for example, moving the baby from one place to another.
    - Note that if there are words as well, it is probably not just instrumental and should be categorized as the other function.
- Note that there are two kinds of instrumental actions (between which we are not distinguishing).
    - One kind includes an implicit (not overtly stated) request for co-operation or co-ordination from the infant (e.g., even if there are no words, putting a spoonful of food in the infant's mouth includes an implicit request for the infant to open his or her mouth and take the food.)
    - The other kind has little to no unstated requests for co-operation, because little is required (e.g., moving a baby or taking a toy away that the baby is about to drop).
- If it is an action with an object around the baby, make sure it is one that does not have an interactive component.
    - E.g., pushing the juice away from the baby *without saying anything* would be an <u>instrumental action</u>. Pushing the juice away from the baby *while saying "don't touch that"* would be a <u>directing</u> overture.
    - E.g., pushing the juice towards a baby when the baby "asked" for it (by reaching or crying) is a <u>helping</u> overture, but pushing it towards the baby without any implicit request from the baby is an <u>instrumental action</u>.
- Note that sometimes it is necessary to see the context to decide between an instrumental or other kind of overture, but even if you can't see the context in detail, broad contextual cues can direct your choices.
    - For instance, if the situation is task oriented, and the parent doesn't say anything, it might possibly be an instrumental action.
    - But if the broad situation is more playful, and the parent is doing an action without words that doesn't have to be done (i.e., it isn't a "task"), then it might be a different kind of overture.

HINTS FOR FUNCTIONS (form vs. function)

Some overtures appear the same in form or physical properties (e.g., saying the baby's name), but they are actually serving different functions (e.g., greeting vs. seeking attention).

The following are some criteria for differentiating among overtures that are the same formally but different functionally. You'll notice that the criteria draws almost entirely on the overture's immediate context.

<u>Poking the baby</u>:

- Is it to get the baby's attention? = A1
- Is it a playful contact? = C2

<u>Asking a question</u>:

Careful!! Questions are hard! Think about what the parent is saying in the overture and how the infant might answer it.

- Is all the information in the overture what the parent can clearly see as the current situation? (E.g., "you eating spaghetti?" when the parent can see the infant is eating spaghetti or "you've gotta book?" when the infant is holding a book), then the parent is labeling the situation for the baby = D1
- Is it a question about the current situation that the parent can't know and that the baby might possibly know but *can't possibly answer*, such as infant-directed commentary of what is happening? (E.g., "how did you get up there, baby?") = D1
- Is it a question about the current situation that the parent can't know and that the baby would know (e.g., the baby's opinion or inner situation) and that the baby *could indicate* somehow? (E.g., "you enjoying the spaghetti?" or "you like that?" could be answered with a smile or wiggle of affirmation, "you wanna piece of bread?" could be answered with reaching for the bread) = C3
    - Note that what differentiates this from a D1 question is that the baby could reasonably answer these questions by indicating (nonverbally) his or her preference or feelings. E.g., "you wanna go on the swing?" could be answered with reaching for the swing.
    - NOTE: "you enjoying the spaghetti" or "you like that" *without questioning syntax or rising intonation* would be D1, because it is a statement about the situation, *not a question*.
- Is the question an indirect request where the parent seems to be expecting compliance? (E.g., "you wanna sit down now?" when it was said in a context where the mother was trying to get the babies to sit in their highchairs: she was expecting the baby to sit.) = A2

Request:

- Is there an expectation of compliance? Even if it is said in a playful way? (E.g., laughing while saying “don’t touch the lens!”) = A2
- Is it playful and joking (e.g., “don’t come over here” said in an exaggeratingly comic tone)? = D1

“yeah”:

- Listen to previous context. The “yeah” often reinforces what was just said. Also listen to the tone of voice.
    - Is it after a narrative overture? = probably D1
    - Is it after a comforting overture? = probably B
    - Is it after the baby “said something” = probably C3
- If it is after the baby did something that was good or that the parent had asked for (e.g., in a directive overture) = probably C4

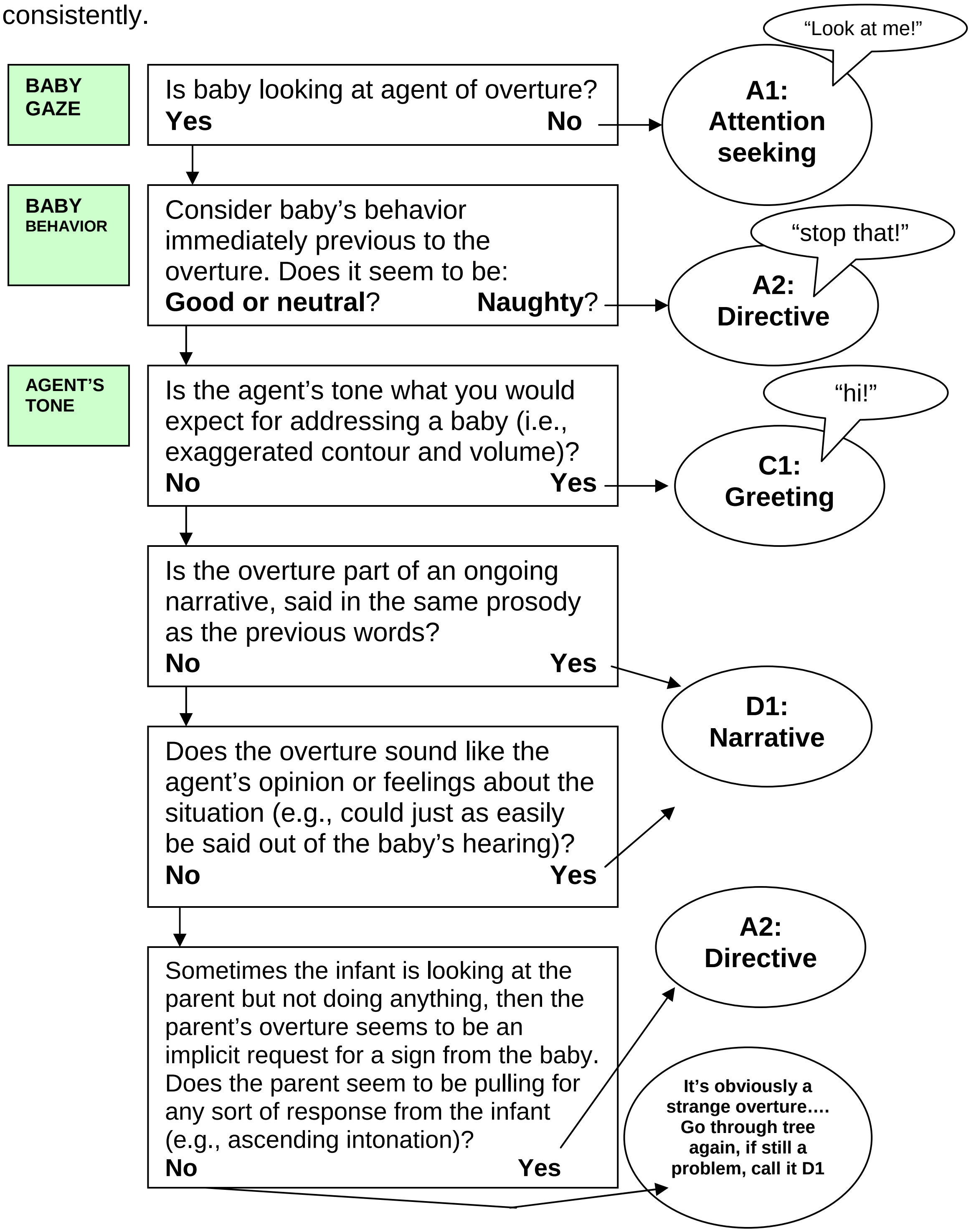
Little random noises and squeals:

- Pay attention to previous context.
    - Does it seem to be an attempt to initiate an interaction = probably C2
    - Does it seem to be a response to something the baby has just done, such as rushing towards the parent or hitting the parent = probably D1

Saying the baby’s name: (see decision tree on next page)

Use this decision tree when the overture consists only of the parent saying the infant's name (i.e., without a salutation or additional words or actions)

To assign a function to these overtures requires careful consideration of the immediate context (especially the infant's behavior immediately preceding the overture) and the parent's tone when saying the infant's name. Consider these variables in the following order, using this chart to help with assigning function consistently.



SUMMARY of OVERTURE FUNCTIONS:

This chart is not enough for understanding the analysis, use it in conjunction with the detailed operational definitions.

Type of overture	*code*	*Pull*[1]	*Expected response*	*example*	*Hints*
Attention seeking	**A1**	strong	Specific: look at parent	Baby's name Baby's nickname A poke	Make sure that it is only attention that is being sought
Directing	**A2**	strong	Specific: do what is being asked	"Sit down", "Stop hitting your brother", "Come to mummy", "Look at mummy"[2]	Write down the specific expected response. If touching, paraphrase to see if it is directing
Helping	**B**	Less strong	Specific: Stop displaying distress (e.g., crying, reaching)	"There, there", "S'Okay", "OK, I'm coming"	Write what the baby is needing/ requesting
Greeting	**C1**	Weaker	Vague	"Hi"	
Playful	**C2**	Weaker	Vague	"Tootle ootle", "Whee" Playful poke	If touching, paraphrase to make sure it isn't a directing overture
Conversational	**C3**	Weaker	Vague	"Yeah, you do that", "Is that right?"	Usually preceded by the baby "talking"
Rewarding	**C4**	Weaker	Vague	"Thank you", "Good girl", nodding	Write down what is being rewarded
Narrative	**D1**	Weakest	Vague to none	"How did you get up there?"	
Instrumental	**D2**	Weakest	Vague to none	Moving baby into bath	Usually unaccompanied by words

[1] the strength of expectation that the parent would reasonably have that the baby will respond.
[2] this is not A1 because the content of the words is more complex

DIVIDING OVERTURES (BLANK ANALYSIS SHEET)
clip__________
Analyst __________________ Date_____________

times	ov#	baby#	overture description	divide?
				by agent? **Y N**
				by function? **Y N**
				by modality? **Y N**
				new number
				by agent? **Y N**
				by function? **Y N**
				by modality? **Y N**
				new number
				by agent? **Y N**
				by function? **Y N**
				by modality? **Y N**
				new number
				by agent? **Y N**
				by function? **Y N**
				by modality? **Y N**
				new number

(add more lines as needed)

Stage 3: Agent Visibility Analysis (modality feasibility)

Purpose: to determine in how many overtures the agents (mother or father) are visible.

Operational Definition: Agents are considered to be visible when they are on-screen during the overture **and** their faces and bodies can be seen well enough to view both their facial expressions and gestures.

- If an agent is visible (both face and hands) for a portion of the overture, mark the agent as visible.
- If a part of the body isn't visible, (i.e. one of the hands), and you **know** that it wouldn't be used in a gesture because it is involved in a task that makes it unavailable for gesturing(i.e., holding a baby) and the rest of the agent (face and other hand) is visible, note the agent as visible.

Steps for analysis
First step
Using the overture times from the previous analyses locate the overture. Watch each overture and note if agent is onscreen. If agent is not onscreen proceed to next overture.
Second step
If agent is onscreen, determine whether the hands and face are visible enough that you could view both their facial expression and gestures. If both the hands and face are visible then note the agent as visible on the analysis sheet. Proceed to the next overture.

Notes:
Face visibility: eyes and mouth most important
Body visibility: hands most important

Stage 4: Identifying and categorizing baby behaviors after overtures

Purpose: The purpose is to differentiate between infant behaviors that are responses vs. not responses to overtures directed at the infant. (This is our measure of social reciprocity.) Note that "response" here is used as a technical term that will be clearly explicated below (i.e., do not think of "response" in its colloquial sense). Considering what the overture projects, does the infant take up the proposal?

Framework and guidelines:

Clark (1996) distinguished between levels of joint action in communication, which can be adapted to parent-infant interaction. For successful co-ordination with the parent, the infant must (1) *attend* to the adult, (2) *identify* what the adult is doing as a meaningful action directed towards him or her, (3) *understand* what the action means, and (4) *take up the offer* of the action, that is, agree to participate. We are interested in the infant's behavior at the 4th level, that is, for the infant's action to be considered a response, it has to be an indication that the infant is agreeing to participate in the parent's proposal. For example, if the overture is "come to mummy", the parent is proposing that the infant begins to walk over to the mother. To be a response, in this analysis, the infant has to decide to take up the proposal of walking to the mother, and walking towards the mother indicates that the infant attended to the overture, identified it as meaningful, understood it, and agreed to it. Although not walking to the mother might be a response in a colloquial sense (e.g., a display of defiance), for the purposes of this analysis it would not be a response.

For each overture, you will be noting the infant's behaviors immediately preceding and following the overture's onset and comparing them to each other: Is there a change in behavior? Next, if there is a change in behavior timed with the overture, you will consider (1) the nature of the overture itself, (2) the joint project the parent is proposing with that overture, and (3) the context of the interaction. With this information, you can check if the change in the infant's behavior indicates that the infant has taken up the parent's proposal. Is that change in behavior predictable given the nature of the overture?

General operational definitions:

What is a response? A response is a change in the baby's observable behavior that (1) occurs after the overture's onset and (2) is a behavioral indication that the baby is taking up the proposal that the parent's overture projected. It is a behavior that is functionally related to the parent's overture.

What is a change in behavior? A change in the baby's behavior is defined as a change between the baby's behavior before and after the overture. A change can be an obvious new behavior, the cessation of a behavior, or a subtle increase or decrease in an ongoing behavior (e.g., a baby might wiggle more or move faster). Even these subtle differences, if temporally related to overture onset, should be considered a change in behavior.

What is the critical point at which to look for a change? The change should be temporally related to the overture, that is, it should occur sometime after the overture begins. The critical point for noting a change of behavior is defined here as the period of time between the onset of the overture to about a second after the whole overture is completed, depending on the timing of the next overture to that baby.

What is a change that is *functionally related* to (or *predictable* given) the nature of the overture? First consider what the overture is projecting, what is the project that the parent is proposing? (This question will be made slightly easier because we are analyzing overtures one function at a time.) A change in behavior can be considered functionally related to the overture if it is what the overture was projecting.

- Try to be overly inclusive, i.e., keep the option of the behavior being related as open as possible. If the behavior seems to fit at all into what you might expect, categorize it as related. Depending on the type of overture, *it should be hard for a baby to make a change in behavior after an overture that is completely unrelated to the nature of the overture.* [Note, however, with A1 and A2 overtures, the demand of the overture is quite specific and therefore changes in behavior will have to also be quite specific to be considered a response.]
    - E.g., **Predictable**: 9-12:1, before overture 2, the infant fell off his toy. In overture 2 the mother said "oh, you falling down?". She might be proposing that she and the infant commiserate about him falling down. The baby's behavior following her overture is to start crying. As a behavior, crying seems like an indication that he is taking up her proposal.
    - E.g., **Predictable**: 9-12:1, before overture 12, the infant put her head on a pillow and made a little noise. In the overture, the mother said "yeah, oh, soft and cuddly Madeline". Her tone of voice and the words appeared to be a proposal that she and the infant interact in a warm and friendly way; they are agreeing that the pillow is soft. The proposal isn't strong and specific, but it is still an invitation to interact. The baby's behavior following this overture is to roll over, look at the mom, and smile, which matches the proposal.
    - E.g., **Not Predictable**: 9-12:3, before overture 23, the infant was sitting on his toy truck bobbing up and down, apparently in an effort to make it move forward. The mother said "you're trying to move

along, little one?". The mother appeared to be proposing that the infant will continue to try to move along in the car and she'll encourage him. After the overture, the baby stopped bobbing up and down on the seat of his toy, which stopped him from moving. This behavior doesn't seem to take up his mother's proposal, so even though it is a change in behavior, it is not a response by our definition.

- E.g., **Not Predictable**: 12-16:4, before overture 3, the baby was running away from his mother and laughing, immediately before the overture, he sat on the floor. In the overture, the mother tickled the baby and said, "I got you!" in a playful tone. She seemed to be proposing that they play a game where she chases him and tickles him while he laughs and tried to run away. (Note how complex this proposal is!!) The baby's behavior after her overture was to stop laughing and get up. He did not appear to be taking up her proposal, so this behavior was not considered a response.

Specific operational definitions for specific overture functions:

We'll be evaluating infant behaviors in groups according to the function of the overture, so we'll do all overtures of one function at a time. Although it's a pain to move from clip to clip and to try to ascertain new situations quickly, this approach should facilitate consistent decision making. Use this table for rules and definitions tailored to each kind of overture function.

Overture function and brief definition	What constitutes a predictable response

A1: Attention Seeking
the parent appears to be trying to get the infant to look at her or him.
 	
The proposal is always "look at me".
	• Orienting with eye gaze towards parent after overture onset
	    • Sometimes this is obvious (infant facing away from parent to facing parent)
	    • Sometimes it is subtle (infant already facing parent and shifting eye gaze from away to towards parent)
	• If the start of the look towards the parent is simultaneous to overture onset, that's still a response (infant may be responding to sound of first syllable of name)
	• Beginning to turn towards parent is an acceptable response, only if the turn culminates in later eye contact. This is mostly relevant to situations where another overture begins before the infant has turned all the way.

A2: Directing
The parent is telling the infant to do something or to stop something.
 	
The proposal is for the baby to do what the parent is telling him or her to do.
	• Think about what the specific proposal of the overture is:
	    • If it is explicit (like "sit down"), then it is easy to tell what the demand is (sit down).
	    • If it is implicit (like "whoa" or saying the baby's name in an angry tone), then you have to think about what the parent is implicitly proposing to the infant (in these cases, stop running towards me, or stop doing something naughty, for example).
	• Once you have the specific proposal in mind, watch the infant's post-overture behavior and check if the infant's response indicates that he or she has understood and agreed to participate.
	    • Sometimes agreement is obvious (like sitting when the parent said to sit). Other times it isn't so obvious. Be open to expressions of agreement to the proposal that are less expected but equally indicative.
	    • Note that disobedience is not an indication that the infant is agreeing to the parent's proposal. It could be an indication that the infant is not agreeing to the proposal, but it could also be an indication that the infant didn't understand or was not attending. Therefore, although it's arguably a sophisticated kind of response, apparent acts of disobedience are *not* responses for the purpose of this analysis.
	    • The beginning of fulfilling the demand is enough to be a response, but only if the behavior follows through to the full response. Some responses take a bit of delay, but keep in mind not to extend your leeway past the beginning of the next overture to that baby.
	    • If the parent touches or maneuvers the baby thus forcibly changing the trajectory of the behavior, it doesn't count as a response or not. Write *parent intervenes* in the behavior after onset cell, and put a line through all other cells.

	• Sometimes there is more than one directing overture in a row where the parent acts an infant repeatedly to do something because the infant is not doing it. (E.g., the parent asks the infant to sit again and again.) If these happen in close succession, the rules would say you should write *no time* for that overture. But because the overtures are proposing the same project each time, follow this procedure instead: The first overture, if followed by another with not enough time, should be *no time*. If there are subsequent overtures that seem to have not enough time and if the infant is not complying, each of them should be *no response* (i.e., no change in behavior or the change is not predictable).
B: helping Overture is in response to expressed need of baby (e.g., distress or reaching).	• If overture is a way to soothe an infant who is crying, what would count as a response would be stop crying or cry less (e.g., softer, less intense) or sometimes even to start crying, depending on the nature of the soothing. • If overture is satisfying a more instrumental need that the baby has (reaching for a bottle, trying to get out of something), then any indication of cooperation in the baby's behavior (e.g., taking the bottle, moving arms to facilitate parent's help) counts as a response.

C1: Greeting
Saying hi to a baby
 	
The proposal is to initiate and/or sustain an interaction
	• What the parent is projecting in these overtures is either the need for the infant to acknowledge the greeting or to maintain or sustain the interaction in some social way.
	• If baby is not quite looking at the parent, just a look at the parent is sufficient to be called a response
	• If the baby is already looking at the parent, what is needed is
	    • A change *back* to looking such as looking away and looking right back
	    • A positive escalation from the look (i.e., maintaining eye contact alone is not enough to be a response). A positive escalation could be increase in positive affect (e.g., smiling, smiling bigger, widening eyes, laughing) or it could be an increase in orientation towards the parent (e.g., leaning towards parent, re-orienting body towards parent, crawling faster towards the parent). Even if before the overture the infant is smiling while looking, if the infant doesn't change a behavior in a positive way (i.e., he or she just keeps smiling and looking), then it is not a response.
	• If the baby looks away and makes a noise that is not directed towards the parent, it is not a social response. But if a baby who wasn't smiling while looking at the parent, smiles just as he or she looks away, it is a response because it was a positive escalation just as the infant was turning away.

C2: Playful
Playful action towards baby.
 	
The proposal is to play (i.e., have fun) together
	• What the parent is projecting in these overtures is for the infant to engage with him or her in a playful interaction. So responses here should display **engagement** and **enjoyment**.
	    • Infant behaviors that count as engagement are parent-directed gaze, actions (e.g., with hands or limbs), or actions with objects (pushing a toy back to the parent).
	    • Infant behaviors that count as enjoyments are positive affect, as indicated by smiles or laughter.
	• We are looking for a *social* response, not just a response. A social response indicates to the parent that the infant is taking up the parent's proposal to play.
	• Actions that are not displaying engagement and enjoyment may very

<table>
<tr><td></td><td>well be responses, but they are not they kinds of responses we are looking for here.

Timing of the social response is key. It should happen during the overture or immediately following it.
For “is there a response” put Y if you see any response.
For “is it a social response”, put Y if the infant displays engagement AND enjoyment.

Put N –enj if there is engagement but not enjoyment;
put N –eng if there is enjoyment but not engagement.
Put N –eng – enj if there is neither engagement nor enjoyment.

</td></tr>
<tr><td>C3: Conversational
Talking to infant as though infant can answer.

The proposal is either for the infant to communicate when possible or to pretend to communicate.</td><td>There are two different kinds of conversational overtures:

some are asking a question that the parent does not know the answer to and that the infant can indicate. For infant behaviors to count as agreement to take up the proposal of the question, the infant has to orient to the adult (indicating attention) and answer the question. Note that answering many questions will be indicated by affect or by eye gaze (e.g., do you want X could be answered by the infant looking at X).
some are pretending to have a conversation. For infant behaviors to count as agreement to take up a pretend conversation, the infant has to orient to the adult and make a noise when it is the infant’s turn to “talk”.
</td></tr>
<tr><td>C4: Rewarding
The infant has done something desirable and the parent is rewarding with an overture.

The proposal is to take the reward offered for the action.</td><td>

the overture is projecting that the infant should receive the reward. Receiving it really only requires that the infant look towards the parent either during or immediately after the overture. Extra actions (like doing the rewarded action again or smiling) are nice, but not necessary.

If the infant is looking away and looks at the agent, it is a response
If the infant is already looking during the beginning of the overture, the infant has to do something new to indicate a response. The something new can be as easy as looking away (reward received, attention elsewhere), or it can be increased activity, or a smile. If the infant is already looking and does nothing new (i.e., just continues to stare), then the look alone is not sufficient to be a response. (To see why, imagine what it is like to receive a blank stare during and after you’d said something…)

</td></tr>
<tr><td>D1: Narrative
Parent describes what the infant is doing.

The proposal is to initiate and/or sustain an interaction</td><td>

What the parent is projecting in these overtures is for the infant to maintain or sustain the interaction in some social way. (Note these criteria are the same as for responses to greeting overtures.)
If baby is not looking at the parent (agent), a look at the parent is sufficient to be called a response
If the baby is already looking at the parent, what is needed is

A change back to looking such as looking away and looking right back
A positive escalation from the look (i.e., maintaining eye contact alone is not enough to be a response). A positive escalation could be increase in positive affect (e.g., smiling, smiling bigger, widening eyes, laughing) or it could be an increase in orientation towards the parent (e.g., leaning towards parent, re-orienting body towards parent, crawling faster towards the parent). Even if before the overture the infant is smiling while looking, if the infant doesn’t change a behavior in a positive way (i.e., he or she just keeps smiling and looking), then it is not a response.

</td></tr>
</table>

D2: Instrumental The parent is moving the infant around without any additional social component.
 	
The proposal is to accomplish something that needs doing
	• These actions are not social.
	• Because there isn't speech or vocalizations during instrumental actions (it likely would have been classified as a kind of overture had there been either), the parent is not projecting a social contact.
	• The parent is instead proposing that something needs to get done. That something could be that the baby needs to be put somewhere, re-positioned, handed something, etc. Therefore what the parent is projecting is cooperation from the infant, even if the cooperation needed is minimal.
	    • Evidence that the infant has taken up the parent's proposal is simply cooperation in the joint activity. If the parent hands the infant something, the infant's cooperation is indicated by the infant taking it. If the parent puts the baby down, the infant's cooperation is indicated by landing on the ground in a smooth manner. This kind of evidence is almost invisible because of the successful coordination between the parent and the infant. Note that the baby may indicate that he or she is not enjoying the action, but unless the baby is actively disrupting or making the action impossible, still consider the baby's actions a response. If you feel you are being over inclusive with responses, it might be helpful to imagine what would not be cooperative in the same situation.
	    • Evidence for not cooperating would be the opposite and would look disruptive. For instance, the infant would not take the object being handed to him or her, or the infant would struggle a lot when being maneuvered around. Or the infant would not take responsibility for planting his or her limbs when being put down in a lying, sitting, or standing position.
	• Note that the analysis sheet is slightly different because evidence that the infant is taking up the parent's proposal is not based on change but on physical cooperation with the parent. So instead of the usual last two columns, the last column on the analysis sheet indicates that you should note if the baby's behavior is cooperative (yes or no). Your decision as to whether the response is analyzable or not should proceed as it has for the other overtures.

I see an overture that is not on my sheet!!

It is possible (but not ideal), at this stage of the analysis, that analysts will find an overture that previous analysts missed. Before adding any, check first if what you are seeing wasn't included because it is from the pilot data. If it wasn't in the pilot data, then check the handwritten previous analysis sheets (especially overture location sheets), there may be a reason the overture you are seeing was noticed and deemed not an overture by the definition, which would be noted on the sheets. If this is not the case, and you decide to add an overture, insert it into the summaries of the previous analyses without changing any overture numbers. Previous numbering has been 1, 2, 3a, 3b, etc. If a new overture is added, label it with the number of the immediately previous overture and add a decimal (e.g., 4.5). Thus the unique number for each overture in each clip will indicate if it was always a single overture, if it was divided, or if it was added later. Make sure to add all information about the new overture into the SPSS file, including time, function, etc. And add it to the appropriate overture type for the response analysis. If that type has been analyzed for responses already, you'll have to analyze this new overture and be sure to change the results for that type, which may include checking in a few places for results! (Get Jennifer to do this.)

<u>I think the overture I see has a different function!!</u>

It's possible that once you see a bunch of overtures with the same function that one will pop out to you as seeming to have a different function. Don't change the function of an overture without discussing it with Jennifer or with Jan. Make sure that you aren't changing it because of the infant's response, there must be other criteria to warrant a change. If you change it, write on your analysis sheet the change and why, then ensure that the SPSS file gets updated. It'll have to be added to the response analysis sheets for the new type of overture. If that type has been analyzed for responses already, you'll have to analyze this new overture and be sure to change the results for that type, which may include checking in a few places for results! (Get Jennifer to do this.)

Procedures and analysis:

1. Besides the videos, etc., you'll need (1) the filled-in analysis sheet for the set of overtures you are analyzing, (2) these rules and (3) the summary & decision tree sheet.
2. All overtures on the analysis sheet are one type of function. Here's a guide to the analysis sheet. These are the columns that are already filled in:
    a. The **age range** tells you the approximate age of the infants in the excerpt: 3 = 12-15 months; 2 = 9-11 months; 1 = 6-8 months. The clips will be in decreasing chronological order.
    b. The **clip number** is the file name for the mpg file you will need for each overture.
    c. **Overture time** is the approximate onset and offset of the overture.
    d. The **overture number** is provided to help with later data entry, you will not really need it for the response analysis.
    e. The **infant** is the recipient of the overture. The numbers correspond to each infant the same way that they did during the overture analysis.
    f. **Overture description** is the actions or the words of the parent giving the overture. Note that the agent is not listed here (and information pertaining to agent is often crucial for ascertaining a social response). If you have the correct time and the description of the overture, you should be able to figure out the agent. If there's a question, check the SPSS file, the agent is listed there.
    g. **Start of the next overture** is the start time of the next overture. You may need to check this time to make sure any infant behavior you are assessing is temporally related to the overture being analyzed and not the next one.

3. Note that there are three times when we will check reliability:
    a. After analyzable vs. not analyzable
    b. After change vs. no change
    c. After functional relationship vs. not a functional relationship

    Although there are three opportunities to check, I do not intend for analysis to proceed through those three stages only one at a time. Instead, make the three decisions for each overture. Then, when we check reliability, we'll discuss the decisions in order. If necessary, stop when there is a disagreement, resolve it, and the independently adjust answers pertaining to later decisions about that overture. (E.g., if you said "not analyzable", and later decide that it is analyzable, you'll need to independently adjust your answers for *change* and *functional relationship* before doing reliability on those stages: These decisions used to have dashes through them, now they will have to have a Y or an N, etc. If you said "no change", and after discussion, decide that there is a change, you'll have to adjust your answer for whether the change is related to the nature of the overture: It used to have a dash through it, now it will have to have a Y or an N.)

4. Identifying *changes in behavior*:

    a. Watch the excerpt to get an idea of what each baby is doing and the context of the whole interaction. This is especially important if you are not familiar with the excerpt.
    b. As mentioned previously, consult the analysis sheet for the onset time (it may be somewhat approximate) and the baby you should be watching.
    c. Select the period of time that starts a second or two *before* the onset time of the overture and ends just at overture onset (i.e., when you watch the selection, you won't see the overture yet). Watch this short section a couple of times and **note as "behavior before overture" the infant's behavior during the selection** (e.g., looking at a book, smiling at the mother, etc.).
    d. Then, keeping that selection, allow the video to play through the overture itself and a second or so afterwards. (You can play the selection then the bit afterwards a few times. The break between the two will allow you to see the behavior before and after the onset time a bit more clearly.)
    e. Before you make a judgment about change, note that there are a few situations on the video that may limit your ability to judge. These make the infant's behavior not analyzable. In these cases, we will not be including the overture as one where we can judge infant response (i.e., these will come out of the analysis). There are at least three ways the behavior could be not analyzable:
        i. The excerpt ends, there is a transition (i.e., a cut to a new scene) in the excerpt very soon after the overture, or there is a new overture to that baby right away. **If you see a response, note it as a response (i.e., be biased to noting a quick response).** If you see an unrelated new behavior or a lack of response, write *no time* in that cell and cross out the cells in that same row that ask "is there a change?" and "if so, is change predictable". There might have been a response later, and it isn't fair to count a lack of a behavior in that short period of time as no response.
        ii. You can't see whether there is a change in behavior because the baby goes offscreen or is not sufficiently visible to make a judgment. Write *not visible* in that cell and cross out the cells in that same row that ask "is there a change?" and "if so, is change predictable".
        iii. There may be other reasons that it would not be fair to judge whether the infant is responding or not. For instance, that part of the episode may be very chaotic, or the infant may be

in a very confusing situation, or the parent may be intervening in some way that makes it impossible to judge the infant's behavior. Note why the overture is not analyzable.

Do reliability here based on *analyzable* vs. *not analyzable* (no time, not visible, or parent intervenes with A2), then resolve any disagreements before proceeding on to making judgment about change vs. no change. It is not necessary to get agreement on why it is not analyzable, just whether it is or is not is sufficient.

f. **Note (and describe) the infant's behavior after overture onset.** If the behavior is the same as before the overture, just write *same* here.

g. **Note whether the baby's behavior changed**. Make a decision as to whether the baby's behavior after the onset of the overture changed from before it. Changes you should look for are actions such as (but not limited to) the following:
   i. redirecting gaze, a whole body reaction (e.g., increased wiggling, kicking), a facial reaction (e.g., smile), an escalation or de-escalation in ongoing activity, or a new action.
   ii. Double check that the behavior you are describing here is not due to a subsequent overture, that is, make sure that the behavior you are seeing occurs *before the onset of the next overture*. The onset time of the next overture to that infant is noted on your analysis sheet. If there is no overture immediately following, this cell will have a line through it.
   iii. If the baby is being active, it can be hard to decide if the movement you are seeing is timed with the overture. **It can help to check if the baby's action seems smooth, seamless, steady, and uninterrupted by the overture, in which case it is probably not showing a *change* in behavior, even though the baby is moving around. Try turning down the audio, sometimes that helps with focusing on the baby's behavior.**

Write a "*Y*" in the "is there a change?" column if you think there is a change.

Write an "*N*" in the "is there a change?" column if you think there is not a change

Do reliability here based on *change* vs. *no change*. Resolve any disagreements before proceeding to the next stage. It is not necessary to agree on the actual descriptions of behavior, but these description may be useful when resolving disagreement. Reliability calculation will be for agreements as to *Y* vs. *N* for only those overtures that analysts had already agreed were analyzable.

5. Identifying if there is a relationship between the overture and the infant's change in behavior (i.e., categorizing changes in behavior).

    a. This column may already have some cells crossed off with a dash (because there was no opportunity to see a behavior, there was no time for the baby to respond, the parent intervened, or the baby did not respond). If there's a dash, don't worry about doing analysis for that overture.
    b. Wherever you have decided that there is a change in the baby's behavior (indicated by a "Y" in the previous column, decide if the changed behavior matches the proposal that the parent was making in the overture. That is, ask yourself if the new behavior is predictable given the function of the parent's overture. It is necessary for you to use the table above ("Specific operational definitions for specific overture functions") for guidelines as to what constitutes a response to each different kind of overture.
    Write a "*Y*" in the "is change predictable?" column if you think the change is predictable. (This is now considered a response)
    Write an "*N*" in the "is change predictable?" column if you think the change is not predictable.
    c. Get reliability for this decision (number of agreements over the number of decisions). Agreements based on *Y* vs. *N* for only those overtures where analysts had already agreed there was a change in behavior. Resolve any disagreements before entering the data.

Summary of response analysis (please use in conjunction with detailed rules):

1. In the video clip, select the time from a couple of seconds before overture onset up to the actual time of onset (i.e., not including overture). Watch a few times.
2. Note baby's behavior during this section on your sheet.
3. Now watch again but allow selection to play past overture onset into the overture, *but not past onset of next overture*.
4. Now use this decision tree:

Once the overture starts, is the baby sufficiently visible for you to judge his or her behavior?
Yes No

Write "*not visible*" in the "is there a change" cell and go on to the next overture.

Does the clip end or transition to another section right away before you can judge the baby's behavior?
No Yes

If you see an obvious response, note the response. If you don't, write "*no time*" in the "is there a change" cell and go on to the next overture.

If there is another overture to that baby listed on the sheet, does it start before you can judge the baby's behavior?
No Yes

In the immediately previous overture (if there is one), does the agent make the same proposal?
Yes No

If you see an obvious response, note the response. If you don't, write "*no time*" in the "is there a change" cell and go on to the next overture.

Does the baby's behavior change in one of the following ways:
- baby starts a new behavior
- baby stops current behavior
- baby increases ongoing activity
- baby decreases ongoing activity

Yes No

Write *same* in behavior description cell and "*N*" in the "is there a change" cell and go on to the next overture.

Is the timing of the change of behavior at or after the onset of the overture?
Yes No

Note new behavior and write "*Y*" in the "is there a change" cell.
Is there any way you can consider the change predictable, given the nature of the overture?
Yes No

Write "*N*" in the "is change predictable" cell and go on to the next overture.

Write "*Y*" in the "is change predictable" cell and go on to next overture

How to make analysis sheets for response analysis

For the response analysis, we are creating one set of analysis sheets for each individual function. Note: This is fairly time consuming. Plan to set aside a couple of hours and to be very patient.

How to make analysis sheets for response analysis:

Step one: creating table from SPSS file:

- Open SPSS file
- Under "view', make sure "value labels" is not selected. (This is to keep infant names off the analysis sheet.)
- Go to "data", "sort cases…" and put the following variables in the "sort by" box in the following order:
  1. what was the function (sort order doesn't matter)
  2. which age range (sort order "descending")
  3. clip number (sort order "descending")
  4. overture number (sort order "ascending")
- Once the file is resorted, all the overtures will be listed by function.
- Select the set of overtures for the function for which you are creating the sheet. Select only the columns AGE RANGE, CLIP, TIME, OVERTURE, BABY, and DESCRIPTION (Make sure they are already in that order in the file.)
- Copy these.
- Paste them into a template of the analysis sheets for the response analysis.
  - Note that sometimes pasting from SPSS into a word table doesn't work. Try pasting them first into Excel then from Excel into the table. When you paste into the table, just do a few rows at a time, if there aren't the correct number of rows in the table for the excel file, you will either lose or repeat data.
  - All columns but one should match up with the column labels in the template. The exception is the "description" column, which you will have to move from "behavior before overture" to "overture description".

Step two: Making it more readable for analysts:

Make alternating clip sections shaded, so it is obvious when the analyst is supposed to move from clip to clip.

Step three: putting "start of next overture" information in:

- Now you have to fill in the column on the analysis sheet called "start of next overture". Go back to the SPSS file and resort it in the following way:
  1. which age range (sort order descending)
  2. clip number (sort order descending)
  3. overture number (sort order ascending)
- Put the SPSS file and the analysis sheet side by side on the desktop.

- For each overture, find it in the SPSS file. Now, still looking at the SPSS file, look at the overture immediately following the overture. On the analysis sheet, in the overture's row in the column "start of next overture" record the following information:
    - If there was no immediately following overture, put a line through the cell on the analysis sheet.
    - If there was one, but it was to a different baby, put a line through the cell on the analysis sheet.
    - If there was one, and it was to the *same baby*, put the onset time in the cell on the analysis sheet

INFANT RESPONSES: __BLANK ANALYSIS SHEET_

Analyst________________________ Date____________________

Age range	Clip number	**Overture time**	Ov #	infant	Behavior before overture	Overture description	Start of the next overture	Behavior after overture onset		
								describe	Is there a change	If so, is change predictable

(Add more lines as needed)

Stage 5: Characterizing baby behaviors before overtures

Purpose: The purpose is, for each overture, to characterize the infant's activity immediately preceding it. Later we will be investigating the relationship between these pre-overture behaviors and the infant's response to that overture. Is what the infant doing immediately before the parent addresses him or her systematically influencing the likelihood that the infant responds to the overture? Note that in the response analysis, we will have noted general aspects of the infant's behavior preceding the overture, but the purpose of that analysis was to note the aspects that seemed relevant given (1) what the infant did after the overture, and (2) what the function of the overture was. The purpose of this analysis is to characterize the infant's behavior in a more specific way, namely, to note whether the infant was attending to the agent of the overture (*attending agent*), engaged in a different activity (*otherwise engaged*), or something in between (*potentially available*).

General operational definitions:

AA: What kinds of behaviors constitute the infant attending to the agent?

- Attending to agent is when the baby is already looking at the adult who is about to make an overture to that baby.

OE: What kinds of behaviors indicate that the infant is otherwise engaged?

- When the infant is otherwise engaged, he or she is doing something that appears to be pre-occupying their attention AND that is not something that the agent of the overture is doing with the infant (i.e., it should be an activity that is not involving the agent).

  What indicates engagement?

  - **Sometimes this can be an obvious activity**, where the infant is busy playing or engaged in a project, such as taking tissues out of a box, watching the effect of turning his bottle upside down, or reaching for cheerios on his or her highchair.
  - **Sometimes it is less obvious**, and you need to be aware of the context of the baby's activities. For example, in one episode, the babies are sitting in their highchairs and they are strapped in by little belts. Baby 1 appears to be slumped in his chair, but upon closer inspection (and noting that baby 3 has a clearly visible belt holding him into his chair), it is possible to see that baby 1 is actually touching and exploring his own, less visible, belt. Here infant 1 is engaged in getting to know his belt.
  - Finally, **be aware of what is in the room** when the infants seem to be watching something intently. Sometimes this is a TV (which can be heard) or sometimes it is engagement with another adult (who isn't the agent of the overture). In all of these examples, the infant is otherwise engaged.

- Engagement can be indicated simply by the **infant changing his or her environment** by making little noises, just be sure that the infant appear to be engaged (absorbed) in the activity.
- In older age range, engagement is often actively doing something, such as moving diapers around, turning pages in a book, or riding in a toy car. In younger age range, engagement is more exploring objects (like fiddling with them or sucking on them).
- Look for intensity of gaze or intensity of attention.

What indicates the adult NOT being involved?

- The infant could be doing the activity with or without the adult being present, that is, the adult is just passively witnessing the activity and not engaged in it with the infant. For example, an infant dripping water onto the floor from bottles does not require the adult's participation, even if it was occurring next to the agent and she was witnessing (i.e., filming) it. Proximity does not necessarily mean involvement.

PA: What behaviors can be characterized as the infant being potentially available?

- Potentially available is when the infant is **not clearly paying attention to the adult and is not obviously otherwise engaged.** His or her activities indicate that the infant is potentially available. Look for wandering gaze, lack of intensity with objects or with own body/self. This is a bit of a "catch all" category. The easiest way to think about it is that the infant is ready to be turned on, as though the infant is on stand by. There are a few additional, particular situations that you can consider potentially available:
    - The infant **has been involved in some sort of interaction sequence** (even short ones) and a fraction of a second before the overture, the infant looks away. Therefore you can't call the behavior "attending agent" (because the infant is not looking at the adult), but it wouldn't be fair to say that the infant is already "otherwise engaged" in something new. The infant is "potentially available" for interaction because he or she has been engaged with the adult during the seconds immediately previous to the overture.
    - The infant is **engaged in a joint activity with the agent**, such as eating an apple that the agent is holding. If the infant is looking or acting on that object with which the infant and parent are mutually engaged, (e.g., the apple), then the infant is available for interaction with the parent (i.e., is potentially available).
    - The **infant is looking to a spot very close to the agent**, but not quite at the agent. Because the infant's gaze would require such a tiny change to be directed at the agent, you can consider the infant to be potentially available.

General procedures:

We'll be evaluating infant behaviors in groups according to the function of the overture, so we'll do all overtures of one function at a time. Although it's a pain to move from clip to clip and to try to ascertain new situations quickly, this approach should facilitate consistent decision making and a satisfying accumulation of results as we go along.

When you are doing analysis, do not focus on the overture itself, particularly the infant's response (or lack of response) to the overture. It is important that the decision you make regarding infant behaviors is not biased by what you see the infant do after the overture onset. However, sometimes you will have to watch the overture and some time afterwards in order to understand the infant's behavior. For example, it may not be clear whether an infant is staring into empty space (which would be *potentially available*) or at the TV (which would be *otherwise engaged*) unless you watch more of the episode. If you need to watch more, just keep in mind that you should be able to make a strong argument supporting your decision that does not depend at all on the infant's post-overture behavior.

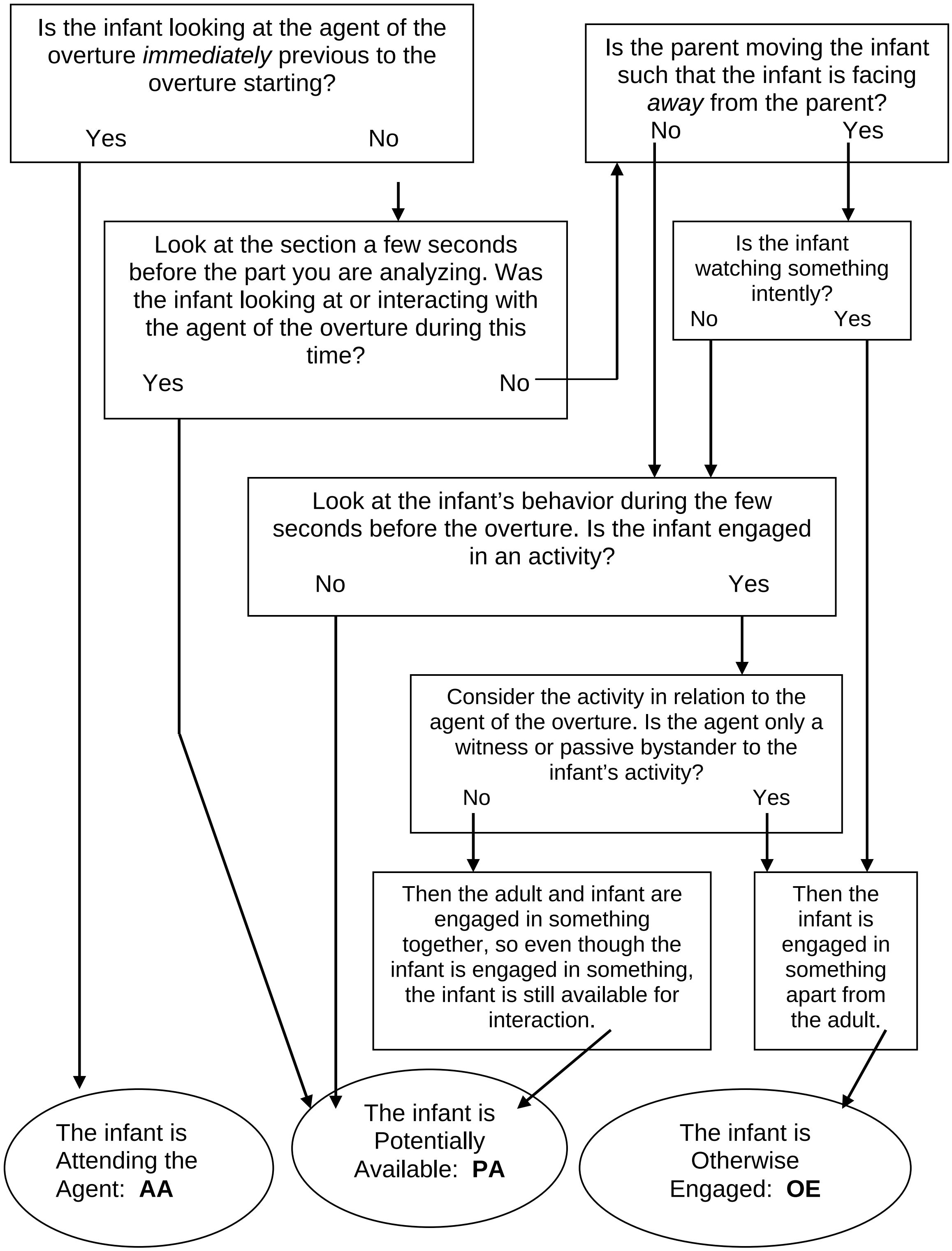
Procedures and analysis:

1. Besides the videos, etc., you'll need (1) the filled-in analysis sheet for the set of overtures you are analyzing, and (2) these rules.
2. All overtures on the analysis sheet are one type of function. Here's a guide to the analysis sheet. These are the columns that are already filled in:
    a. The **age range** tells you the approximate age of the infants in the excerpt: 3 = 12-16 months; 2 = 9-12 months; 1 = 6-9 months. The clips will be in decreasing chronological order.
    b. The **clip number** is the file name for the mpg file you will need for each overture.
    c. **Overture time** is the approximate onset and offset of the overture. The onset time is the most important time for you.
    d. The **overture number** is provided to help with later data entry, you will not really need it for the response analysis.
    e. The **infant** is the recipient of the overture. The numbers correspond to each infant the same way that they did during the overture analysis.
    f. **Overture description** is the actions or the words of the parent giving the overture. Note that the agent is not listed here, if you have the correct time and the description of the overture, you should be able to figure out the agent. If there's a question, check the SPSS file. You will only need information as to overture description for reference (e.g., am I watching the correct overture?), it shouldn't be required for making decisions as to pre-overture infant behaviors.

3. <u>Identifying *pre-overture behaviors*</u>:

    a. Watch enough of the excerpt (only up to the onset of the overture though) to get an idea of what each baby is doing and the context of the whole interaction. This is especially important if you are not familiar with the excerpt.
    b. As mentioned previously, consult the analysis sheet for the onset time (it may be somewhat approximate) and the baby you should be watching.
    c. Select the period of time that starts a few seconds *before* the onset time of the overture and ends just at overture onset (i.e., when you watch the selection, you won't see the overture). Watch this short section a couple of times and **note as "behavior before overture" the infant's behavior during the selection**. Write what supports your decision, for example, if you are characterizing the behavior as "otherwise engaged", write here what makes you say that. If infant is "potentially available", write what indications brought you to that decision. What you write here will be for your own and other's reference, we will not do reliability on descriptions.
    d. Then decide whether that activity (or lack of activity) should be classified as *attending to agent, otherwise engaged,* or *potentially available*. Write the initials of your decision in the corresponding column on the analysis sheet.
    e. Go on to the next overture.

Pre-overture behaviors: decision tree for characterizing behaviors as *Attending Agent*, *Potentially Available*, or *Otherwise Engaged*. (See detailed definitions and examples as well.)



How to make analysis sheets for pre-overture analysis

For the pre-overture analysis, we are creating one set of analysis sheets for each individual function.
How to make analysis sheets for pre-overture behaviors analysis:

Step one: figuring out which overtures to include:

- Open the relevant response analysis sheet. Resave it in the pre-overture analysis folder under a temporary name.
- Look at the results sheet (hard copy is easiest) for that particular response. A number of rows are red. These are overtures that were removed from the response analysis and they should not be included as part of the pre-overture behavior analysis.
- Remove the red overtures from the temporary analysis sheet that you created. When you are done, the overtures that are included should all be ones that were deemed analyzable in the response analysis.
- Open a pre-overture behavior analysis sheet and make it blank. Save as the name of the overture for which you are making a new sheet. Put the name of the overture after "PRE-OVERTURE BEHAVIOR":.
- Format all the rows so that they are not shaded.
- Copy and paste relevant information from your temporary file into the analysis sheet you are creating.
- Make sure the page numbers are correct on the new sheet (page *X* of *Y*)
- Delete the temporary file.

Step two: Making it more readable for analysts:

Make alternating clip sections shaded, so it is obvious when the analyst is supposed to move from clip to clip.

PRE-OVERTURE BEHAVIORS: _BLANK ANALYSIS SHEET__
Analyst________________________ Date____________________

Age range	Clip number	**Overture time**	Ov #	infant	Behavior before overture	Overture description	Characterization of infant's pre-overture behavior:		
							A.Agent	P.Avail	O.Engage

(Add more lines as needed)

Appendix G: Reliability Summaries for Study II

RELIABILITY SUMMARY SHEET: OVERTURES

Agreement as to:	% of data for reliability	Reliability score represents:	Score across all age ranges	Score expressed as a percentage	Score per age range	Main analyst	Reliability with:
Is an overture happening, and if so, to which infant?	2787/12509 (seconds) = **22.28%**	**Second-by-second agreement proportion:** *number of seconds on which analysts agree (overture to same baby vs. not an overture)* *total number of seconds analyzed*	**2543 / 2626**	**96.84%**	12- 15: **96.33%** 9-11: **97.00%** 6-8: **97.32%**	Jennifer Jennifer or Sara	Sara or Christine
Is an overture happening, and if so, to which infant?	2787/12509 (seconds) = **22.28%**	**Event-by-event agreement proportion:** *number of times analysts agree on a change from overture (to same baby) to not an overture* *total number of event changes across both analysts*	**344 / 409**	**84.11%**	12- 15: **84.24%** 9-11: **75.58%** 6-8: **88.61%**	Jennifer Jennifer or Sara	Sara or Christine
Should the overture be divided because of a change in agent?	191/734 (overtures) = **26.02%**	**Overture-by-overture agreement proportion:** *number of overtures on which analysts agree that the overture should or should not be divided because of a change in agent* *total number of decisions (i.e., overtures)*	**173 / 173**	**100%**	12- 15: **100%** 9-11: **100%** 6-8: **100%**	Jennifer Jennifer or Sara	Sara or Christine
What is the agent of each overture?	191/734 (overtures) = **26.02%**	**Overture-by-overture agreement proportion:** *number of overtures on which analysts agree on the identity of the agent of the overture* *total number of decisions (i.e., overtures)*	**176 / 176**	**100%**	12- 15: **100%** 9-11: **100%** 6-8: **100%**	Jennifer Jennifer or Sara	Sara or Christine
Should the overture be divided because of a change in function?	191/734 (overtures) = **26.02%**	**Overture-by-overture agreement proportion:** *number of overtures on which analysts agree that the overture should or should not be divided because of a change in function* *total number of decisions (i.e., overtures)*	**167 / 176**	**94.89%**	12- 15: **92.41%** 9-11: **96.88%** 6-8: **96.92%**	Jennifer Jennifer or Sara	Sara or Christine
What is the overture's function?	191/734 (overtures) = **26.02%**	**Overture-by-overture agreement proportion:** *number of overtures on which analysts agree on the function of the overture* *total number of decisions (i.e., overtures)*	**161 / 189**	**85.19%**	12- 15: **87.06%** 9-11: **82.35%** 6-8: **84.29%**	Jennifer Jennifer or Sara	Sara or Christine

Is the agent of the overture onscreen?	174/814 (overtures) = **21.38%**	**Overture-by-overture agreement proportion:** *number of overtures on which analysts agree that the agent can be seen on the screen* *total number of decisions*	**172** **174**	**98.85%**	12- 15: **100%** 9-11: **100%** 6-8: **96.36%**	Sara or Christine	Sara or Christine
Can you see the hands and face of the agent?	174/814 (overtures) = **21.38%**	**Overture-by-overture agreement proportion:** *number of overtures on which analysts agree that the face and hands of the agent can be seen sufficiently well to determine facial expressions and gestures* *total number of decisions*	**173** **174**	**99.43%**	12- 15: **98.11%** 9-11: **100%** 6-8: **100%**	Sara or Christine	Sara or Christine

Procedures used for reliability: Response analysis

For each overture function:

1. Put all overtures into Excel file. Use one worksheet per function so all functions are together in the same file.
2. Get randomized permutation from http://www.tufts.edu/~gdallal/random_permutation.htm
    a. Enter smallest integer as the number of the first line that has an overture
    b. Enter largest integer as the last line
    c. Generate random permutation in one low column
    d. Copy column
    e. Paste into a column in Excel file
3. Figure out how many overtures will be approximately 20% of all overtures for that function
4. Start a column next to the random permutations, numbering consecutively up to the 20% number (e.g., if you need to do 13 overtures for reliability, find the first 13 number on the random permutation.
5. Locate the overtures that correspond with those numbers (e.g., the overtures that correspond with the first 13 random numbers).
6. Those will be the overtures to use for reliability. Label them “reliability” and put in bold font.
7. If there are other overtures of the same function in the same clip, mark those as ones to do alone.
8. All overtures remaining can be used for training or calibrating on the rules.
9. Calculate reliability for each function separately as well as for all together.

RELIABILITY SUMMARY SHEET: RESPONSES (done with Sara)

For which function?	*Analyzable vs. not analyzable*		*Change in behavior vs. no change in behavior*		If there is a change, is it *predictable vs. not predictable* given what the agent was proposing in the overture	
	agree	dec	agree	decisions	agree	decisions
Attention seeking	**11**	**14**	**11**	**11**	**9**	**10**
Directing	**22**	**22**	**11**	**13**	**13**	**13**
Helping	**7**	**8**	**3**	**3**	**3**	**3**
Greeting	**28**	**28**	**17**	**17**	**15**	**16**
Playful	**13**	**13**	**11**	**11**	**9**	**11**
Conversational	**9**	**10**	**6**	**6**	**5**	**5**
Rewarding	**11**	**12**	**8**	**9**	**7**	**7**
Narrative	**40**	**45**	**23**	**27**	**23**	**23**
IN TOTAL	**141/152 = 92.8%**		**90/97 = 92.8%**		**84/88 = 95.5%**	

	Analyzable vs. not analyzable		Were the infant's behaviors during the overture cooperative?	
	agree	dec	agree	dec
Instrumental action	**10**	**10**	**10**	**10**

Procedures used for reliability: Pre-overture behaviors analysis

For each overture function:

1. Copy and paste all overtures from the analysis sheet into the Excel file. Use one worksheet per function so all functions are together in the same file.
2. Get randomized permutation from http://www.tufts.edu/~gdallal/random_permutation.htm
   a. Enter smallest integer as the number of the first line that has an overture
   b. Enter largest integer as the last line
   c. Generate random permutation in one low column
   d. Copy column
   e. Paste into a column in Excel file
3. Figure out how many overtures will be approximately 20% of all overtures for that function
4. Start a column next to the random permutations, numbering consecutively up to the 20% number (e.g., if you need to do 13 overtures for reliability, find the first 13 numbers on the random permutation.
5. Locate the overtures that correspond with those numbers (e.g., the overtures that correspond with the first 13 random numbers).
6. Those will be the overtures to use for reliability. Label them "reliability" and put in bold font.
7. If there are other overtures to *the same infant in the same clip*, mark those as ones to do alone.
8. All overtures remaining can be used for training or calibrating on the rules.
9. Indicate on the main analysis sheet which ones are for reliability and which ones can be used for training or calibrating.
10. Make a reliability analysis sheet with the calibrating rows removed. It is sometimes helpful to leave the whole episode of those set aside for reliability (i.e., not just the reliability overtures, but all overtures from that episode) on the sheet. If you do so, highlight electronically the ones that are for reliability.
11. Calculate reliability for each function separately as well as for all together.

RELIABILITY SUMMARY: PRE-OVERTURE BEHAVIORS (done with Christine)

For which function?	Attending Agent, Otherwise Engaged, or Potentially Available,	
	agree	decisions
Attention seeking	**12**	**14**
Directing	**12**	**14**
Helping	**5**	**6**
Greeting	**18**	**21**
Playful	**7**	**10**
Conversational	**6**	**9**
Rewarding	**8**	**11**
Narrative	**23**	**30**
IN TOTAL	**94/112 = 83.9%**	

Appendix H: Number of overtures in each analysis:

		subtotals	Notes
Number of overtures at the end of overture location analysis	734		
number added because of dividing	+ 80	**814**	Number analyzed in modality analysis
Number deemed as not having an analyzable function	- 13	801	7 → Words unclear 2 → 2 simultaneous functions 2 → function unclear 1 → parent uses wrong name 1 → parent laughing, not talking
		801	Number included in response analysis
Number of overtures removed during response analysis	- 3	798	2 → removed because 2 overtures had been previously divided because different functions (so there were 4), then the function of one in each pair changed, so they ended up being the same function after all. So they were put back together. 1 → 2 simultaneous agents
		811	Number of overtures in overture results: = 814 - three removed during response analysis
Number of overtures removed because infant response was not analyzable	- 183	615	not visible, no time, parent intervenes, too chaotic, can't tell where agent is, words unclear, message in overture too mixed
Number of instrumental actions	- 50	**565**	Number analyzed for social responses

Criteria for including overtures in social response analysis:

1. parent's words clearly audible
2. one clear function
3. one clear agent
4. infant visible enough to judge response
5. infant had reasonable amount of time to respond
6. knew where parent was, if necessary (e.g., if necessary to judge direction of infant's gaze)

Appendix I: All data

age range	clip number	overture time	ov #	agent	infant	OVERTURE	function	response
6-9 months	03.30.2000.10	1.15.01-1.17.22	01a	father	3	touches baby's cheek	C1 greeting	response
6-9 months	03.30.2000.10	1.17.22-1.19.69	01b	father	3	moves baby	D2 instrumental	
6-9 months	03.30.2000.10	2.42.90-2.45.13	02a	father	2	pulls arm	D2 instrumental	
6-9 months	03.30.2000.10	2.45.13-2.49.09	02b	father	2	tickles hand	C2 playful	response
6-9 months	03.30.2000.10	2.50.58-2.51.78	3	father	2	pulls on baby	D2 instrumental	
6-9 months	03.30.2000.10	2.54.01-2.58.42	4	father	2	moves hand + "sweetie watch your bother's eyes"	A2 directing	not analyzable
6-9 months	03.30.2000.10	3.46.56-3.48.03	5	father	2	moves baby's leg	D2 instrumental	
6-9 months	03.30.2000.10	4.11.35-4.15.89	6	father	2	moves baby's leg	D2 instrumental	
6-9 months	03.30.2000.10	4.44.28-4.45.51	7	father	3	moves baby's arm	D2 instrumental	
6-9 months	04.02.2000.13	49.52-50.55	1	mother	2	[name]	A1 attention seeking	no response
6-9 months	04.02.2000.13	50.74-51.88	2	mother	2	[name]	A1 attention seeking	no response
6-9 months	04.02.2000.13	53.14-54.37	3	mother	2	[name]	A1 attention seeking	response
6-9 months	04.02.2000.13	56.56-57.69	4	mother	2	[name]	A1 attention seeking	response
6-9 months	04.02.2000.13	59.52-1.00.88	05a	mother	2	hi [name]	C1 greeting	not analyzable
6-9 months	04.02.2000.13	1.00.88-1.01.72	05b	mother	2	whoops!	D1 narrative	not analyzable
6-9 months	04.02.2000.13	1.03.08-1.04.36	6	mother	2	hi [name]	C1 greeting	response
6-9 months	04.02.2000.13	1.04.83-1.05.47	7	mother	2	hi	C1 greeting	not analyzable
6-9 months	04.02.2000.13	1.06.11-1.09.99	8	mother	2	look at you what a sweet baby girl	D1 narrative	not analyzable
6-9 months	04.02.2000.13	1.10.14-1.11.78	9	mother	2	hi [name]	C1 greeting	no response
6-9 months	04.02.2000.13	1.13.08-1.13.50	10a	mother	2	yeah	C4 rewarding	not analyzable
6-9 months	04.02.2000.13	1.13.50-1.15.60	10b	mother	2	you jump in the jolly jumper	D1 narrative	not analyzable
6-9 months	04.02.2000.13	1.54.43-1.55.59	11	mother	3	baby boy	A1 attention seeking	response
6-9 months	04.02.2000.13	1.57.06-1.58.32	12	mother	3	baby boy	A1 attention seeking	response
6-9 months	04.02.2000.13	1.59.27-2.00.00	13	mother	3	hi	C1 greeting	response
6-9 months	04.02.2000.13	2.04.81-2.06.22	14	mother	3	hi baby boy	C1 greeting	no response
6-9 months	04.02.2000.13	2.11.44-2.12.54	15	mother	3	baby boy	A1 attention seeking	no response
6-9 months	04.02.2000.13	2.14.20-2.15.17	16	father	3	[name]	A1 attention seeking	not analyzable
6-9 months	04.02.2000.13	2.17.45-2.18.61	17	mother	3	hi baby boy	C1 greeting	no response
6-9 months	04.02.2000.13	3.04.48-3.05.41	18	father	1	[name] (wrong name)	not analyzable	
6-9 months	04.02.2000.13	3.05.60-3.06.59	19	father	1	Hey M-	A1 attention seeking	response
6-9 months	04.02.2000.13	3.08.61-3.09.82	20	father	1	sorry [name]	D1 narrative	response
6-9 months	04.02.2000.13	3.15.04-3.16.16	21	father	1	[name]	A1 attention seeking	response
6-9 months	04.02.2000.13	3.18.87-3.20.40	22	mother	1	hi baby boy	C1 greeting	response
6-9 months	04.02.2000.13	3.20.91-3.21.61	23a	mother	1	Hi	C1 greeting	response
6-9 months	04.02.2000.13	3.21.61-3.22.96	23b	mother	1	are you having fun?	C3 conversational	response
6-9 months	04.02.2000.13	3.23.66-3.24.31	24	mother	1	yup	D1 narrative	no response
6-9 months	04.02.2000.13	3.32.31-3.33.16	25	mother	1	[name]	A1 attention seeking	response
6-9 months	04.02.2000.13	3.35.47-3.36.34	26	mother	1	jump jump jump	A2 directing	not analyzable
6-9 months	04.02.2000.13	3.38.11-3.39.11	27	mother	1	jump	A2 directing	response
6-9 months	04.03.2000.14	14.44-15.44	1	father	1	[name]	A1 attention seeking	no response
6-9 months	04.03.2000.14	16.37-17.79	2	father	1	[name]	A1 attention seeking	no response
6-9 months	04.03.2000.14	24.04-24.78	3	mother	1	taps fingernails on table	A1 attention seeking	no response
6-9 months	04.03.2000.14	37.44-37.98	04a	mother	1	baby	A1 attention seeking	response
6-9 months	04.03.2000.14	37.98-40.60	04b	mother	1	look that tray is bigger than you are!	D1 narrative	not analyzable
6-9 months	04.03.2000.14	41.66-42.41	05a	mother	1	oh	B calming	response
6-9 months	04.03.2000.14	42.41-43.63	05b	mother	1	you don't like your tray?	C3 conversational	no response
6-9 months	04.03.2000.14	44.33-46.08	6	mother	1	taps	A1 attention seeking	not analyzable
6-9 months	04.10.2000.18	1.47.78-1.48.99	1	mother	2	good morning	C1 greeting	response
6-9 months	04.10.2000.18	1.50.63-1.52.18	2	mother	2	yeah good morning	C4 rewarding	no response
6-9 months	04.10.2000.18	1.53.53-1.56.38	3	mother	2	let's say hi to your brother he's waking up too	D1 narrative	response
6-9 months	04.10.2000.18	1.57.08-1.58.03	4	mother	2	yeah	D1 narrative	response
6-9 months	04.10.2000.18	1.58.98-1.59.89	5	mother	2	yeah	D1 narrative	response
6-9 months	04.10.2000.18	2.01.32-2.02.29	6	mother	2	yeah	D1 narrative	response
6-9 months	04.10.2000.18	2.12.09-1.14.01	7	mother	1	good morning [name]	C1 greeting	response
6-9 months	04.10.2000.18	2.15.32-2.17.20	8	mother	1	hi baby boy	C1 greeting	response
6-9 months	04.10.2000.18	2.24.60-2.27.10	9	mother	1	good morning [name]	C1 greeting	response
6-9 months	04.10.2000.18	2.54.12-2.55.20	10	mother	1	hi baby	C1 greeting	not analyzable
6-9 months	04.10.2000.18	2.55.80-2.56.34	11	mother	1	yeah	D1 narrative	response
6-9 months	04.10.2000.18	3.12.06-3.13.92	12	mother	2	hi [name]	C1 greeting	response
6-9 months	04.10.2000.18	3.15.22-3.17.38	13	mother	2	hi [name]	C1 greeting	not analyzable
6-9 months	04.18.2000.23	12.19-14.58	1	mother	3	Hi you cute heart	C1 greeting	response
6-9 months	04.18.2000.23	22.60-24.49	2	mother	3	Hi	C1 greeting	response
6-9 months	04.18.2000.23	27.00-28.63	03a	mother	3	You little sweetheart	D1 narrative	response
6-9 months	04.18.2000.23	28.63-29.30	03b	mother	3	yeah	C4 rewarding	response
6-9 months	04.18.2000.23	29.49-30.49	4	mother	3	[name]	D1 narrative	no response
6-9 months	04.18.2000.23	31.52-36.02	5	mother	3	Oh mummys coming to get you, okay, mummys coming to get you sweetboy	D1 narrative	not analyzable
6-9 months	04.18.2000.23	46.52- 47.60	6	mother	1	[name]	A1 attention seeking	response
6-9 months	04.18.2000.23	47.99-48.84	7	mother	1	[name]	A1 attention seeking	response
6-9 months	04.18.2000.23	49.75-50.43	8	mother	1	Hi	C1 greeting	not analyzable

6-9 months	04.18.2000.23	51.40- 52.24	9	mother	1	[name]	A1 attention seeking	no response
6-9 months	04.18.2000.23	55.81- 56.84	10	mother	1	Camera shy?	C3 conversational	response
6-9 months	04.18.2000.23	57.71- 1.00.36	11	mother	1	Hi hi hi hi, you jumpy boy	C1 greeting	response
6-9 months	04.18.2000.23	1.01.56-1.03.01	12	mother	1	Hi jumpy	C1 greeting	response
6-9 months	04.18.2000.23	1.04.71-1.06.19	13	father	2	picks baby up	D2 instrumental	
6-9 months	04.18.2000.23	1.13.50-1.14.70	14	father	2	shifts baby	B calming	response
6-9 months	04.18.2000.23	1.17.99-1.19.40	15	father	2	shifts baby	D2 instrumental	
6-9 months	04.18.2000.23	1.52.20-1.53.11	16	father	1	[name]	not analyzable	
6-9 months	04.18.2000.23	1.58.51-1.59.52	17	mother	1	[name]	A1 attention seeking	response
6-9 months	04.18.2000.23	1.59.65-2.01.05	18	mother	1	jump jump jump	D1 narrative	response
6-9 months	04.18.2000.23	2.01.21-2.01.70	19a	mother	1	yah	C4 rewarding	not analyzable
6-9 months	04.18.2000.23	2.01.70-2.02.82	19b	mother	1	[name]	A1 attention seeking	response
6-9 months	04.18.2000.23	2.02.82-2.03.69	19c	mother	1	ah	C4 rewarding	response
6-9 months	04.18.2000.23	2.03.99-2.06.09	20	mother	1	you doing the jumping jack? (?)	D1 narrative	response
6-9 months	04.22.2000.25	10.52-12.13	1	mother	1	oh [name]	A1 attention seeking	response
6-9 months	04.22.2000.25	14.41-15.71	2	mother	1	whatcha gonna do?	C3 conversational	no response
6-9 months	04.22.2000.25	18.75-20.35	3	mother	1	you're gonna look at Cody	D1 narrative	no response
6-9 months	04.22.2000.25	47.09-48.13	4	mother	3	[name]	C1 greeting	not analyzable
6-9 months	04.22.2000.25	48.98-50.66	5	mother	3	hi baby boy	C1 greeting	response
6-9 months	04.22.2000.25	50.96-51.70	6	mother	3	aah	D1 narrative	response
6-9 months	04.22.2000.25	52.00-54.79	7	mother	3	oh you're attacking, attack attack!	D1 narrative	no response
6-9 months	04.22.2000.25	1.40.19-1.41.68	8	father	2	takes toy away	D2 instrumental	
6-9 months	04.22.2000.25	1.48.22-1.49.27	9	father	2	puts baby down	D2 instrumental	
6-9 months	04.22.2000.25	1.53.30-1.53.80	10	mother	2	oh	D1 narrative	not analyzable
6-9 months	04.22.2000.25	1.54.21-1.55.75	11	mother	2	way to go [name]	C4 rewarding	no response
6-9 months	04.22.2000.25	2.12.26-2.14.18	12	mother	2	pushes ball towards baby	C2 playful	no response
6-9 months	04.22.2000.25	2.43.77-2.47.62	13	mother	1	kicking ball towards baby	C2 playful	no response
6-9 months	04.22.2000.25	2.55.32-2.56.62	14	mother	3	careful [name]	A2 directing	response
6-9 months	04.22.2000.25	3.45.00-3.46.22	15	father	3	gives baby toy	D2 instrumental	
6-9 months	04.22.2000.25	4.07.80-4.08.23	16	mother	3	oh	D1 narrative	no response
6-9 months	04.22.2000.25	4.15.99-4.17.90	17	father	2	you get it [name] you get it	A2 directing	no response
6-9 months	04.22.2000.25	4.41.42-4.42.63	18	mother	3	hi [name]	C1 greeting	no response
6-9 months	04.22.2000.25	4.48.80-4.50.11	19	mother	1	hi [name]	C1 greeting	response
6-9 months	04.22.2000.25	4.58.50-5.00.47	20	mother	1	hi [name]	C1 greeting	not analyzable
6-9 months	04.22.2000.25	5.00.99-5.01.32	21	mother	1	hi	C1 greeting	no response
6-9 months	04.22.2000.25	5.42.68-5.43.08	22a	mother	2	oh	D1 narrative	not analyzable
6-9 months	04.22.2000.25	5.43.08-5.44.02	22b	mother	2	oh, careful	A2 directing	response
6-9 months	04.22.2000.25	5.49.20-5.51.22	23	father	2	moves hand	A2 directing	not analyzable
6-9 months	04.22.2000.25	5.50.60-5.51.72	24	mother	3	oh	D1 narrative	no response
6-9 months	04.22.2000.25	5.52.53-5.52.92	25a	father	2	moves hand	A2 directing	not analyzable
6-9 months	04.22.2000.25	5.52.92-5.54.43	25b	mother	2	[name]	A1 attention seeking	not analyzable
6-9 months	04.22.2000.25	6.04.54-6.05.54	26	mother	2	oh lost it	D1 narrative	no response
6-9 months	04.22.2000.25	6.16.94-6.18.04	27	mother	2	moves ball	C2 playful	response
6-9 months	04.22.2000.25	6.22.87-6.24.82	28	mother	2	pushes ball towards baby	C2 playful	response
6-9 months	04.22.2000.25	6.34.16-6.35.31	29	mother	2	[name]	A1 attention seeking	response
6-9 months	04.22.2000.25	6.35.74-6.37.00	30	mother	2	pushes ball towards baby	C2 playful	no response
6-9 months	04.22.2000.25	6.39.02-6.40.13	31	mother	2	oh cody	D1 narrative	no response
6-9 months	04.22.2000.25	6.50.12-6.52.67	32	mother	2	moves ball	C2 playful	response
6-9 months	04.22.2000.25	6.54.94-6.56.00	33a	mother	2	pushes ball to baby + "OK"	B calming	response
6-9 months	04.22.2000.25	6.56.00-6.57.11	33b	mother	2	pushes ball to baby + "OK"	C3 conversational	response
6-9 months	04.22.2000.25	7.28.96-7.29.90	34	mother	1	[name]	A1 attention seeking	no response
6-9 months	04.22.2000.25	7.55.13-7.56.18	35	mother	2	[name]	C1 greeting	response
6-9 months	04.22.2000.25	8.00.90-8.01.58	36	mother	2	help	D1 narrative	not analyzable
6-9 months	04.22.2000.25	8.02.69-8.08.43	37	mother	2	[name] + tickling and touching	not analyzable	
6-9 months	04.22.2000.25	8.11.18-8.12.83	38	mother	2	screams + moves hand away	not analyzable	
6-9 months	04.22.2000.25	8.13.80-8.14.90	39	mother	2	whoa!	D1 narrative	response
6-9 months	04.23.2000.26	1.26.56-1.28.85	1	father	1	thank you for that dance, [name]	D1 narrative	not analyzable
6-9 months	04.23.2000.26	1.38.91-1.40.56	2	mother	3	little scream	C2 playful	response
6-9 months	04.24.2000.27	1.02.93-1.03.75	1	father	2	[name]	A1 attention seeking	no response
6-9 months	04.24.2000.27	1.04.62-1.05.30	2	father	2	[name]	A1 attention seeking	no response
6-9 months	04.24.2000.27	1.12.61-1.13.30	3	mother	2	where's daddy?	A2 directing	no response
6-9 months	04.24.2000.27	1.23.06-1.24.70	4	mother	2	whatterya doing sweetie girl?	C3 conversational	no response
6-9 months	04.24.2000.27	1.42.00-1.43.00	5	mother	2	what are you doing?	C3 conversational	response
6-9 months	04.24.2000.27	3.04.19-3.05.47	6	mother	3	wiggles baby	C2 playful	no response
6-9 months	04.24.2000.27	3.24.61-3.25.69	7	mother	3	[name]	A1 attention seeking	no response
6-9 months	04.24.2000.27	3.25.69-3.26.49	8	mother	3	whistles	A1 attention seeking	no response
6-9 months	04.24.2000.27	3.26.72-3.27.72	9	mother	3	[name]	A1 attention seeking	response
6-9 months	04.24.2000.27	3.28.40-3.28.99	10a	mother	3	hey	C4 rewarding	response
6-9 months	04.24.2000.27	3.28.99-3.30.16	10b	mother	3	hi cutie	C1 greeting	no response
6-9 months	04.30.2000.30	32.95-34.29	1	mother	1	oh big yawn	D1 narrative	response
6-9 months	04.30.2000.30	1.57.04-1.58.95	2	mother	2	hi sweetie girl	C1 greeting	response
6-9 months	04.30.2000.30	2.08.80-2.10.30	3	mother	2	yes baby girl	D1 narrative	response
6-9 months	04.30.2000.30	3.18.87-3.20.58	4	mother	1	oh that's no fun	B calming	response
6-9 months	04.30.2000.30	3.20.88-3.21.76	5	mother	1	yeah	B calming	not analyzable

6-9 months	04.30.2000.30	3.54.85-3.57.54	6	mother	1	whaddaya think maybe then... (drowned out by crying)	C3 conversational	response
6-9 months	05.04.2000.32	16.65-18.72	1	mother	2	play the piano again [name]	A2 directing	no response
6-9 months	05.04.2000.32	22.07-23.17	2	mother	2	plong plong	not analyzable	
6-9 months	05.04.2000.32	30.00-30.52	3	mother	2	whoop	D1 narrative	response
6-9 months	05.09.2000.33	1.05.97-1.06.87	1	mother	1	[name]	A1 attention seeking	no response
6-9 months	05.12.2000.34	3.00-4.39	1	father	2	bouncing baby	C2 playful	not analyzable
6-9 months	05.12.2000.34	10.864-14.404	2	father	2	picks baby up, bounces baby	C2 playful	not analyzable
6-9 months	05.12.2000.34	22.53-24.604	3	father	2	moves baby	D2 instrumental	
6-9 months	05.19.2000.35	2.09.91-2.11.21	1	mother	3	hello naked boy	C1 greeting	not analyzable
6-9 months	05.19.2000.35	2.11.8-2.12.40	2	mother	3	Hi	C1 greeting	response
6-9 months	05.19.2000.35	2.14.64-2.16.02	03a	mother	3	reaches out hand and touches baby on head + holds baby back + "eeyou"	C1 greeting	response
6-9 months	05.19.2000.35	2.16.02-2.20.05	03b	mother	3	holds baby back	D2 instrumental	
6-9 months	05.19.2000.35	2.20.05-2.23.4	03c	mother	3	eeyou	D1 narrative	response
6-9 months	05.19.2000.35	2.51.48-2.52.21	4	mother	3	[name]	A1 attention seeking	not analyzable
6-9 months	05.19.2000.35	2.52.51-2.52.42	5	mother	3	are you a happy boy?	C3 conversational	not analyzable
6-9 months	05.19.2000.35	2.53.91-2.54.44	6	mother	3	[name]	A1 attention seeking	response
6-9 months	05.19.2000.35	2.55.29-2.56.27	7	mother	3	hi happy	C1 greeting	not analyzable
6-9 months	05.19.2000.35	2.56.48-2.57.24	8	mother	3	hi happy	C1 greeting	response
6-9 months	05.19.2000.35	3.04.09-3.04.88	9	mother	3	hi happy	C1 greeting	response
6-9 months	05.19.2000.35	3.05.30-3.06.0	10	mother	3	hi	C1 greeting	no response
6-9 months	05.19.2000.35	3.17.41-3.18.34	11	mother	3	hi happy	C1 greeting	response
6-9 months	05.19.2000.35	3.19.20-3.20.99	12	mother	3	Did you have fun in the bathtub?	C3 conversational	no response
6-9 months	05.19.2000.35	3.22.00-3.23.30	13	mother	3	Yah, you did	C3 conversational	no response
6-9 months	05.19.2000.35	3.23.81-3.24.46	14	mother	3	yah	D1 narrative	no response
6-9 months	05.19.2000.35	3.34.62-3.35.32	15	mother	3	uh uh	D1 narrative	no response
6-9 months	05.19.2000.35	3.58.89-3.59.81	16	mother	2	[name]	C1 greeting	response
6-9 months	05.19.2000.35	4.05.42-4.06.30	17	mother	2	[name]	A1 attention seeking	response
6-9 months	05.19.2000.35	4.08.89-4.09.0	18	mother	2	ah	C4 rewarding	response
6-9 months	05.19.2000.35	4.53.71-4.54.90	19	mother	1	[name]	A1 attention seeking	response
6-9 months	05.19.2000.35	5.02.42-5.02.99	20	mother	1	uh oh	D1 narrative	not analyzable
6-9 months	05.19.2000.35	5.03.41-5.05.18	21	mother	1	hard to crawl over that stuff isn't it?	C3 conversational	response
6-9 months	05.19.2000.35	5.05.72-5.08.71	22	mother	1	ah, how can I get over it? oh he says I can do it	D1 narrative	response
6-9 months	05.19.2000.35	5.09.89-5.10.8	23	mother	1	uh oh	D1 narrative	response
6-9 months	05.19.2000.35	5.12.01-5.12.55	24	mother	1	hi	C1 greeting	not analyzable
6-9 months	05.19.2000.35	5.13.22-5.14.05	25	mother	1	it's mummy	D1 narrative	response
6-9 months	05.26.2000.37	1.31.9-1.33.09	1	mother	2	[name]	C1 greeting	not analyzable
6-9 months	05.26.2000.37	1.33.59-1.34.59	2	mother	2	woah	D1 narrative	response
6-9 months	05.26.2000.37	1.36.89-1.38.09	3	mother	2	Hi [name]	C1 greeting	response
6-9 months	05.26.2000.37	1.41.00-1.41.60	4	mother	2	oops	D1 narrative	not analyzable
6-9 months	05.26.2000.37	1.42.51-1.43.11	5	mother	2	oops	D1 narrative	no response
6-9 months	05.26.2000.37	2.31.50-2.35.31	6	mother	2	[name] is giving her brother a hug, ahhh	D1 narrative	response
6-9 months	05.26.2000.37	2.36.214-2.37.3	7	mother	2	yeah	D1 narrative	response
6-9 months	05.26.2000.37	2.41.55-2.42.79	8	mother	2	Hi Baby Girl	C1 greeting	response
6-9 months	05.26.2000.37	2.49.80-2.51.11	9	mother	2	Hi baby girl	C1 greeting	response
6-9 months	05.27.2000.38	1.12.25-1.13.37	1	mother	2	[name]	A1 attention seeking	not analyzable
6-9 months	05.27.2000.38	1.13.50-1.14.31	2	mother	2	[name]	A1 attention seeking	no response
6-9 months	05.27.2000.38	1.14.99-1.15.97	3	mother	2	[name]	A1 attention seeking	response
6-9 months	05.27.2000.38	1.18.28-1.19.12	4	mother	2	yay	C4 rewarding	response
6-9 months	05.27.2000.38	1.20.51-1.22.01	5	mother	2	you got the hat	C4 rewarding	no response
6-9 months	05.27.2000.38	1.40.50-1.41.27	6	mother	3	Hi	C1 greeting	no response
6-9 months	05.27.2000.38	1.46.00-1.50.05	7	father	2	picks up and puts down baby	D2 instrumental	
6-9 months	05.27.2000.38	1.46.70-1.50.78	8	mother	3	your sitting on your own[name], look at you	C4 rewarding	response
6-9 months	05.27.2000.38	1.58.71-2.00.41	9	mother	3	hi [name]	C1 greeting	no response
6-9 months	05.27.2000.38	2.13.22-2.14.16	10	father	1	[name]	A1 attention seeking	no response
6-9 months	05.27.2000.38	3.54.69-1.56.70	11	mother	3	oh attack of the pillow	D1 narrative	no response
6-9 months	05.27.2000.38	4.57.21-4.58.09	12a	mother	3	oh sitting	D1 narrative	not analyzable
6-9 months	05.27.2000.38	4.58.09-5.00.08	12b	mother	3	you're sitting baby boy, yep	C4 rewarding	response
6-9 months	05.27.2000.38	5.01.70-5.02.99	13	mother	3	you're sitting	C4 rewarding	response
6-9 months	05.27.2000.38	6.45.15-6.46.91	14	mother	1	yes [name]	C3 conversational	response
6-9 months	05.31.2000.39	13.03-14.17	1	mother	2	hey [name]?	C3 conversational	response
6-9 months	05.31.2000.39	24.95-26.45	2	mother	2	Who's my wiggly girl?"	D1 narrative	no response
6-9 months	05.31.2000.39	28.27-28.67	3	mother	2	hmm?	D1 narrative	not analyzable
6-9 months	05.31.2000.39	1.30.00-1.31.29	4	mother	1	[name]	A2 directing	response
6-9 months	05.31.2000.39	1.36.42-1.37.89	5	mother	1	ahhh	D1 narrative	response
6-9 months	05.31.2000.39	1.39.39-1.41.29	6	mother	1	hi [name]	C1 greeting	response
6-9 months	05.31.2000.39	1.42.89-1.43.63	7	mother	1	uh oh oh oh	D1 narrative	response
6-9 months	05.31.2000.39	1.54.63-1.56.27	8	mother	1	hand reaches out and strokes babies head	C1 greeting	response

6-9 months	05.31.2000.39	1.58.61-1.59.28	09a	mother	1	woah	D1 narrative	not analyzable
6-9 months	05.31.2000.39	1.59.28-2.01.42	09b	mother	1	Oh no don't touch the lens pulls babies hand down	A2 directing	not analyzable
6-9 months	05.31.2000.39	2.06.89-2.08.57	10	mother	2	[name] show us your new crawl	A2 directing	no response
6-9 months	05.31.2000.39	2.48.08-2.49.76	11	mother	3	Hi [name]	C1 greeting	response
6-9 months	05.31.2000.39	3.07.34-3.08.12	12	mother	3	[name]	A1 attention seeking	response
6-9 months	05.31.2000.39	4.12.35-4.14.86	13	father	1	hee hee, hi [name]	C1 greeting	not analyzable
6-9 months	06.02.2000.40	1.8-3.09	1	mother	3	hey [name]	C1 greeting	response
6-9 months	06.02.2000.40	19.79-22.16	2	mother	3	yeah, and then into a crawl	D1 narrative	response
6-9 months	06.02.2000.40	22.59-23.3	3	mother	3	perfect	C4 rewarding	response
6-9 months	06.02.2000.40	23.57-24.09	4	mother	3	uh oh	D1 narrative	not analyzable
6-9 months	06.02.2000.40	24.9-25.57	5	mother	3	yikes	D1 narrative	not analyzable
6-9 months	06.02.2000.40	25.6-26.77	6	mother	3	here comes trouble	D1 narrative	response
6-9 months	06.02.2000.40	36.635-38.875	7	mother	2	there's [name], wiggly girl	D1 narrative	response
6-9 months	06.02.2000.40	39.025-40.625	8	mother	2	resting her feet on the couch	D1 narrative	response
6-9 months	06.02.2000.40	42.345-44.495	9	mother	1	there's [name], I see him	D1 narrative	response
6-9 months	06.02.2000.40	45.025-46.335	10	mother	3	ope, [name]	D1 narrative	not analyzable
6-9 months	06.02.2000.40	46.875-48.895	11	mother	3	ahhh, climbing his mommy	D1 narrative	response
6-9 months	06.02.2000.40	1.13.01-1.14.54	12	mother	3	that's me, mumma	D1 narrative	response
6-9 months	06.02.2000.40	1.52.60- 1.54.6	13	mother	2	attacking her brother, ooh	D1 narrative	not analyzable
6-9 months	06.02.2000.40	2.00.34-2.01.26	14	mother	3	it's okay	B calming	not analyzable
6-9 months	06.06.2000.43	25.11-26.52	1	mother	3	There's [name]	D1 narrative	response
6-9 months	06.06.2000.43	27.29-28.68	2	mother	3	there's [name]	D1 narrative	response
6-9 months	06.06.2000.43	33.33-34.70	3	mother	3	hi [name]	C1 greeting	response
6-9 months	06.06.2000.43	39.35-40.99	4	mother	3	hi [name]	C1 greeting	no response
6-9 months	06.06.2000.43	1.13.40-1.14.68	5	mother	3	There's my boy	D1 narrative	no response
6-9 months	06.06.2000.43	2.12.72-2.14.10	6	mother	1	[name]	C1 greeting	no response
6-9 months	06.06.2000.43	4.36.22-4.39.00	7	mother	3	Don't stop talking on my account, [name]	A2 directing	response
6-9 months	06.06.2000.43	4.47.58-4.49.81	8	mother	3	oh, that would be a new one, you climbing in there	D1 narrative	not analyzable
6-9 months	06.06.2000.43	4.50.32-4.51.89	9	mother	3	Normally you climb out of there	D1 narrative	response
6-9 months	06.11.2000.45	0.0-1.65	1	mother	2	dee do do do	C2 playful	no response
6-9 months	06.11.2000.45	36.56-37.72	2	mother	2	[name] Mum puts spoon to babies mouth	A2 directing	response
6-9 months	06.11.2000.45	38.1-38.8	03a	mother	2	huh	D1 narrative	not analyzable
6-9 months	06.11.2000.45	38.8-39.51	03b	mother	2	hold on	A2 directing	not analyzable
6-9 months	06.11.2000.45	39.51-39.79	03c	mother	2	here	D1 narrative	not analyzable
6-9 months	06.11.2000.45	39.79-41.37	03d	mother	2	brings spoon towards baby, feeding baby	D2 instrumental	
6-9 months	06.11.2000.45	43.8-46.63	04a	mother	3	feeds baby	D2 instrumental	
6-9 months	06.11.2000.45	45.04-46.083	04b	mother	3	mother opens her mouth	A2 directing	response
6-9 months	06.11.2000.45	49.98-51.26	05a	mother	1	uh	C3 conversational	not analyzable
6-9 months	06.11.2000.45	51.26-54.1	05b	mother	1	feeds baby with spoon	D2 instrumental	
6-9 months	06.11.2000.45	51.93-52.82	05c	mother	1	mother opens her mouth	A2 directing	response
6-9 months	06.11.2000.45	54.7-55.84	6	mother	1	tickles under chin	C2 playful	not analyzable
6-9 months	06.11.2000.45	1.09.17-1.11.76	7	mother	2	pets babies head and pats back	B calming	not analyzable
6-9 months	06.11.2000.45	1.12.51-1.14.49	8	mother	1	feeds baby	D2 instrumental	
6-9 months	06.13.2000.47	34.31-36.82	1	mother	1	Banana? Do you want some banana?	C3 conversational	response
6-9 months	06.16.2000.48	18.00-18.97	1	mother	2	hi	C1 greeting	response
6-9 months	06.16.2000.48	20.14-21.21	2	mother	2	hi	C1 greeting	response
6-9 months	06.16.2000.48	23.01-24.94	3	mother	2	aw baby girl	D1 narrative	response
6-9 months	06.16.2000.48	25.88-27.51	4	mother	2	yeah [name]	C3 conversational	no response
6-9 months	06.16.2000.48	28.78-31.01	5	mother	3	There comes [name]	D1 narrative	response
6-9 months	06.16.2000.48	34.19-34.71	6	mother	3	da	C2 playful	no response
6-9 months	06.16.2000.48	36.15-36.61	7	mother	3	yeah	D1 narrative	response
9-12 months	06.19.2000.01	1.12.10-1.13.56	1	mother	3	come up and see mummy?	A2 directing	response
9-12 months	06.19.2000.01	1.22.40-1.23.15	2	mother	3	hello	C1 greeting	response
9-12 months	06.19.2000.01	1.24.69-1.25.97	3	mother	3	says something	not analyzable	
9-12 months	06.19.2000.01	1.38.60-1.41.45	4	mother	3	oh thank you very much thank you very much	D1 narrative	no response
9-12 months	06.19.2000.01	1.54.21-1.55.20	5	mother	3	whoop	D1 narrative	response
9-12 months	06.19.2000.01	1.56.32-1.58.29	6	mother	3	oh it's OK, it's OK	B calming	not analyzable
9-12 months	06.20.2000.02	1.12.81-1.14.95	1	father	3	Oh please drool on me again [name]	D1 narrative	response
9-12 months	06.20.2000.02	1.30.83-1.31.57	02a	father	1	raspberry	C2 playful	response
9-12 months	06.20.2000.02	1.35.55-1.36.94	02b	father	1	raspberry	C2 playful	not analyzable
9-12 months	06.20.2000.02	1.39.91-1.41.41	3	father	2	raspberry	C2 playful	not analyzable
9-12 months	06.20.2000.02	3.03.92-3.08.99	4	father	1	[name] no wonder the dog growled at you yesterday you're brutal!	D1 narrative	response
9-12 months	06.20.2000.02	3.16.90-3.25.07	5	father	1	touches hand and moves it away a bit	D2 instrumental	
9-12 months	06.20.2000.02	3.26.83-3.28.09	6	father	1	you look so innocent	D1 narrative	response
9-12 months	06.20.2000.02	3.50.61-3.53.29	7	mother	2	hi [name] hi	C1 greeting	response

9-12 months	06.20.2000.02	3.58.22-3.59.12	8	mother	2	oh	D1 narrative	not analyzable
9-12 months	06.20.2000.02	4.00.46-4.02.70	9	mother	2	oh oh ho, [name]	D1 narrative	no response
9-12 months	06.20.2000.02	4.31.06-4.40.07	10	father	3	touches back	D2 instrumental	
9-12 months	06.29.2000.06	0.00-1.37	1	mother	3	puts food in mouth	D2 instrumental	
9-12 months	06.29.2000.06	9.24-10.28	2	mother	2	puts food in mouth	D2 instrumental	
9-12 months	06.29.2000.06	19.24-20.26	3	mother	3	puts food in mouth	D2 instrumental	
9-12 months	06.29.2000.06	22.97-23.66	4	mother	1	puts food in mouth	D2 instrumental	
9-12 months	06.30.2000.07	0.14-1.50	1	mother	1	need some more bread?	C3 conversational	response
9-12 months	06.30.2000.07	2.50-4.18	2	mother	1	puts food in mouth	D2 instrumental	
9-12 months	06.30.2000.07	9.14-10.43	3	mother	2	[name]	A1 attention seeking	no response
9-12 months	06.30.2000.07	10.57-12.52	4	mother	2	Do you want another piece of bread?	C3 conversational	no response
9-12 months	06.30.2000.07	13.96-15.43	05a	mother	2	Is that yes or no? bread?	C3 conversational	not analyzable
9-12 months	06.30.2000.07	15.43-17.96	05b	mother	2	I can't see your mouth sweetie	D1 narrative	not analyzable
9-12 months	06.30.2000.07	18.82-20.24	6	mother	2	puts food in mouth	D2 instrumental	
9-12 months	07.02.2000.08	5.11-7.12	1	mother	1	whatcha got on your finger [name]	D1 narrative	not analyzable
9-12 months	07.02.2000.08	8.00-9.52	2	mother	1	what's that on your finger	D1 narrative	response
9-12 months	07.02.2000.08	10.84-11.90	3	mother	1	yeah	C4 rewarding	response
9-12 months	07.02.2000.08	21.39-23.09	04a	mother	1	yeah show how you put your finger in there	A2 directing	response
9-12 months	07.02.2000.08	23.09-24.30	04b	mother	1	yeah that's right	C4 rewarding	no response
9-12 months	07.02.2000.08	25.33-26.53	5	mother	1	woo-hoo	C4 rewarding	response
9-12 months	07.02.2000.08	30.00-30.89	5.5	mother	1	m-hm	C4 rewarding	response
9-12 months	07.02.2000.08	32.67-35.36	6	mother	1	yeah look at that you got your finger in there	D1 narrative	response
9-12 months	07.02.2000.08	36.23-37.21	7	mother	1	yeah	C4 rewarding	response
9-12 months	07.02.2000.08	38.19-40.40	8	mother	1	oo you can crawl with your finger in there	D1 narrative	no response
9-12 months	07.02.2000.08	53.20-55.03	9	mother	1	K can you put your finger in there	A2 directing	response
9-12 months	07.02.2000.08	1.08.07-1.09.32	10	mother	1	There you go	C4 rewarding	response
9-12 months	07.02.2000.08	1.09.48-1.11.17	11	mother	1	Yeah that's alright	C4 rewarding	response
9-12 months	07.02.2000.08	1.39.70-1.40.70	12	mother	2	boo-be-doo	C2 playful	response
9-12 months	07.02.2000.08	1.42.21-1.43.26	13	mother	2	wiggly girl	D1 narrative	response
9-12 months	07.02.2000.08	3.22.21-3.23.74	14	mother	2	Hi [name]	C1 greeting	response
9-12 months	07.02.2000.08	3.24.48-3.25.52	15	mother	2	Hi	C1 greeting	response
9-12 months	07.02.2000.08	3.26.32-3.27.92	16	mother	2	little noise	C2 playful	response
9-12 months	07.02.2000.08	4.27.73-4.28.96	17	mother	1	Hi [name]	C1 greeting	response
9-12 months	07.04.2000.09	0.40-1.50	1	mother	2	Hi [name]	C1 greeting	no response
9-12 months	07.04.2000.09	2.42-3.32	2	mother	2	you're standing	D1 narrative	not analyzable
9-12 months	07.04.2000.09	3.91-4.92	3	mother	2	yeah	D1 narrative	no response
9-12 months	07.04.2000.09	7.50-8.85	4	mother	2	[name]	A1 attention seeking	response
9-12 months	07.04.2000.09	13.80-15.39	5	mother	2	oo, hold on tight	A2 directing	response
9-12 months	07.04.2000.09	16.74-17.88	6	mother	2	yeah	C4 rewarding	response
9-12 months	07.04.2000.09	18.29-20.02	7	mother	2	?	not analyzable	
9-12 months	07.04.2000.09	47.95-49.58	8	mother	1	Hi [name]	C1 greeting	not analyzable
9-12 months	07.04.2000.09	49.71-51.09	9	mother	1	bounce bounce bounce	A2 directing	response
9-12 months	07.04.2000.09	52.10-53.81	10	mother	1	yeah bounce bounce bounce	C4 rewarding	response
9-12 months	07.04.2000.09	58.60-1.00.04	11	mother	1	bounce bounce bounce	D1 narrative	response
9-12 months	07.04.2000.09	1.01.77-1.02.77	12	mother	1	[name]	A1 attention seeking	response
9-12 months	07.04.2000.09	1.03.08-1.03.74	13	mother	1	bounce bounce	A2 directing	response
9-12 months	07.04.2000.09	1.05.41-1.06.70	14	mother	1	yeah	C4 rewarding	response
9-12 months	07.08.2000.11	28.41-29.30	1	mother	3	whoop	D1 narrative	no response
9-12 months	07.08.2000.11	32.31-34.69	2	mother	3	oh you see that the door's open you little...	D1 narrative	no response
9-12 months	07.08.2000.11	37.18-38.05	3	mother	3	baby	D1 narrative	not analyzable
9-12 months	07.08.2000.11	38.12-38.76	4	mother	3	[name]	A1 attention seeking	not analyzable
9-12 months	07.08.2000.12	22.72-23.34	1	mother	3	[name]	A1 attention seeking	response
9-12 months	07.08.2000.12	23.82-24.74	2	mother	3	whaddaya doing?	D1 narrative	not analyzable
9-12 months	07.08.2000.12	26.41-28.61	3	mother	3	you eating the diapers? You little silly?	D1 narrative	response
9-12 months	07.08.2000.12	28.79-31.44	4	mother	3	oooh	D1 narrative	response
9-12 months	07.08.2000.12	34.41-38.30	5	father	2	picks up and says things	B calming	response
9-12 months	07.08.2000.12	38.91-40.10	6	mother	1	aaah	D1 narrative	response
9-12 months	07.08.2000.12	44.01-44.67	7	father	2	taps baby	D2 instrumental	
9-12 months	07.08.2000.12	47.68-49.62	8	father	2	little noises	D1 narrative	response
9-12 months	07.08.2000.12	1.00.35-1.06.06	9	mother	3	laughing then "oh will you quit coming at me you little crazy oink oink"	D1 narrative	response
9-12 months	07.08.2000.12	1.06.44-1.07.30	10	mother	3	little noise	C2 playful	response
9-12 months	07.08.2000.12	1.08.76-1.11.69	11	mother	3	little noises	D1 narrative	response
9-12 months	07.08.2000.12	1.14.87-1.15.72	12	mother	3	help!	D1 narrative	not analyzable
9-12 months	07.08.2000.12	1.28.11-1.29.02	13	mother	3	aah!	D1 narrative	not analyzable
9-12 months	07.08.2000.12	1.30.56-1.31.80	14	mother	1	little scream	D1 narrative	not analyzable
9-12 months	07.08.2000.12	1.35.00-1.36.29	15	mother	2	hi [name]	C1 greeting	response
9-12 months	07.08.2000.12	1.37.80-1.38.70	16a	mother	2	hi	C1 greeting	not analyzable

9-12 months	07.08.2000.12	1.38.70-1.41.68	16b	mother	2	oh here comes another one...	D1 narrative	not analyzable
9-12 months	07.08.2000.12	1.44.61-1.46.41	17	mother	2	hi [name]	C1 greeting	response
9-12 months	07.08.2000.12	1.47.76-1.48.78	18	mother	3	little noise	D1 narrative	not analyzable
9-12 months	07.08.2000.12	1.48.78-1.49.82	19	mother	2	oh	D1 narrative	not analyzable
9-12 months	07.09.2000.13	38.96-39.99	1	mother	2	hi [name]	C1 greeting	not analyzable
9-12 months	07.09.2000.13	40.60-41.61	2	mother	2	whoa	C2 playful	response
9-12 months	07.12.2000.14	3.00-3.83	1	mother	2	Hi	C1 greeting	no response
9-12 months	07.12.2000.14	46.88-49.11	2	mother	2	[name] don't you want to be in there anymore?	B calming	response
9-12 months	07.12.2000.14	51.18-51.64	3	mother	2	m-kay	B calming	not analyzable
9-12 months	07.12.2000.14	52.15-53.76	4	mother	1	Hi [name]	C1 greeting	response
9-12 months	07.12.2000.14	54.51-55.72	5	mother	1	say hi	A2 directing	not analyzable
9-12 months	07.12.2000.14	55.80-57.18	6	mother	1	wave hi mummy	A2 directing	response
9-12 months	07.20.2000.16	1.02-4.40	1	mother	2	Now that mummy's videotaping you stop what you are doing	D1 narrative	response
9-12 months	07.20.2000.16	8.73-9.98	2	mother	2	yeah	C3 conversational	no response
9-12 months	07.20.2000.16	16.88-17.99	3	mother	3	yeah	D1 narrative	no response
9-12 months	07.20.2000.16	19.82-20.88	4	mother	3	[name]	A1 attention seeking	no response
9-12 months	07.20.2000.16	48.82-50.09	5	mother	2	yeah eh eh eh	D1 narrative	not analyzable
9-12 months	07.20.2000.16	50.32-51.98	6	mother	2	[name] eat your cheerios	A2 directing	no response
9-12 months	07.20.2000.16	53.08-53.85	7	mother	2	eh	C3 conversational	response
9-12 months	07.20.2000.16	57.15-1.00.00	8	mother	3	good boy [name] good boy	C4 rewarding	response
9-12 months	07.20.2000.16	1.04.67-1.06.66	09a	mother	1	oh good boy	C4 rewarding	response
9-12 months	07.20.2000.16	1.06.66-1.08.61	09b	mother	1	oh did that one make it in your mouth?	C3 conversational	not analyzable
9-12 months	07.20.2000.16	1.09.51-1.10.38	10	mother	1	yeah	C4 rewarding	not analyzable
9-12 months	07.20.2000.16	1.12.10-1.13.11	11	mother	1	mm?	D1 narrative	response
9-12 months	07.20.2000.16	1.13.88-1.15.16	12	mother	1	yeah	C3 conversational	not analyzable
9-12 months	07.20.2000.16	1.16.41-1.17.58	13	mother	2	[name]	C1 greeting	not analyzable
9-12 months	07.20.2000.16	1.17.71-1.19.78	14	mother	2	you need to eat some too	A2 directing	no response
9-12 months	07.20.2000.16	1.29.41-1.31.34	15	mother	2	you eat that cheerio [name]	A2 directing	no response
9-12 months	07.20.2000.16	1.36.79-1.37.55	16	mother	2	you eat that	A2 directing	not analyzable
9-12 months	07.20.2000.16	1.38.07-1.39.01	17	mother	2	you eat it	A2 directing	no response
9-12 months	07.20.2000.16	1.40.71-1.43.05	18	mother	2	yeah eat it [name] put it in your mouth	A2 directing	no response
9-12 months	08.12.2000.20	5.56-10.91	1	mother	2	holding apple	B calming	response
9-12 months	08.12.2000.20	11.51-16.03	2	mother	3	holding apple	D2 instrumental	
9-12 months	08.12.2000.20	16.03-19.51	3	mother	3	holding apple	D2 instrumental	
9-12 months	08.12.2000.20	20.91-25.03	4	mother	2	holding apple	D2 instrumental	
9-12 months	08.12.2000.20	27.06-28.53	5	mother	3	holding apple	B calming	response
9-12 months	08.12.2000.20	30.40-31.96	6	mother	3	oh you gotta big piece	D1 narrative	no response
9-12 months	08.12.2000.20	31.92-36.86	7	mother	2	holding apple	D2 instrumental	
9-12 months	08.12.2000.20	42.74-46.86	8	mother	2	holding apple	D2 instrumental	
9-12 months	08.12.2000.20	54.30-56.60	9	mother	1	oh + widens eyes	C4 rewarding	response
9-12 months	08.12.2000.20	1.00.48-1.11.49	10	mother	3	holding apple	B calming	response
9-12 months	08.12.2000.20	1.19.70-1.22.10	11a	mother	3	reaches for apple	not analyzable	
9-12 months	08.12.2000.20	1.19.70-1.22.10	11b	mother	3	picks lint off sweater	D2 instrumental	
9-12 months	08.12.2000.20	1.32.85-1.34.25	12	mother	3	makes face	C4 rewarding	response
9-12 months	08.12.2000.20	1.34.71-1.35.88	13	mother	3	is it a good apple?	C3 conversational	no response
9-12 months	08.12.2000.20	1.39.77-1.40.77	14	mother	3	it's yummy	D1 narrative	no response
9-12 months	08.12.2000.20	1.47.81-1.50.14	15	mother	2	picks up and puts into lap	B calming	response
9-12 months	08.12.2000.20	1.50.81-1.51.34	16a	mother	3	takes apple	D2 instrumental	
9-12 months	08.12.2000.20	1.51.34-1.52.73	16b	mother	3	oh will you share that with [name]?	A2 directing	not analyzable
9-12 months	08.12.2000.20	1.52.73-1.54.42	16c	mother	3	let's give [name] a little bite	D1 narrative	no response
9-12 months	08.12.2000.20	1.52.75-2.00.05	17	mother	2	holding apple	D2 instrumental	
9-12 months	08.12.2000.20	1.55.31-1.55.74	18a	mother	3	oh	D1 narrative	not analyzable
9-12 months	08.12.2000.20	1.55.74-1.57.75	18b	mother	3	careful [name]	A2 directing	response
9-12 months	08.12.2000.20	2.02.02-2.13.13	19	mother	3	holding apple	B calming	response
9-12 months	08.12.2000.20	2.14.55-2.15.44	20	mother	2	holding apple	B calming	response
9-12 months	08.12.2000.20	2.18.39-2.21.85	21	mother	3	holding apple	B calming	response
9-12 months	08.16.2000.21	7.50-8.35	1	mother	2	hi [name]	C1 greeting	not analyzable
9-12 months	08.16.2000.21	15.39-16.22	2	mother	3	little noise	C2 playful	response
9-12 months	08.16.2000.21	22.49-23.24	03a	mother	3	hi	C1 greeting	not analyzable
9-12 months	08.16.2000.21	23.24-25.50	03b	mother	3	yeah wave hi yeah	C4 rewarding	response
9-12 months	08.16.2000.21	38.89-39.89	4	mother	2	hi baby	C1 greeting	not analyzable
9-12 months	08.16.2000.21	40.39-41.11	5	mother	2	hi	C1 greeting	response
9-12 months	08.16.2000.21	42.11-42.81	06a	mother	2	wave hello	A2 directing	response
9-12 months	08.16.2000.21	42.81-43.09	06b	mother	2	yeah	C4 rewarding	response
9-12 months	08.16.2000.21	43.09-43.99	06c	mother	2	hi [name]	C1 greeting	not analyzable
9-12 months	08.16.2000.21	43.99-45.42	06d	mother	2	wave to mummy	A2 directing	not analyzable
9-12 months	08.16.2000.21	45.91-47.33	7	mother	2	wave to mummy	A2 directing	response
9-12 months	08.16.2000.21	47.91-48.73	08a	mother	2	hi	C1 greeting	not analyzable
9-12 months	08.16.2000.21	48.73-50.14	08b	mother	2	yeah that's a good girl	C4 rewarding	response
9-12 months	08.16.2000.21	52.00-53.76	9	mother	2	hi + waving	C1 greeting	response

9-12 months	08.16.2000.21	57.40-58.20	10	mother	3	[name]	A1 attention seeking	response
9-12 months	08.16.2000.21	58.87-59.79	11	mother	3	hi	C1 greeting	response
9-12 months	08.16.2000.21	1.02.40-1.03.57	12	mother	3	wave to mama	A2 directing	no response
9-12 months	08.16.2000.21	2.07.80-2.08.61	13	mother	3	[name]	A1 attention seeking	response
9-12 months	08.16.2000.21	2.09.00-2.10.10	14	mother	3	say hi mama	A2 directing	not analyzable
9-12 months	08.16.2000.21	2.10.71-2.11.60	15	mother	3	say hi mummy	A2 directing	response
9-12 months	08.16.2000.21	2.14.33-2.15.43	16	mother	3	yeah hi mummy	C4 rewarding	response
9-12 months	08.16.2000.21	2.18.72-2.19.45	17	mother	3	[name]	A1 attention seeking	response
9-12 months	08.16.2000.21	2.20.11-2.21.20	18	mother	3	say hi mummy	A2 directing	no response
9-12 months	08.16.2000.21	2.25.03-2.26.10	19	mother	3	hey [name]	A1 attention seeking	response
9-12 months	08.16.2000.21	2.30.70-2.31.74	20	mother	3	do that thing	A2 directing	not analyzable
9-12 months	08.16.2000.21	2.40.80-2.42.66	21	mother	1	you got down outta there yourself	D1 narrative	no response
9-12 months	08.16.2000.21	2.44.51-2.45.90	22	mother	1	there's mum's cast	D1 narrative	response
9-12 months	08.16.2000.21	2.46.98-2.47.92	23	mother	1	oh	D1 narrative	no response
9-12 months	08.16.2000.21	3.38.15-3.40.93	24	mother	3	what've you got to say, baby?	D1 narrative	response
9-12 months	08.16.2000.21	3.43.80-3.45.38	25	mother	3	gotta few words to say?	D1 narrative	response
9-12 months	08.16.2000.21	3.46.19-3.48.10	26	mother	3	hey gotta few things to say?	D1 narrative	no response
9-12 months	08.16.2000.21	3.50.73-3.51.95	27	mother	3	hey [name]	A1 attention seeking	response
9-12 months	08.16.2000.21	3.53.99-3.54.91	28	mother	3	hey [name]	A1 attention seeking	no response
9-12 months	08.18.2000.22	10.63-12.10	1	mother	3	OK shall I let you go?	C3 conversational	no response
9-12 months	08.18.2000.22	13.20-14.71	2	mother	3	aw, two kitties	D1 narrative	not analyzable
9-12 months	08.18.2000.22	15.67-17.19	3	mother	3	two kitties, aw yeah	D1 narrative	no response
9-12 months	08.18.2000.22	27.92-30.00	4	mother	3	[name] come to mummy	A2 directing	not analyzable
9-12 months	08.18.2000.22	31.53-32.40	5	mother	3	come to mummy	A2 directing	no response
9-12 months	08.18.2000.22	37.05-38.27	6	mother	3	come to mummy?	A2 directing	no response
9-12 months	08.20.2000.23	18.40-20.70	1	mother	3	to mummy, let's see you walk	A2 directing	not analyzable
9-12 months	08.20.2000.23	21.90-22.83	02a	mother	3	yeah, yeah	C3 conversational	not analyzable
9-12 months	08.20.2000.23	22.83-23.40	02b	mother	3	come on	A2 directing	response
9-12 months	08.20.2000.23	30.95-31.58	3	mother	3	yes	C4 rewarding	no response
9-12 months	08.20.2000.23	34.33-34.92	4	mother	3	oooh	D1 narrative	not analyzable
9-12 months	08.20.2000.23	40.90-42.29	5	father	3	[name] leave the chair behind	A2 directing	response
9-12 months	08.20.2000.23	57.80-59.19	06a	father	3	way to go [name]	C4 rewarding	response
9-12 months	08.20.2000.23	59.19-1.01.60	06b	both mothe	3	yay [name] + "yay"	C4 rewarding	response
9-12 months	08.20.2000.23	1.08.50-1.10.79	7	mother	3	what a good boy [name]	C4 rewarding	no response
9-12 months	08.20.2000.23	1.38.87-1.40.50	8	mother	3	what are you doing to mum's cast?	D1 narrative	response
9-12 months	08.20.2000.23	1.47.44-1.48.21	9	mother	3	hey cutie	C1 greeting	response
9-12 months	08.20.2000.23	1.49.30-1.49.99	10a	mother	3	hi cutie	C1 greeting	response
9-12 months	08.20.2000.23	1.49.99-1.51.73	10b	mother	3	yeah never mind + moves hand	A2 directing	not analyzable
9-12 months	08.20.2000.23	1.51.73-1.52.41	10c	mother	3	ooh	D1 narrative	not analyzable
9-12 months	08.20.2000.23	1.54.99-1.55.51	11	mother	2	hi [name]	C1 greeting	response
9-12 months	08.20.2000.23	3.26.59-3.28.41	12	mother	3	mummy sees you	D1 narrative	no response
9-12 months	08.20.2000.23	3.37.47-3.38.38	13	mother	2	hi baby	C1 greeting	not analyzable
9-12 months	08.20.2000.23	3.43.99-3.45.21	14	mother	1	hi [name]	C1 greeting	no response
9-12 months	08.20.2000.23	3.46.65-3.47.59	15	mother	3	hi [name]	C1 greeting	response
9-12 months	08.26.2000.24	1.80-2.61	1	mother	2	[name]	A1 attention seeking	no response
9-12 months	08.26.2000.24	5.19-7.09	2	mother	1	[name] don't steal her toy	A2 directing	response
9-12 months	08.26.2000.24	8.90-10.61	3	mother	1	yeah you get some other toy, hey?	A2 directing	no response
9-12 months	09.01.2000.26	4.70-6.49	1	mother	2	daddy, it's mama	C3 conversational	response
9-12 months	09.01.2000.26	10.79-12.00	2	mother	2	hi [name]	C1 greeting	not analyzable
9-12 months	09.01.2000.26	30.48-30.96	03a	mother	1	oh	D1 narrative	not analyzable
9-12 months	09.01.2000.26	30.96-31.74	03b	mother	1	careful now	A2 directing	response
9-12 months	09.01.2000.26	1.17.90-1.20.08	4	mother	1	gonna eat the cheerios [name]?	C3 conversational	response
9-12 months	09.01.2000.26	2.39.00-2.40.00	5	mother	3	[name]	A1 attention seeking	response
9-12 months	09.01.2000.26	2.58.89-2.59.91	6	mother	3	hi cutie	C1 greeting	no response
9-12 months	09.03.2000.27	8.29-9.61	1	mother	2	woo	C2 playful	response
9-12 months	09.03.2000.27	29.11-30.54	2	mother	2	aw	D1 narrative	not analyzable
9-12 months	09.03.2000.27	59.00-59.96	3	mother	1	yup	C2 playful	no response
9-12 months	09.03.2000.27	1.01.11-1.01.86	4	mother	1	hi	C1 greeting	response
9-12 months	09.03.2000.27	1.04.57-1.05.88	5	mother	1	[name] hi	C1 greeting	response
9-12 months	09.03.2000.27	1.07.96-1.08.59	6	mother	1	hi	C1 greeting	not analyzable
9-12 months	09.03.2000.27	3.00.89-3.02.60	7	mother	3	runs up to baby	C2 playful	response
9-12 months	09.03.2000.27	3.04.86-3.07.28	8	mother	3	turns to baby and grabs	C2 playful	response
9-12 months	09.03.2000.27	3.24.64-3.26.65	9	mother	1	reaches out and touches baby	C2 playful	response
9-12 months	09.03.2000.27	3.36.32-3.39.89	10	mother	2	tickles + little noise + "[name]"	C2 playful	response
9-12 months	09.03.2000.27	3.43.00-3.45.74	11	mother	2	looks at baby, shakes head, whispery noise	C2 playful	response
9-12 months	09.03.2000.27	3.45.75-3.46.19	12	mother	3	turns to baby	C2 playful	response
9-12 months	09.03.2000.27	3.46.47-3.49.54	13	mother	2	turns to baby	C2 playful	response
9-12 months	09.03.2000.27	3.50.20-3.54.62	14	mother	2	lowers head then raises + kiss	C2 playful	response
9-12 months	09.10.2000.30	28.41-29.32	1	mother	2	oh!	D1 narrative	not analyzable
9-12 months	09.10.2000.30	40.90-42.61	2	mother	2	mummy's coming to get you!	D1 narrative	response
9-12 months	09.10.2000.30	1.02.50-1.03.30	3	mother	3	hi baby	C1 greeting	response
9-12 months	09.10.2000.30	1.04.31-1.05.49	4	mother	3	growly noise	C2 playful	not analyzable

9-12 months	09.10.2000.30	1.49.09-1.50.19	5	mother	1	little scream	D1 narrative	not analyzable
9-12 months	09.10.2000.30	2.03.07-2.04.41	6	mother	3	here comes [name]	D1 narrative	not analyzable
9-12 months	09.10.2000.30	2.04.81-2.05.73	7	mother	3	hi [name]	C1 greeting	response
9-12 months	09.10.2000.30	3.33.88-3.35.18	8	mother	2	is that good [name]?	D1 narrative	response
9-12 months	09.10.2000.30	3.35.42-3.37.47	9	mother	2	that food you just ate off the floor? hmm?	D1 narrative	response
9-12 months	09.11.2000.31	1.19-3.60	1	mother	3	oh you gotta package from your grandma?	D1 narrative	response
9-12 months	09.11.2000.31	5.13-9.24	2	mother	3	is that a birthday package from your grandma [name]?	D1 narrative	not analyzable
9-12 months	09.11.2000.31	10.00-12.78	3	mother	3	look at the big strong boy	C4 rewarding	response
9-12 months	09.11.2000.31	13.01-15.87	4	mother	3	look at the big strong boy	C4 rewarding	response
9-12 months	09.11.2000.31	18.89-20.26	5	mother	2	hi [name]	C1 greeting	no response
9-12 months	09.11.2000.31	1.02.32-1.05.29	6	mother	2	whaddaya got [name]? a package from grandma?	D1 narrative	response
9-12 months	09.11.2000.31	1.06.44-1.07.08	07a	mother	2	yeah?	C3 conversational	not analyzable
9-12 months	09.11.2000.31	1.07.08-1.08.69	07b	mother	2	a package from grandma?	D1 narrative	response
9-12 months	09.11.2000.31	1.13.10-1.14.42	8	mother	3	hi	C1 greeting	not analyzable
12-16 months	01.01.2001.32	15.01-16.89	1	mother	3	you wanna little bit more of the beans?	C3 conversational	no response
12-16 months	01.01.2001.32	18.21-19.17	2	mother	3	you wanna pull that off?	A2 directing	not analyzable
12-16 months	01.01.2001.32	19.81-21.63	3	mother	3	there you go, that's for you	D1 narrative	no response
12-16 months	01.01.2001.32	1.05.21-1.07.08	4	mother	1	put food onto highchair table	B calming	response
12-16 months	09.20.2000.35	7.61-8.64	1	mother	3	Hi	C1 greeting	no response
12-16 months	09.20.2000.35	12.59-13.57	2	mother	2	Hi [name]	C1 greeting	no response
12-16 months	09.20.2000.35	52.60-53.45	3	mother	3	??	not analyzable	
12-16 months	09.20.2000.35	56.99-57.80	4	mother	1	[name]	A1 attention seeking	no response
12-16 months	09.20.2000.35	58.58-59.43	05a	mother	3	[name]	A1 attention seeking	not analyzable
12-16 months	09.20.2000.35	59.43-59.95	05b	mother	3	look	A2 directing	response
12-16 months	09.20.2000.35	1.00.77-1.01.36	6	mother	3	Hi	C1 greeting	response
12-16 months	09.20.2000.35	1.02.79-1.04.00	7	mother	3	You a jack in the box?	D1 narrative	not analyzable
12-16 months	09.20.2000.35	1.04.37-1.05.51	8	mother	3	You a [name] in the box?	D1 narrative	no response
12-16 months	09.21.2000.36	0.00-0.87	1	mother	2	[name]	A1 attention seeking	response
12-16 months	09.22.2000.37	0.00-1.34	1	mother	2	yeah	C3 conversational	response
12-16 months	09.22.2000.37	4.59-5.87	02a	mother	2	ha ha good girl	C4 rewarding	response
12-16 months	09.22.2000.37	5.87-6.68	02b	mother	2	you jumped	D1 narrative	response
12-16 months	09.22.2000.37	7.65-8.48	3	mother	2	yeah	D1 narrative	response
12-16 months	09.22.2000.37	20.12-20.82	4	mother	2	[name]	A1 attention seeking	no response
12-16 months	09.22.2000.37	22.75-24.04	5	mother	2	can you walk to mummy?	A2 directing	no response
12-16 months	09.22.2000.37	30.00-30.61	6	mother	2	[name]	A1 attention seeking	response
12-16 months	09.22.2000.37	31.99-32.94	7	mother	2	can you walk to mummy?	A2 directing	response
12-16 months	09.22.2000.37	39.06-40.16	8	mother	2	can you walk to mummy?	A2 directing	response
12-16 months	09.22.2000.37	43.32-44.58	9	mother	2	whoa good jumping	C4 rewarding	response
12-16 months	09.22.2000.37	53.39-54.37	10	father	3	there's mama	A2 directing	not analyzable
12-16 months	09.22.2000.37	1.00.42-1.01.49	11	mother	2	[name]	A1 attention seeking	no response
12-16 months	09.22.2000.37	1.19.22-1.19.89	12a	mother	3	Hi [name]	C1 greeting	response
12-16 months	09.22.2000.37	1.19.89-1.21.01	12b	mother	3	you standing?	D1 narrative	no response
12-16 months	09.24.2000.38	2.21-3.47	01a	mother	2	[name]	A2 directing	not analyzable
12-16 months	09.24.2000.38	3.47-4.42	01b	mother	2	sit down please	A2 directing	response
12-16 months	09.24.2000.38	5.73-7.04	2	mother	2	that's a good girl	C4 rewarding	response
12-16 months	09.24.2000.38	12.86-14.09	3	mother	2	yeah [name]	C4 rewarding	response
12-16 months	09.24.2000.38	14.58-16.78	4	mother	2	drinking milk from a cup, huh?	D1 narrative	no response
12-16 months	09.24.2000.38	28.30-29.15	05a	mother	2	[name]	A1 attention seeking	response
12-16 months	09.24.2000.38	29.15-30.21	05b	mother	2	sit down please	A2 directing	no response
12-16 months	09.24.2000.38	30.94-31.88	06a	mother	2	sit down	A2 directing	no response
12-16 months	09.24.2000.38	31.88-33.03	06b	mother	2	[name]	A2 directing	no response
12-16 months	09.24.2000.38	33.47-34.94	7	mother	2	sit down please	A2 directing	not analyzable
12-16 months	09.24.2000.38	39.72-40.87	8	mother	3	ya drinking?	D1 narrative	not analyzable
12-16 months	09.24.2000.38	41.88-44.30	9	mother	3	there's nothing left in there now, hey?	D1 narrative	no response
12-16 months	09.24.2000.38	1.06.00-1.06.95	10	mother	2	hey [name]	A1 attention seeking	no response
12-16 months	09.24.2000.39	5.47-6.38	1	mother	2	yeah?	C3 conversational	response
12-16 months	09.24.2000.39	7.31-8.15	2	mother	2	OK	C3 conversational	response
12-16 months	09.24.2000.39	13.31-14.10	3	mother	2	yeah	C3 conversational	response
12-16 months	09.24.2000.39	31.78-32.93	4	mother	2	There's [name]	D1 narrative	response
12-16 months	09.24.2000.39	33.94-34.90	5	mother	2	There's [name]	D1 narrative	not analyzable
12-16 months	09.24.2000.39	41.02-43.30	6	mother	1	taking off diaper	D2 instrumental	
12-16 months	09.24.2000.39	45.46-48.01	07a	mother	1	lifts into bath	D2 instrumental	
12-16 months	09.24.2000.39	48.01-49.70	07b	mother	1	whoa	C2 playful	not analyzable
12-16 months	09.24.2000.39	51.17-56.44	8	mother	3	removes diapers	D2 instrumental	
12-16 months	09.24.2000.39	57.90-59.91	09a	mother	3	lifts into tub	D2 instrumental	
12-16 months	09.24.2000.39	59.91-1.01.88	09b	mother	3	and put you in front of there	D1 narrative	no response
12-16 months	09.24.2000.39	1.02.79-1.03.48	10a	mother	2	[name]	D1 narrative	no response
12-16 months	09.24.2000.39	1.03.48-1.08.32	10b	mother	2	takes off diaper	D2 instrumental	

12-16 months	09.24.2000.39	1.10.16-1.15.52	11	mother	2	lifts baby into tub + "and... little [name]"	D1 narrative	not analyzable
12-16 months	09.24.2000.39	1.29.12-1.31.45	12	mother	2	[name] Teddy + gives baby the teddy bear	D1 narrative	response
12-16 months	09.24.2000.39	1.31.81-1.32.31	13	mother	2	yeah	C4 rewarding	no response
12-16 months	09.24.2000.39	2.24.15-2.25.15	14	mother	1	put washcloth onto head	C2 playful	no response
12-16 months	09.24.2000.39	2.51.07-2.52.11	15	mother	1	little noise	not analyzable	
12-16 months	09.24.2000.39	2.52.45-2.53.52	16	mother	1	ah ah ah	A2 directing	no response
12-16 months	09.24.2000.39	2.53.70-2.56.58	17a	mother	1	no no no no no no not there while tickling	C2 playful	no response
12-16 months	09.24.2000.39	2.56.58-2.57.99	17b	mother	1	moves baby into sitting position	D2 instrumental	
12-16 months	09.24.2000.39	3.19.44-3.21.50	18a	mother	1	ah ah ah "no no no"	A2 directing	not analyzable
12-16 months	09.24.2000.39	3.21.50-3.25.04	18b	mother	1	tickling and moving into sitting position	C2 playful	response
12-16 months	09.24.2000.39	3.26.10-3.26.66	19	mother	1	shakes finger at baby	C2 playful	response
12-16 months	09.24.2000.39	3.34.53-3.35.60	20a	mother	1	ah ah ah little noises + tickles	A2 directing	not analyzable
12-16 months	09.24.2000.39	3.35.60-3.36.84	20b	mother	1	ah ah ah little noises + tickles	C2 playful	no response
12-16 months	09.24.2000.39	3.37.38-3.39.95	21	mother	1	tickles	C2 playful	response
12-16 months	09.24.2000.39	3.57.61-3.58.46	22a	mother	1	ah ah ah + tickles	A2 directing	not analyzable
12-16 months	09.24.2000.39	3.58.46-3.59.95	22b	mother	1	ah ah ah + tickles	C2 playful	response
12-16 months	09.24.2000.39	4.01.44-4.02.62	23	mother	1	ah ah ah + tickles	C2 playful	response
12-16 months	09.24.2000.39	4.05.84-4.07.23	24	mother	1	ah ah ah + tickles	C2 playful	response
12-16 months	09.24.2000.39	4.10.01-4.11.38	25	mother	1	ah ah ah + tickles	C2 playful	response
12-16 months	09.24.2000.39	5.22.97-5.24.43	26	mother	2	drips water onto head	C2 playful	no response
12-16 months	09.24.2000.39	5.26.02-5.27.70	27	mother	2	drips water onto head	C2 playful	not analyzable
12-16 months	09.24.2000.39	5.29.30-5.30.29	28	mother	1	drips water onto head	C2 playful	response
12-16 months	09.24.2000.39	5.32.29-5.33.77	29	mother	3	drips water onto head	C2 playful	no response
12-16 months	09.24.2000.39	5.35.06-5.38.72	30a	mother	3	Teddy bear kisses	C2 playful	response
12-16 months	09.24.2000.39	5.35.06-5.38.72	30b	father	3	making growling sounds	C2 playful	no response
12-16 months	09.24.2000.39	5.40.32-5.40.91	31	father	3	growling sounds	C2 playful	no response
12-16 months	10.03.2000.41	6.03-6.67	1	mother	1	Hi	C1 greeting	not analyzable
12-16 months	10.03.2000.41	9.53-10.58	2	mother	2	Good girl [name]	C4 rewarding	response
12-16 months	10.03.2000.41	10.76-13.20	3	mother	2	Yeah you put your hand in your mouth and eat it?	C4 rewarding	no response
12-16 months	10.03.2000.41	13.75-14.60	4	mother	2	That's good	C4 rewarding	no response
12-16 months	10.03.2000.41	37.91-38.77	5	mother	3	Yum	D1 narrative	no response
12-16 months	10.03.2000.41	42.67-44.13	6	mother	3	That's good, hey?	D1 narrative	response
12-16 months	10.03.2000.41	48.01-50.23	7	mother	3	Not as much on the bottom of the bowl, [name]	D1 narrative	not analyzable
12-16 months	10.03.2000.41	1.06.05-1.06.72	8	mother	1	uh-oh	D1 narrative	response
12-16 months	10.03.2000.41	1.18.89-1.19.98	9	mother	2	he-he-he-yeah	C3 conversational	no response
12-16 months	10.03.2000.41	1.44.85-1.46.23	10	mother	1	yeah	C3 conversational	response
12-16 months	10.03.2000.41	1.50.29-1.51.68	11	mother	1	What is it [name]	C3 conversational	response
12-16 months	10.03.2000.41	1.51.94-1.52.88	12	mother	1	ah	C3 conversational	response
12-16 months	10.03.2000.41	2.28.90-2.31.10	13a	mother	1	Yeah that's a good boy [name]	C4 rewarding	response
12-16 months	10.03.2000.41	2.31.10-2.33.59	13b	mother	1	with your hand you eat it with your hands	D1 narrative	response
12-16 months	10.03.2000.41	3.21.98-3.22.92	14	mother	3	yeah	C3 conversational	response
12-16 months	10.03.2000.41	3.41.37-3.42.23	15	mother	2	[name]	A2 directing	no response
12-16 months	10.03.2000.41	3.56.76-3.59.70	16	mother	2	yeah standing in your high chair, mm?	D1 narrative	response
12-16 months	10.06.2000.42	9.80-11.23	1	mother	3	aw	B calming	not analyzable
12-16 months	10.06.2000.42	20.75-22.48	2	mother	2	maybe an animal cracker?	B calming	not analyzable
12-16 months	10.06.2000.42	23.57-24.35	3	mother	2	yeah	B calming	response
12-16 months	10.07.2000.43	31.02-32.12	1	mother	2	[name] do you like it?	C3 conversational	response
12-16 months	10.07.2000.43	34.15-15.34	2	mother	2	let's see your face	A2 directing	no response
12-16 months	10.07.2000.43	56.82-57.68	3	mother	2	Hi [name]	C1 greeting	no response
12-16 months	10.07.2000.43	58.31-1.00.29	4	mother	2	There we go, nice moustache	C4 rewarding	no response
12-16 months	10.07.2000.43	1.13.83-1.14.54	5	mother	2	mmm	C4 rewarding	not analyzable
12-16 months	10.07.2000.43	3.02.47-3.05.22	6	mother	2	Oh, Oh [name]	D1 narrative	response
12-16 months	10.15.2000.45	17.58-18.71	1	mother	2	Hi [name]	C1 greeting	response
12-16 months	10.15.2000.45	18.82-20.47	2	mother	2	You're gonna come see mummy?	D1 narrative	response
12-16 months	10.17.2000.46	26.61-27.89	1	mother	1	Hi [name]	C1 greeting	response
12-16 months	10.17.2000.46	32.30-33.33	2	mother	2	Hi-ha-ha (cross between hi and laughing)	not analyzable	
12-16 months	10.17.2000.46	43.86-44.39	3	mother	2	[short form of name]	C1 greeting	response
12-16 months	10.17.2000.46	47.57-48.24	4	mother	3	Hi	C1 greeting	no response
12-16 months	10.17.2000.47	1.26.42-1.27.26	1	mother	3	pats bum	C2 playful	no response
12-16 months	10.17.2000.47	1.34.99-1.36.41	2	mother	3	says nonsense syllables	C2 playful	no response
12-16 months	10.17.2000.47	1.42.03-1.42.84	3	mother	3	hits with pillow	C2 playful	not analyzable
12-16 months	10.17.2000.47	1.55.56-1.57.42	4	mother	3	moves pillow away	D2 instrumental	
12-16 months	10.17.2000.47	1.57.93-1.58.69	5	mother	3	touches face	C2 playful	no response
12-16 months	10.17.2000.47	2.04.90-2.05.41	6	mother	3	pats bum	C2 playful	no response
12-16 months	10.17.2000.47	2.06.61-2.07.10	7	mother	3	pokes with pillow	C2 playful	no response
12-16 months	10.17.2000.47	2.28.70-2.29.55	9	mother	1	hi	C1 greeting	response

12-16 months	10.17.2000.47	2.30.10-2.31.58	10	mother	1	I just needed to see you	D1 narrative	response
12-16 months	10.17.2000.47	2.32.91-2.33.88	11	mother	1	look at mummy	A2 directing	response
12-16 months	10.17.2000.47	2.35.19-2.36.43	12	mother	1	come to mummy	A2 directing	response
12-16 months	10.17.2000.47	2.37.61-2.38.77	13	mother	1	come on ??	A2 directing	response
12-16 months	10.17.2000.47	2.39.48-2.40.41	14	mother	1	come on	A2 directing	response
12-16 months	10.17.2000.47	2.41.58-2.46.82	15	mother	1	laughs and holds baby	C2 playful	no response
12-16 months	10.17.2000.47	2.46.89-2.47.80	16	mother	1	oh	D1 narrative	not analyzable
12-16 months	10.17.2000.47	2.48.01-2.49.31	17	mother	1	go to daddy	D1 narrative	no response
12-16 months	10.17.2000.47	2.59.21-3.00.35	18	mother	3	got your blankie?	D1 narrative	no response
12-16 months	10.17.2000.47	3.01.98-3.02.58	19	mother	3	yeah?	D1 narrative	no response
12-16 months	10.17.2000.47	3.15.54-3.16.27	20	mother	1	uh-oh	D1 narrative	not analyzable
12-16 months	10.17.2000.47	3.16.31-3.17.07	21	mother	1	uh-oh	D1 narrative	not analyzable
12-16 months	10.17.2000.47	3.18.58-3.20.83	22	mother	1	gotta get your leg out from the blankie	D1 narrative	not analyzable
12-16 months	10.17.2000.47	3.23.78-3.25.86	23	father	3	puts baby down + "down you get"	D1 narrative	response
12-16 months	10.17.2000.47	3.26.38-3.28.38	24	father	3	lifts baby up	B calming	response
12-16 months	10.17.2000.47	3.34.62-3.35.28	25	mother	2	[name]	C1 greeting	response
12-16 months	10.17.2000.47	3.35.87-3.36.97	26	mother	2	whoopsie	D1 narrative	no response
12-16 months	10.17.2000.47	4.00.21-4.02.56	27	mother	1	watch you don't squish [name] in there hey	A2 directing	response
12-16 months	10.29.2000.48	2.62-3.46	1	mother	3	Hi	C1 greeting	not analyzable
12-16 months	10.29.2000.48	5.25-5.91	2	mother	3	whoop	D1 narrative	not analyzable
12-16 months	10.29.2000.48	6.29-7.61	3	mother	3	Hi [name]	C1 greeting	not analyzable
12-16 months	10.29.2000.48	8.02-9.73	4	mother	3	why don't you come play over here	A2 directing	response
12-16 months	10.29.2000.48	10.60-11.68	5	mother	3	Hi cute	C1 greeting	no response
12-16 months	10.29.2000.48	49.20-50.31	6	mother	3	whoopsie	D1 narrative	no response
12-16 months	10.29.2000.48	58.16-59.08	7	mother	2	Hi [name]	C1 greeting	no response
12-16 months	10.29.2000.48	1.00.30-1.00.68	08a	mother	2	Hi	C1 greeting	not analyzable
12-16 months	10.29.2000.48	1.00.68-1.01.68	08b	mother	2	what've you got, a leaf?	D1 narrative	no response
12-16 months	10.29.2000.48	1.03.45-1.04.26	9	mother	2	Oh	D1 narrative	not analyzable
12-16 months	10.29.2000.48	1.04.51-1.05.29	10	mother	2	whoopsie	D1 narrative	no response
12-16 months	10.29.2000.48	2.15.83-2.17.96	11	mother	3	Hi [name] hey cutie	C1 greeting	response
12-16 months	10.29.2000.48	2.18.78-2.19.70	12	mother	3	Hey cutie	C1 greeting	no response
12-16 months	10.29.2000.48	2.21.91-2.22.92	13	mother	3	Hi	C1 greeting	not analyzable
12-16 months	10.29.2000.48	3.31.41-3.32.10	14	mother	2	oh	D1 narrative	response
12-16 months	10.29.2000.48	3.58.45-3.59.66	15	mother	3	Hi [name]	C1 greeting	response
12-16 months	10.29.2000.48	4.21.18-4.24.23	16	mother	1	Oh [name] you've got two balls now	D1 narrative	no response
12-16 months	10.29.2000.48	4.29.89-4.30.71	17	mother	2	[name]	D1 narrative	no response
12-16 months	10.29.2000.48	4.52.41-4.53.58	18a	mother	2	yeah bye bye	C4 rewarding	no response
12-16 months	10.29.2000.48	4.53.58-4.55.28	18b	mother	2	you waving [name]	D1 narrative	not analyzable
12-16 months	10.29.2000.48	5.00.13-5.01.22	19	mother	3	Hi cutie	C1 greeting	no response
12-16 months	10.31.2000.49	1.52.29-1.53.93	1	mother	2	[name]	C1 greeting	response
12-16 months	10.31.2000.49	1.56.15-1.56.89	2	mother	2	hmmm	D1 narrative	response
12-16 months	10.31.2000.49	2.06.79-2.07.57	3	mother	2	[name]	C1 greeting	response
12-16 months	10.31.2000.49	2.11.97-2.14.45	4	mother	2	where's your snake [name] where's your snakie?	A2 directing	response
12-16 months	10.31.2000.49	2.23.92-2.25.66	5	mother	2	Yeah there's your snake	C4 rewarding	response
12-16 months	10.31.2000.49	2.26.67-2.27.56	6	mother	2	yeah	C4 rewarding	response
12-16 months	10.31.2000.49	2.30.92-2.31.73	7	mother	2	oh	D1 narrative	not analyzable
12-16 months	10.31.2000.49	2.32.50-2.33.70	8	mother	2	oh	D1 narrative	response
12-16 months	11.12.2000.53	1.29-2.32	1	mother	2	hi [name]	C1 greeting	not analyzable
12-16 months	11.12.2000.53	15.67-17.83	02a	father	3	picks up	D2 instrumental	
12-16 months	11.12.2000.53	17.83-19.05	02b	mother	3	I don't think the bottle goes in with you [name]	D1 narrative	not analyzable
12-16 months	11.12.2000.53	19.05-21.99	02c	father	3	takes bottle away	D2 instrumental	
12-16 months	11.12.2000.53	36.54-37.60	03a	mother	3	whatsa matter	B calming	not analyzable
12-16 months	11.12.2000.53	37.60-38.69	03b	mother	3	you need washcloths	D1 narrative	no response
12-16 months	11.12.2000.53	43.76-47.22	4	father	3	lifts baby + "come on you"	A2 directing	not analyzable
12-16 months	11.12.2000.53	1.09.61-1.11.47	5	father	1	splashes water	C2 playful	not analyzable
12-16 months	11.12.2000.53	1.12.29-1.13.20	6	mother	2	hi [name]	C1 greeting	response
12-16 months	11.12.2000.53	1.19.32-1.21.40	7	mother	3	Oh [name's] hair, yeah	D1 narrative	response
12-16 months	11.12.2000.53	1.25.10-1.26.83	8	mother	3	hi [name]	C1 greeting	response
12-16 months	11.12.2000.53	1.28.48-1.29.55	9	mother	3	splash splash	D1 narrative	response
12-16 months	11.12.2000.53	1.48.72-1.49.75	10	mother	2	hi [name]	C1 greeting	response
12-16 months	11.12.2000.53	1.51.18-1.52.37	11	mother	2	hi [name]	C1 greeting	not analyzable
12-16 months	11.12.2000.53	1.51.89-1.53.04	12	father	3	splashes onto water onto bum	C2 playful	not analyzable
12-16 months	11.12.2000.53	2.02.60-2.04.09	13	mother	2	splash splash [name]	A2 directing	no response
12-16 months	11.12.2000.53	2.06.12-2.10.38	14	father	2	washes face	D2 instrumental	
12-16 months	11.12.2000.53	2.23.52-2.25.15	15	father	2	what's up [name]	C3 conversational	response
12-16 months	11.12.2000.53	2.25.32-2.26.01	16	father	2	huh?	C3 conversational	response
12-16 months	11.12.2000.53	2.26.60-2.28.26	17	father	2	oh sweetie, what	C3 conversational	response
12-16 months	11.12.2000.53	2.29.79-2.20.54	18	father	2	what? + touches forehead with own forehead	B calming	response

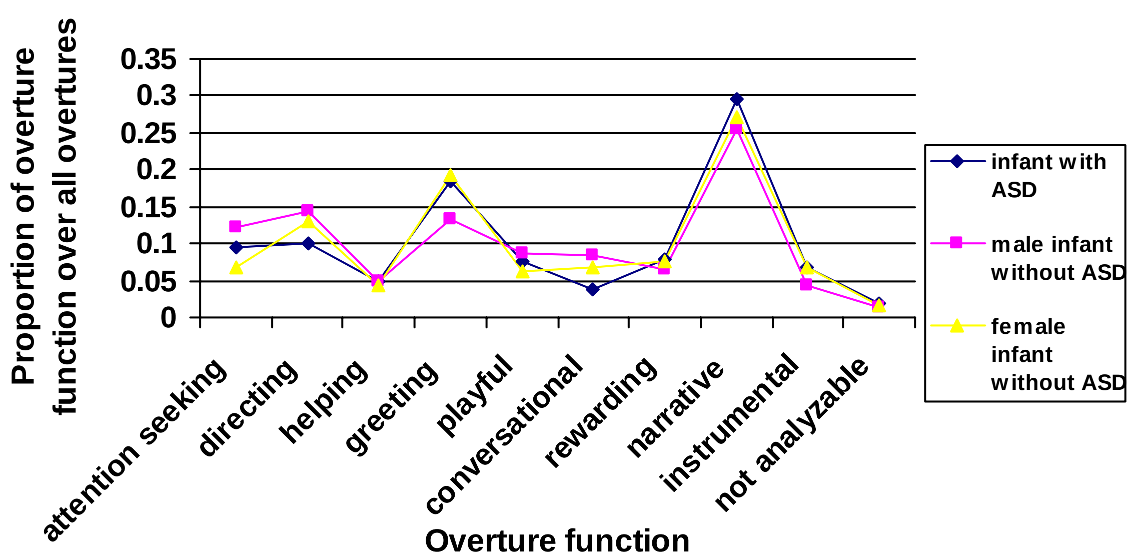
12-16 months	11.13.2000.02	10.51-11.60	1	mother	1	'Sit time for a bath?	D1 narrative	no response
12-16 months	11.13.2000.02	13.83-14.91	02a	mother	1	yeah, time for a bath?	D1 narrative	not analyzable
12-16 months	11.13.2000.02	14.91-16.38	02b	mother	1	you wanna go in the bathroom?	C3 conversational	response
12-16 months	11.13.2000.02	21.00-22.10	3	mother	3	?	not analyzable	
12-16 months	11.13.2000.02	33.00-34.60	4	mother	1	OK	B calming	not analyzable
12-16 months	11.15.2000.04	31.45-32.74	01a	mother	2	pulls hand away	A2 directing	not analyzable
12-16 months	11.15.2000.04	32.74-34.90	01b	mother	2	No [name], don't touch the lens + pulling hand	A2 directing	not analyzable
12-16 months	11.15.2000.04	35.43-38.29	2	mother	2	laughing and pushing hand away	A2 directing	not analyzable
12-16 months	11.15.2000.04	1.42.70-1.45.40	3	mother	1	oh you putting cup one cup inside the other?	D1 narrative	not analyzable
12-16 months	11.15.2000.04	1.45.99-1.46.86	4	mother	1	yeah	D1 narrative	no response
12-16 months	11.15.2000.04	1.48.02-1.48.77	5	mother	1	yeah	D1 narrative	response
12-16 months	11.15.2000.04	1.53.77-1.54.73	6	mother	2	you dancing?	D1 narrative	not analyzable
12-16 months	11.15.2000.04	1.55.58-1.56.75	7	mother	2	[name] dance	A2 directing	not analyzable
12-16 months	11.15.2000.04	1.57.59-1.58.71	8	mother	2	dance, dance	A2 directing	no response
12-16 months	11.20.2000.07	26.09-27.54	1	mother	1	Hey Ma-- [name]	A1 attention seeking	no response
12-16 months	11.20.2000.07	1.16.59-1.18.37	2	mother	1	Ha ha, look at [name]	D1 narrative	response
12-16 months	11.20.2000.07	1.18.64-1.19.41	3	mother	1	wooo	D1 narrative	no response
12-16 months	11.22.2000.09	9.51-12.31	1	mother	1	What're you doing with the diaper genie, huh?	D1 narrative	response
12-16 months	11.22.2000.09	23.50-25.55	2	mother	2	Oh [name] what have you got there?	D1 narrative	no response
12-16 months	11.26.2000.10	0.74-0.96	1	mother	1	poke baby	A1 attention seeking	no response
12-16 months	11.26.2000.10	1.13-2.96	2	mother	1	come on now do you wanna eat some of this egg?	C3 conversational	response
12-16 months	11.26.2000.10	3.97-4.92	3	mother	1	come on + offers	A2 directing	no response
12-16 months	11.26.2000.10	5.53-8.64	4	mother	1	Will you get off? Off off off off... + touching	A2 directing	not analyzable
12-16 months	11.26.2000.10	8.82-9.73	5	mother	3	?? + touch	A2 directing	not analyzable
12-16 months	11.26.2000.10	22.12-23.75	6	mother	2	You gonna sit down, [name]?	A2 directing	response
12-16 months	11.26.2000.10	26.00-26.58	7	mother	2	pulls sweater	D2 instrumental	
12-16 months	11.26.2000.10	27.81-29.81	8	mother	1	How about you [name], will you sit?	A2 directing	response
12-16 months	11.26.2000.10	32.06-34.43	09a	mother	3	You sit down, sit down, sit down + maneuvering	A2 directing	not analyzable
12-16 months	11.26.2000.10	34.43-35.88	09b	mother	3	nodding and maneuvering	C4 rewarding	response
12-16 months	11.26.2000.10	35.88-37.45	09c	mother	3	thank you	C4 rewarding	no response
12-16 months	11.28.2000.12	4.39-5.70	1	mother	1	[name]	A1 attention seeking	no response
12-16 months	11.28.2000.12	5.75-7.29	2	mother	1	How did you get up there, baby?	D1 narrative	no response
12-16 months	11.28.2000.12	8.36-9.55	3	mother	1	What are you doing?	D1 narrative	no response
12-16 months	11.28.2000.12	20.94-21.83	4	mother	2	Hi [name]	C1 greeting	response
12-16 months	11.28.2000.12	22.37-22.98	5	mother	2	Hi	C1 greeting	response
12-16 months	11.28.2000.12	23.69-24.39	6	mother	2	Hi	C1 greeting	response
12-16 months	11.28.2000.12	44.27-45.39	7	mother	2	[name]	C1 greeting	response
12-16 months	11.28.2000.13	9.22-11.46	1	father	3	puts baby down	D2 instrumental	
12-16 months	11.28.2000.13	15.49-16.31	2	father	2	Hi [name]	C1 greeting	no response
12-16 months	11.28.2000.13	1.20.72-1.22.08	3	mother	1	Yes, exactly	C3 conversational	response
12-16 months	11.28.2000.13	2.28.89-2.30.00	4	mother	1	Oh, you gotta book	D1 narrative	no response
12-16 months	11.28.2000.13	4.29.00-4.30.90	5	mother	2	Making a pile, [name]?	D1 narrative	no response
12-16 months	11.30.2000.14	1.62-2.11	1	mother	2	Hi [name]	C1 greeting	not analyzable
12-16 months	11.30.2000.14	2.39-3.46	2	mother	2	Enjoying your spaghetti?	C3 conversational	response
12-16 months	11.30.2000.14	5.83-6.48	3	mother	2	Let's see	D1 narrative	response
12-16 months	11.30.2000.14	6.93-7.92	4	mother	2	Oh	C4 rewarding	response
12-16 months	11.30.2000.14	8.23-10.15	5	mother	2	Nice, you gotta bit in your hair, huh?	D1 narrative	no response
12-16 months	11.30.2000.14	11.73-14.99	6	mother	2	Yeah a little bit of spaghetti in your hair little bit on your tummy	D1 narrative	no response
12-16 months	11.30.2000.14	19.79-20.91	6.5	mother	2	oh	D1 narrative	no response
12-16 months	11.30.2000.14	21.91-23.77	7	mother	2	You think you can eat it through your tummy?	C3 conversational	not analyzable
12-16 months	11.30.2000.14	24.64-25.30	8	mother	2	[name]	A2 directing	response
12-16 months	11.30.2000.14	36.67-37.43	9	mother	2	hi	C1 greeting	not analyzable
12-16 months	11.30.2000.14	40.56-41.91	10	father	3	oh thank you	C4 rewarding	no response
12-16 months	11.30.2000.14	1.14.47-1.16.00	11	mother	1	hey [name]	A1 attention seeking	no response
12-16 months	11.30.2000.14	1.16.16-1.17.14	12	mother	1	[name]	A1 attention seeking	no response
12-16 months	11.30.2000.14	1.19.00-1.19.82	13a	mother	1	stylized throat clearing	A1 attention seeking	not analyzable
12-16 months	11.30.2000.14	1.19.82-1.20.61	13b	father	1	[name], look at mummy	A2 directing	no response
12-16 months	11.30.2000.14	1.22.45-1.23.70	13d	father	1	look at mummy	A2 directing	response
12-16 months	11.30.2000.14	1.24.60-1.25.27	14	mother	1	Hi	C1 greeting	response
12-16 months	11.30.2000.14	1.27.60-1.29.26	15	mother	1	Yeah never mind it's OK	A2 directing	no response
12-16 months	11.30.2000.14	1.30.00-1.33.29	16	mother	1	yeah no no no no forget it with your fingers you	A2 directing	not analyzable
12-16 months	11.30.2000.14	1.39.28-1.41.26	17	father	1	moves water jug away	D2 instrumental	
12-16 months	11.30.2000.14	1.42.68-1.43.52	18	father	1	moves juice container away	D2 instrumental	

12-16 months	11.30.2000.14	1.59.07-2.01.78	19	father	2	oh [name], what's wrong sweetie	B calming	response
12-16 months	11.30.2000.14	2.04.30-2.08.15	20	father	2	if you leave it there too long it'll stick and never come out again	D1 narrative	response
12-16 months	11.30.2000.14	2.43.61-2.45.98	21	mother	2	yeah spaghetti yeah	C4 rewarding	response
12-16 months	12.10.2000.17	3.82-6.22	1	mother	1	you got your bottle and your blankie	D1 narrative	response
12-16 months	12.10.2000.17	7.76-8.70	2	mother	1	yeah	D1 narrative	response
12-16 months	12.10.2000.17	40.02-41.57	3	mother	1	you've got some mittens?	D1 narrative	not analyzable
12-16 months	12.10.2000.17	42.58-44.81	4	mother	1	Mittens that your auntie [name] made, huh?	D1 narrative	no response
12-16 months	12.10.2000.17	2.08.61-2.09.84	5	mother	1	Go get it	A2 directing	not analyzable
12-16 months	12.10.2000.17	3.04.76-3.06.99	06a	father	1	holding, "sh-sh-sh"	B calming	response
12-16 months	12.10.2000.17	3.06.99-3.07.93	06b	father	1	kiss	B calming	response
12-16 months	12.10.2000.17	3.09.00-3.10.09	7	father	1	S'okay	B calming	response
12-16 months	12.10.2000.17	3.11.04-3.14.08	8	father	1	See there you go + places on knee to see mittens	B calming	not analyzable
12-16 months	12.10.2000.17	3.16.01-3.18.70	9	mother	3	What've you got [name], mittens	D1 narrative	no response
12-16 months	12.10.2000.17	3.20.30-3.21.79	10	mother	1	S'okay, [name]	B calming	response
12-16 months	12.10.2000.17	3.22.55-3.23.16	11	father	1	kiss	B calming	not analyzable
12-16 months	12.12.2000.18	31.70-33.59	1	mother	3	oh you wanna go on the swing, [name]?	C3 conversational	response
12-16 months	12.12.2000.18	35.99-37.90	2	mother	3	OK mummy's coming	B calming	no response
12-16 months	12.12.2000.18	1.01.00-1.01.95	3	mother	2	hey [name]	A1 attention seeking	not analyzable
12-16 months	12.12.2000.18	2.18.10-2.19.41	4	mother	3	Hi [name]	C1 greeting	response
12-16 months	12.12.2000.18	2.23.42-2.25.40	5	mother	3	I know it doesn't roll too well, huh?	D1 narrative	not analyzable
12-16 months	12.12.2000.18	2.25.86-2.27.84	6	mother	3	You're doing it, you're doing it, yes!	C4 rewarding	no response
12-16 months	12.12.2000.18	2.28.88-2.29.82	7	mother	3	Yes	C4 rewarding	no response
12-16 months	12.12.2000.18	2.52.50-2.53.40	8	mother	3	hm?	B calming	response
12-16 months	12.12.2000.18	2.53.60-2.54.65	9	mother	3	m-kay	B calming	response
12-16 months	12.13.2000.19	16.93-17.7	1	mother	2	No	D1 narrative	response
12-16 months	12.13.2000.19	22.54-23.58	2	mother	1	Whoa-oa-oa	A2 directing	not analyzable
12-16 months	12.13.2000.19	29.27-30.46	3	mother	2	Yikes!	D1 narrative	not analyzable
12-16 months	12.13.2000.19	30.66-31.38	4	mother	3	Hi [name] (words unclear)	not analyzable	
12-16 months	12.13.2000.19	33.22-33.98	05a	mother	3	Hi [name]	C1 greeting	not analyzable
12-16 months	12.13.2000.19	33.98-35.88	05b	mother	3	you coming out of your fort?	C3 conversational	no response
12-16 months	12.13.2000.19	42.36-42.63	06a	mother	1	Oh	D1 narrative	not analyzable
12-16 months	12.13.2000.19	42.63-44.85	06b	mother	1	no-no-no-no-no baby	A2 directing	not analyzable
12-16 months	12.13.2000.19	45.83-47.40	7	mother	1	Ma [name]	A1 attention seeking	not analyzable
12-16 months	12.13.2000.19	52.51-54.08	8	mother	2	Carrying your clothing around?	D1 narrative	not analyzable
12-16 months	12.13.2000.19	1.01.39-1.02.29	9	mother	1	Hi sweet	C1 greeting	response
12-16 months	12.13.2000.19	1.02.82-1.03.65	10	mother	1	Hi sweet	C1 greeting	no response
12-16 months	12.13.2000.19	1.13.88-1.15.84	11	mother	2	Where're you going with the clothes, [name]	D1 narrative	no response
12-16 months	12.13.2000.19	1.39.00-1.40.19	12	mother	2	careful [name]	A2 directing	no response
12-16 months	12.13.2000.19	1.43.78-1.46.5	13	mother	2	Oh [name] have you found a new hiding spot for the clothing?	D1 narrative	response
12-16 months	12.13.2000.19	1.48.64-1.51.06	14	mother	2	You found a new spot for the clothing?	D1 narrative	no response
12-16 months	12.13.2000.19	1.52.22-1.53.51	15	mother	2	Oh that's handy	D1 narrative	no response
12-16 months	12.13.2000.19	2.15.27-2.16.69	16	mother	3	moves bottle towards baby	B calming	response
12-16 months	12.13.2000.19	3.12.47-3.13.17	17	mother	2	Hi [name]	C1 greeting	response
12-16 months	12.13.2000.19	3.42.89-3.45.69	18	mother	3	[name] stop dripping water onto the floor please	A2 directing	no response
12-16 months	12.13.2000.19	3.48.10-3.49.04	19	mother	3	[name]	A1 attention seeking	no response
12-16 months	12.13.2000.19	3.51.21-3.51.90	20	mother	3	[name]	A1 attention seeking	no response
12-16 months	12.13.2000.19	4.20.92-4.21.93	21	mother	3	Hey [name]	A1 attention seeking	no response
12-16 months	12.13.2000.19	4.30.90-4.33.89	22a	mother	3	Yeh, very nice you're dripping water all over the place sweetie	D1 narrative	not analyzable
12-16 months	12.13.2000.19	4.33.89-4.35.76	22b	mother	3	waving hand	A2 directing	no response
12-16 months	12.13.2000.19	4.30.90-4.35.76	22c	mother	3	hey hey hey hey	A1 attention seeking	no response
12-16 months	12.13.2000.19	4.45.43-4.45.87	23a	mother	2	Oh	D1 narrative	not analyzable
12-16 months	12.13.2000.19	4.45.87-4.46.56	23b	mother	2	hi [name]	C1 greeting	response
12-16 months	12.13.2000.19	4.48.17-4.48.78	24	mother	2	Hi	C1 greeting	no response
12-16 months	12.13.2000.19	5.02.49-5.03.49	25a	mother	1	Squeaky door	D1 narrative	not analyzable
12-16 months	12.13.2000.19	5.03.49-5.04.61	25b	mother	1	[name]?	A1 attention seeking	no response
12-16 months	12.16.2000.22	1.17.60-1.20.00	1	mother	2	hmm oh the book	D1 narrative	not analyzable
12-16 months	12.19.2000.26	9.77-13.06	1	mother	2	maneuvers into sitting position	D2 instrumental	
12-16 months	12.19.2000.26	20.53-22.50	2	mother	2	lifts out of box	B calming	response
12-16 months	12.21.2000.27	6.88-8.44	1	mother	2	little noise	C1 greeting	response
12-16 months	12.29.2000.31	15.81-16.67	1	mother	2	Hi, [name]	C1 greeting	response
12-16 months	12.29.2000.31	17.14-18.98	2	mother	2	you sitting at the table?	D1 narrative	response
12-16 months	12.29.2000.31	20.57-21.59	3	mother	2	yeah	D1 narrative	response

Appendix J: Proportions of Functions Across Infants at all Ages

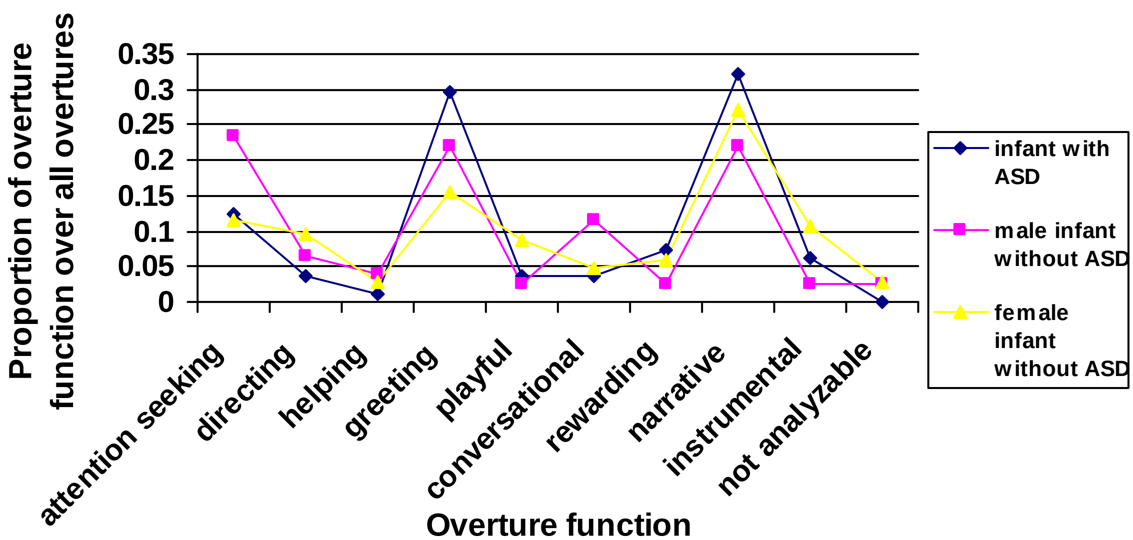
Distribution of overture functions across infants (whole age range)

Type of overture	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attention seeking	25 (.094)	28 (.123)	22 (.069)
Directing	27 (.101)	33 (.145)	41 (.129)
Helping	13 (.049)	11 (.048)	14 (.044)
Greeting	49 (.184)	30 (.132)	61 (.192)
Playful	20 (.075)	20 (.088)	20 (.063)
Conversational	10 (.037)	19 (.084)	22 (.069)
Rewarding	21 (.079)	15 (.066)	24 (.076)
Narrative	79 (.296)	58 (.256)	86 (.271)
Instrumental actions	18 (.067)	10 (.044)	22 (.069)
Not analyzable	5 (.019)	3 (.013)	5 (.016)
Total	267	227	317



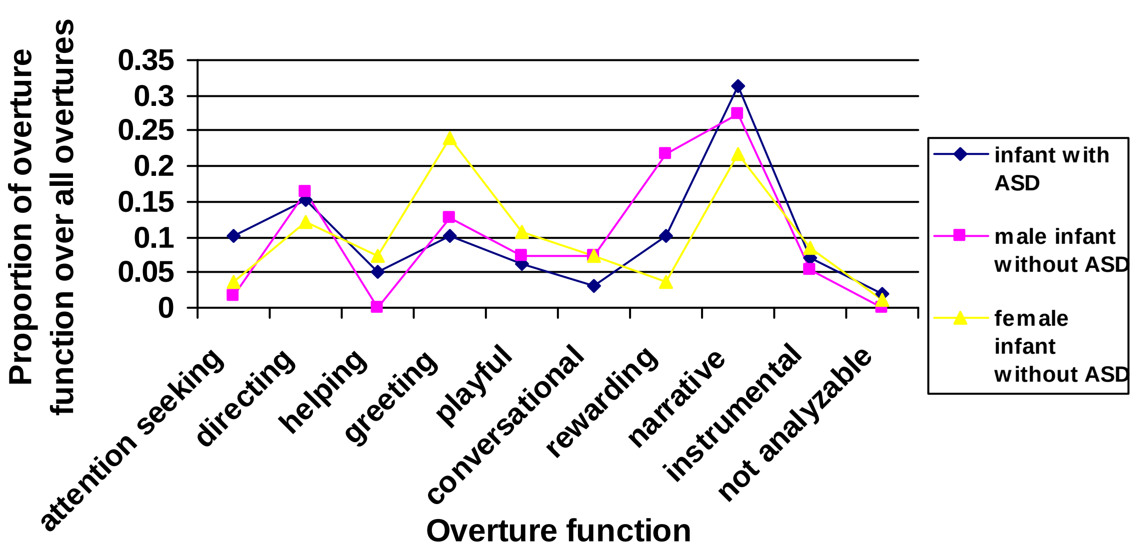
Distribution of overture functions across infants (6-8 months)

Type of overture	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attention seeking	10 (.123)	18 (.234)	12 (.117)
Directing	3 (.037)	5 (.065)	10 (.097)
Helping	1 (.012)	3 (.039)	3 (.029)
Greeting	24 (.296)	17 (.221)	16 (.155)
Playful	3 (.037)	2 (.026)	9 (.087)
Conversational	3 (.037)	9 (.117)	5 (.049)
Rewarding	6 (.074)	2 (.026)	6 (.058)
Narrative	26 (.321)	17 (.221)	28 (.272)
Instrumental actions	5 (.062)	2 (.026)	11 (.107)
Not analyzable	None	2 (.026)	3 (.029)
Total	81	77	103



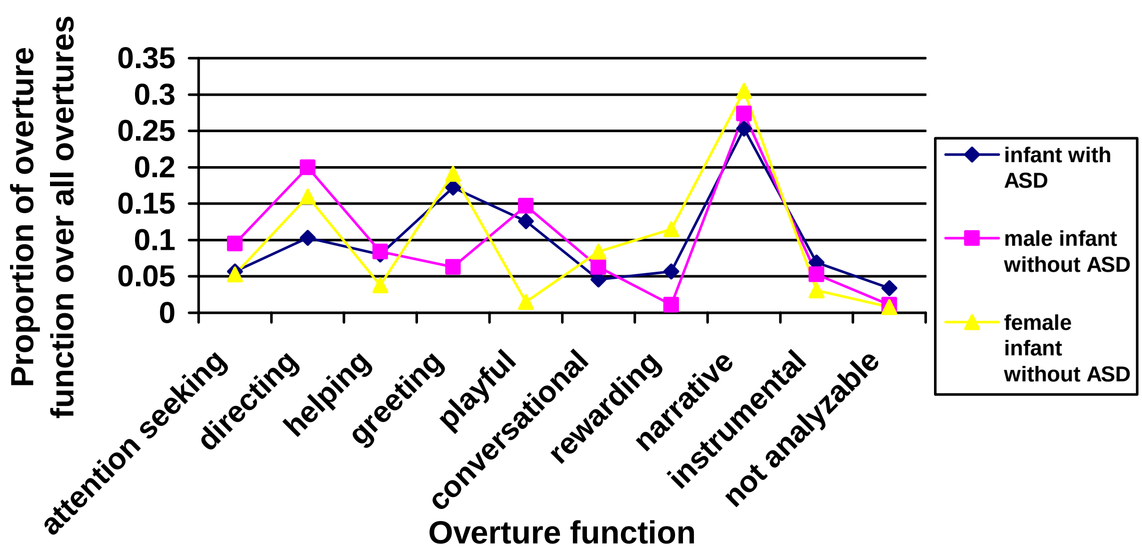
Distribution of overture functions across infants (9-11 months)

Type of overture	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attention seeking	10 (.101)	1 (.018)	3 (.036)
Directing	15 (.152)	9 (.164)	10 (.120)
Helping	5 (.051)	None	6 (.072)
Greeting	10 (.101)	7 (.127)	20 (.241)
Playful	6 (.061)	4 (.073)	9 (.108)
Conversational	3 (.030)	4 (.073)	6 (.072)
Rewarding	10 (.101)	12 (.218)	3 (.036)
Narrative	31 (.313)	15 (.273)	18 (.217)
Instrumental actions	7 (.071)	3 (.055)	7 (.084)
Not analyzable	2 (.020)	None	1 (.012)
Total	99	55	83



Distribution of overture functions across infants (12-15 months)

Type of overture	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attention seeking	5 (.057)	9 (.095)	7 (.053)
Directing	9 (.103)	19 (.200)	21 (.160)
Helping	7 (.080)	8 (.084)	5 (.038)
Greeting	15 (.172)	6 (.063)	25 (.191)
Playful	11 (.126)	14 (.147)	2 (.015)
Conversational	4 (.046)	6 (.063)	11 (.084)
Rewarding	5 (.057)	1 (.011)	15 (.115)
Narrative	22 (.253)	26 (.274)	40 (.305)
Instrumental actions	6 (.069)	5 (.053)	4 (.031)
Not analyzable	3 (.034)	1 (.011)	1 (.008)
Total	87	95	131



Appendix K: All results for pre-overture behavior analysis

Analysis

Which overtures were excluded from analysis?

- Overtures that would have confounded interpretations:
  - Overtures with a *helping* or *greeting* function were excluded because these overtures had been operationally defined by the infant's orientation or attention towards the agent of the overture.
  - *Instrumental* actions were excluded because my interest was in social overtures.

Which overtures were included in analysis?

- Overtures with *attention-seeking*, *directing*, *playful*, *conversational*, *rewarding*, and *narrative* functions.
  - Playful, Conversational, and Rewarding overtures were grouped together into one category (i. e., overtures with a weak pull and non-specific response).

Statistical Analysis

- The test was a two-tailed 2 X 2 chi-square, applied to each infant separately because the n was too small to do comparisons across infants.
- Instead of comparing infants to each other statistically, I checked whether the infant with ASD had the same pattern of results (i.e., significant in the same direction or not significant) as his siblings.
- I tested age differences by grouping all of the analyzed overtures together .

Results

Table 1 and Figure 1: Attention-seeking overtures
Table 2 and Figure 2: Directing, Playful, Conversational, Rewarding, and Narrative overtures
Table 3 and Figure 3: Directing overtures
Table 4 and Figure 4: Playful, Conversational, Rewarding Overtures
Table 5 and Figure 5: Narrative overtures
Table 6 and Figure 6: Infant with ASD across age ranges
Table 7 and Figure 7: Male infant without ASD across age ranges
Table 8 and Figure 8: Female Infant without ASD across age ranges

Table 1: Attention-seeking overtures. Relation of pre-overture behavior to response

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	Male infant with ASD	Male infant without ASD	Female infant without ASD
*Potentially available			
Response	9/11 (.82)	10/13 (.77)	5/8 (.63)
No response	2/11 (.18)	3/13 (.23)	3/8 (.37)
Otherwise engaged			
Response	2/10 (.20)	0/11 (.00)	4/11 (.36)
No response	8/10 (.80)	11/11 (1.00)	7/11 (.64)
Significance test (two-tailed chi-square)	$\chi^2_{(1, N = 21)} = 8.025$; $p < .005$	$\chi^2_{(1, N = 24)} = 14.505$; $p < .001$	$\chi^2_{(1, N = 19)} = 1.269$; *n.s.*

*Note that the function of attention-seeking overtures was to get the infant to look towards the agent, so the infants were, by definition, never looking at the agent when the overture began. Therefore, for this overture function, the pre-overture behaviors I analyzed and tested were limited to potentially available vs. otherwise engaged.

Figure 1: Attention seeking overtures

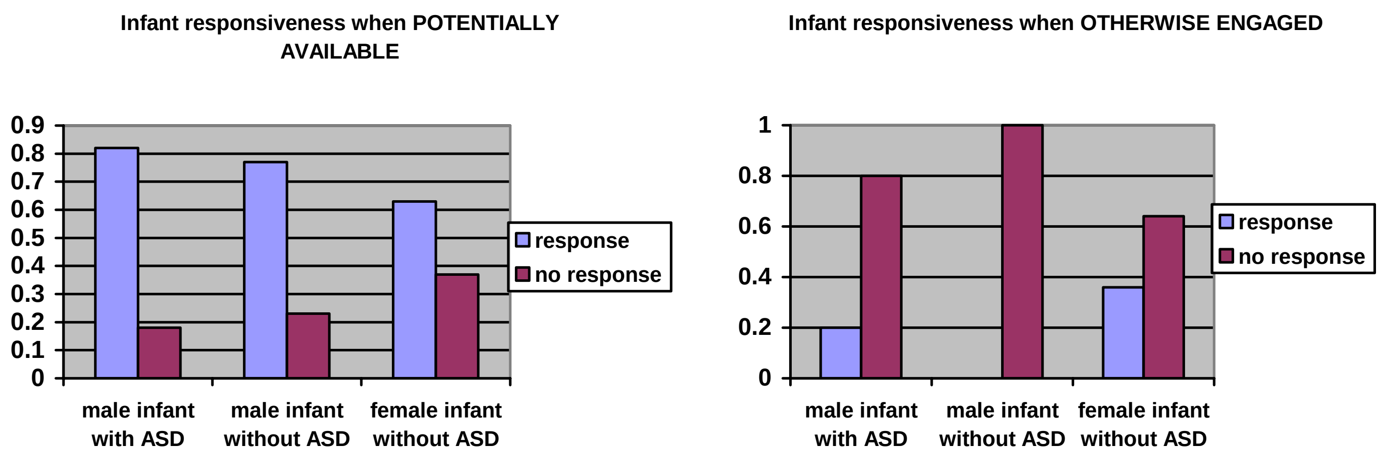


Table 2: Directing, Playful, Conversational, Rewarding, and Narrative overtures. Relation of pre-overture behavior to response

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attending agent			
Response	33/45 (.73)	44/47 (.94)	54/76 (.71)
No response	12/45 (.27)	3/47 (.06)	22/76 (.29)
Otherwise engaged			
Response	8/29 (.28)	18/33 (.55)	9/32 (.28)
No response	21/29 (.72)	15/33 (.45)	23/32 (.72)
Significance test (two-tailed chi-square)	$\chi^2_{(1, N = 74)} = 14.937$; $p < .001$	$\chi^2_{(1, N = 80)} = 16.973$; $p < .001$	$\chi^2_{(1, N = 108)} = 17.073$; $p < .001$

Figure 2: Directing, playful, conversational, rewarding, and narrative overtures

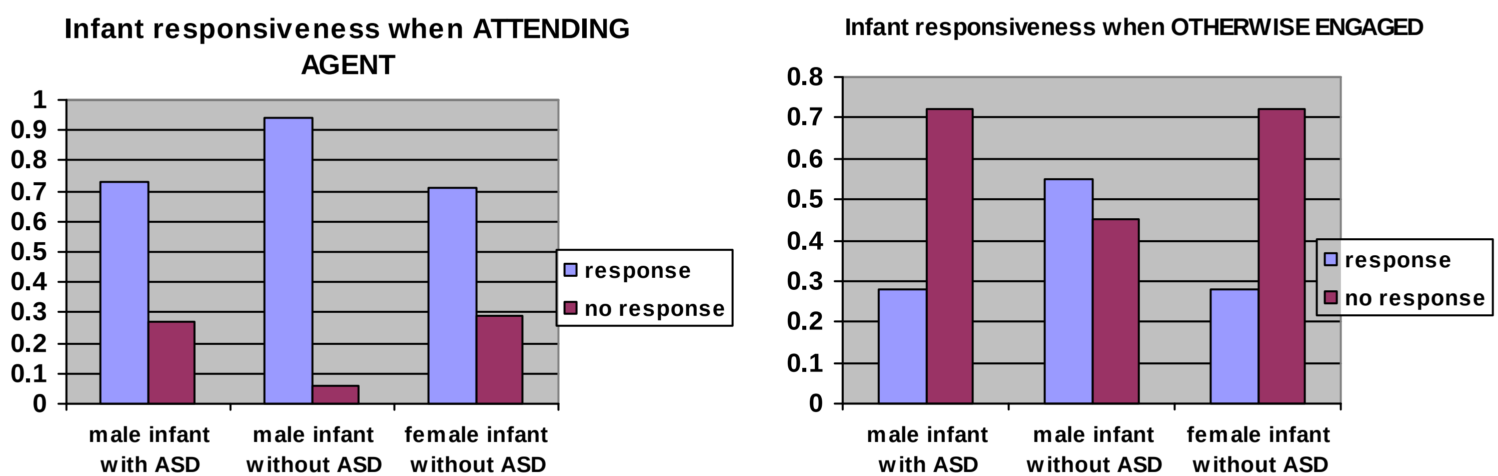


Table 3: Directing overtures. Relation of pre-overture behavior to response

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attending agent			
Response	4/5 (.80)	13/15 (.87)	8/20 (.40)
No response	1/5 (.20)	2/15 (.13)	12/20 (.60)
Otherwise engaged			
Response	4/9 (.44)	3/5 (.60)	3/9 (.33)
No response	5/9 (.56)	2/5 (.40)	6/9 (.67)
Significance test (two-tailed chi-square)	$\chi^2_{(1,\,N\,=\,14)} = 1.660$; *n.s.*	$\chi^2_{(1,\,N\,=\,20)} = 1.667$; *n.s.*	$\chi^2_{(1,\,N\,=\,29)} = 0.117$; *n.s.*

Figure 3: Directing overtures

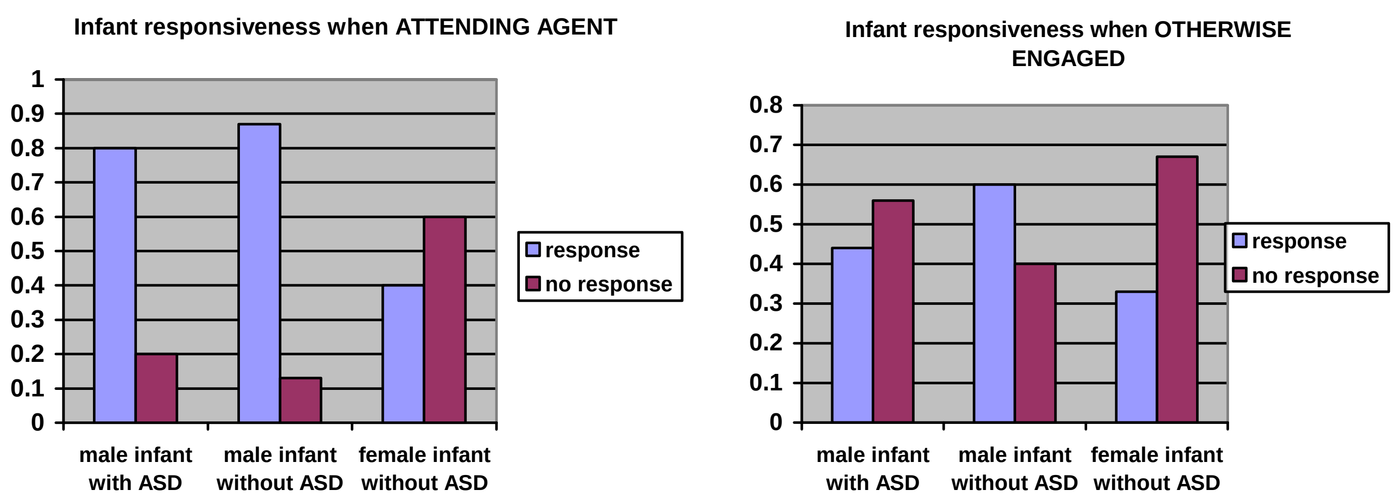
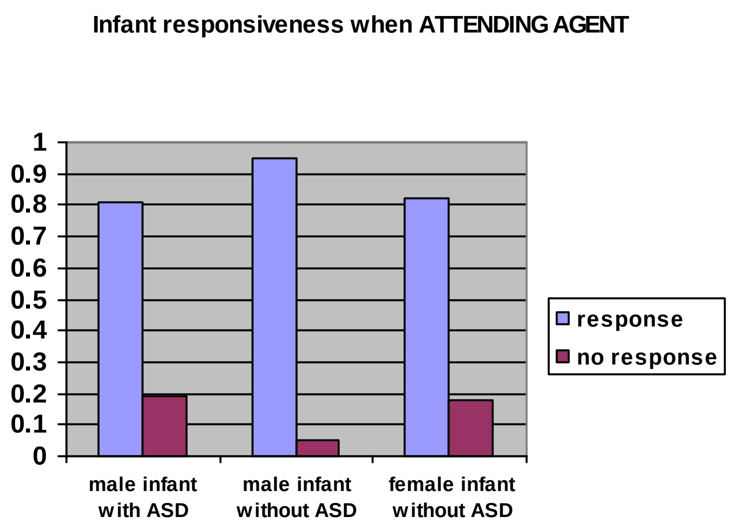


Table 4: Playful, Conversational, Rewarding Overtures. Relation of pre-overture behavior to response

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attending agent			
Response	17/21 (.81)	18/19 (.95)	27/33 (.82)
No response	4/21 (.19)	1/19 (.05)	6/33 (.18)
Otherwise engaged			
Response	1/8 (.125)	11/16 (.69)	3/10 (.30)
No response	7/8 (.875)	5/16 (.31)	7/10 (.70)
Significance test (two-tailed chi-square)	$\chi^2_{(1, N = 29)} = 11.530$; $p < .001$	$\chi^2_{(1, N = 35)} = 4.130$; $p < .05$	$\chi^2_{(1, N = 43)} = 9.770$; $p < .005$

Figure 4: Playful, conversational, rewarding overtures



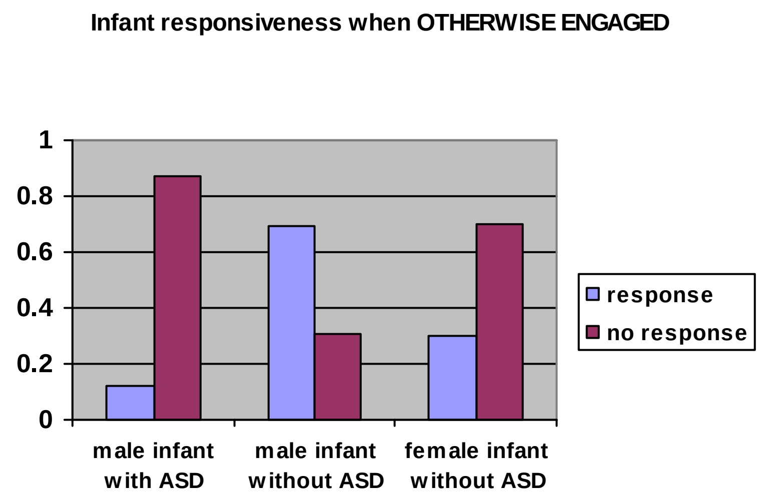
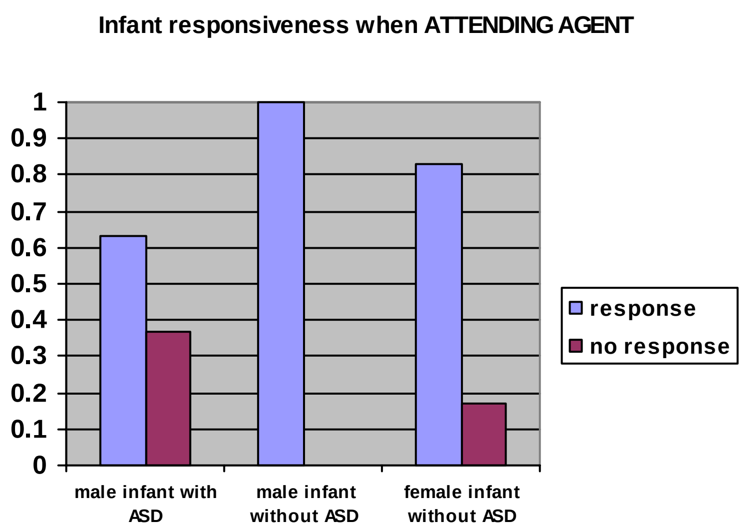


Table 5: Narrative overtures: Relation of pre-overture behavior to response

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	Male infant with ASD	Male infant without ASD	Female infant without ASD
Attending agent			
Response	12/19 (.63)	13/13 (1.00)	19/23 (.83)
No response	7/19 (.37)	0/13 (.00)	4/23 (.17)
Otherwise engaged			
Response	3/12 (.25)	4/12 (.33)	3/13 (.23)
No response	9/12 (.75)	8/12 (.67)	10/13 (.77)
Significance test (two-tailed chi-square)	$\chi^2_{(1, N = 31)} = 4.288$; $p < .05$	$\chi^2_{(1, N = 25)} = 12.745$; $p < .001$	$\chi^2_{(1, N = 36)} = 12.386$; $p < .001$

Figure 5: Narrative overtures



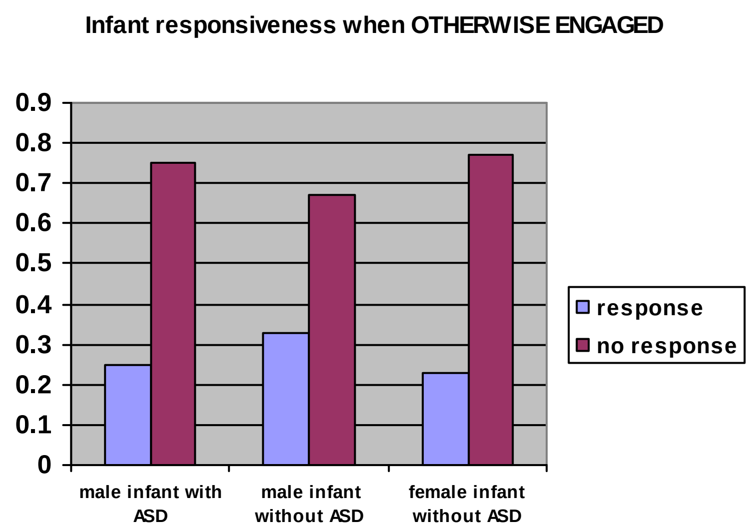


Table 6: Infant with ASD across age ranges: Directing, Playful, Conversational, Rewarding, and Narrative overtures. Relation of pre-overture behavior to response and changes over time

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	6-8 months	9-11 months	12-15 months
Attending agent			
Response	16/18 (.89)	14/18 (.78)	3/9 (.33)
No response	2/18 (.11)	4/18 (.22)	6/9 (.67)
Otherwise engaged			
Response	2/6 (.33)	3/10 (.30)	3/13 (.28)
No response	4/6 (.67)	7/10 (.70)	10/13 (.72)
Significance test (two-tailed chi-square)	$\chi^2_{(1, N = 24)} = 7.407$; $p < .01$	$\chi^2_{(1, N = 28)} = 6.152$; $p < .05$	$\chi^2_{(1, N = 22)} = 0.282$; *n.s.*

Figure 6: Infant with ASD across age ranges

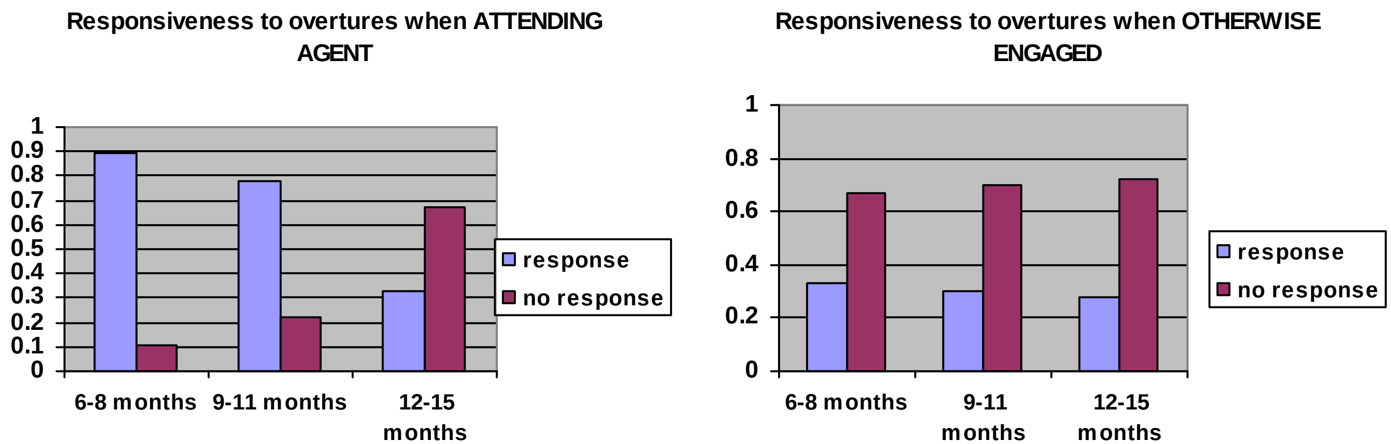
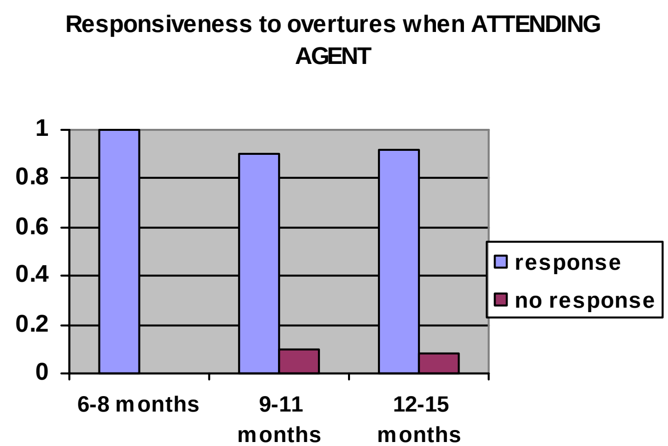


Table 7: Male infant without ASD across age ranges. Directing, Playful, Conversational, Rewarding, and Narrative overtures: Relation of pre-overture behavior to response and changes over time

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	6-8 months	9-11 months	12-15 months
Attending agent			
Response	14/14 (1.00)	19/21 (.90)	11/12 (.92)
No response	0/14 (.00)	2/21 (.10)	1/12 (.08)
Otherwise engaged			
Response	0/3 (.00)	6/7 (.86)	12/23 (.52)
No response	3/3 (1.00)	1/7 (.14)	11/23 (.47)
Significance test (two-tailed chi-square)	$\chi^2_{(1, N = 17)} = 17.000$; $p < .001$	$\chi^2_{(1, N = 28)} = 0.124$; *n.s.*	$\chi^2_{(1, N = 35)} = 5.459$; $p < .05$

Figure 7: Male infant without ASD



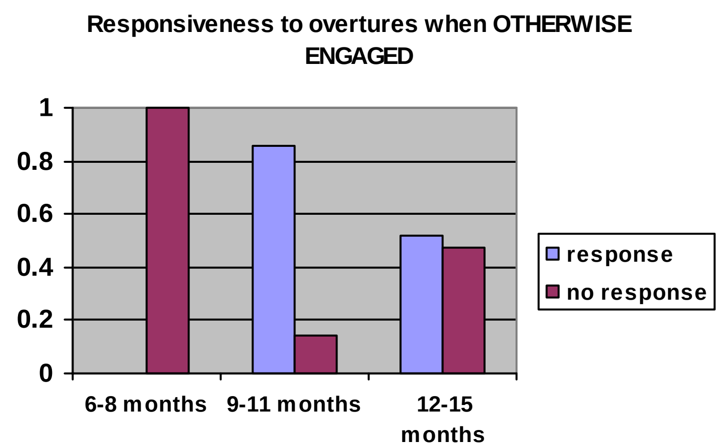


Table 8: Female Infant without ASD across age ranges. Directing, Playful, Conversational, Rewarding, and Narrative overtures: Relation of pre-overture behavior to response and changes over time

	Proportion of response vs. not a response given the infant's behavior before the overture began		
Proportion of responses in relation to pre-overture behavior	6-8 months	9-11 months	12-15 months
Attending agent			
Response	15/23 (.65)	13/18 (.72)	26/35 (.74)
No response	8/23 (.35)	5/18 (.28)	9/35 (.25)
Otherwise engaged			
Response	3/8 (.375)	3/7 (.43)	3/17 (.18)
No response	5/8 (.625)	4/7 (.57)	14/17 (.82)
Significance test (two-tailed chi-square)	$\chi^2_{(1, N = 31)} = 1.873$; *n.s.*	$\chi^2_{(1, N = 25)} = 1.886$; *n.s.*	$\chi^2_{(1, N = 52)} = 14.881$; $p < .001$

Figure 8: Female infant without ASD