Spontaneous Emotion-Related Speech during Dyadic Play in Toddlers at Elevated Likelihood of Autism Spectrum Disorder

by

Catarina Marie Chiaramonte

Bachelor of Philosophy, University of Pittsburgh, 2023

Submitted to the Graduate Faculty of the

Dietrich School of Arts and Sciences in partial fulfillment

of the requirements for the degree of

Bachelor of Philosophy

University of Pittsburgh

2023

UNIVERSITY OF PITTSBURGH

DIETRICH SCHOOL OF ARTS AND SCIENCES

This thesis was presented

by

Catarina Marie Chiaramonte

It was defended on

April 12, 2023

and approved by

Barbara Kucinski, Teaching Professor, Department of Psychology

Jessie B. Northrup, Assistant Professor, Department of Psychiatry

Julia Parish-Morris, Assistant Professor, Department of Psychiatry, University of Pennsylvania

Thesis Advisor: Jana M. Iverson, Professor, Department of Physical Therapy, Boston University

Spontaneous Emotion-Related Speech during Dyadic Play in Toddlers at Elevated Likelihood of Autism Spectrum Disorder

Catarina Marie Chiaramonte

University of Pittsburgh, 2023

In neurotypical development, children acquire their first feeling-state words around 18-20 months. By 36 months, children develop the ability to talk about their emotional states and those of others and discuss causes and consequences of emotional states (Bretherton & Beeghly, 1982; Dunn et al., 1991). Children with developmental disorders, including autism spectrum disorder (ASD) and language delays (LD), may not follow the same trajectory of emotion understanding and expression. Prior studies on emotion discourse have focused on eliciting emotion discussions between caregiver-child dyads. However, little work has examined naturally occurring emotion discourse. This research will provide new insight into the spontaneous occurrence of emotion-related speech and if this differs depending on the child's developmental status.

This study addressed the following questions: 1a) What is the frequency of maternal spontaneous emotion-related speech, does it differ between developmental outcome groups, and is maternal emotion-related speech prompted by their child's current emotional state? 1b) What is the frequency of children's spontaneous use of emotion-related speech, and does it differ between groups? 2) Does the valence and function of maternal emotion-related speech differ between groups? and 3) What is the relation between maternal and child use of spontaneous emotion-related speech?

Participants included mother-child dyads ($N = 77$), including children with an autistic older sibling, who are at an elevated likelihood (EL) for ASD and LD, and a comparison group of

children at typical likelihood (TL) for ASD. At 36-months-old, children were videotaped engaging in semi-structured play with their mothers. All mother- and child-directed speech was transcribed and separated into utterances (Britsch, 2022). Instances of spontaneous emotion-related speech were identified and classified by valence (positive, neutral, negative), function (labeling or describing an emotion, posing emotion-related questions, or encouraging a specific emotion state), and whether they were prompted by the child's current emotional state. Findings indicated that, although infrequent, emotion-related speech is naturally incorporated into everyday play in similar ways, regardless of children's developmental status. This study provides us with a foundational understanding of spontaneous emotion discourse during everyday play and helps us better understand the mother-child play environment for children with diverse developmental outcomes.

Table of Contents

List of Tables

List of Figures

1.0 INTRODUCTION

Emotions are powerful internal cues and regulators that motivate behavior and influence the social environment. The ability to identify and interpret one's own emotions and the emotions of others has important implications for language and social-emotional development (Dunn et al., 1987). Understanding the use of spontaneous emotion-related speech during everyday play can provide information about how children naturally acquire a social-emotional understanding. Prompted discussions of feeling-states and emotions during play has been shown to contribute to social-emotional understanding both concurrently and longitudinally in early childhood, but further research is needed to investigate the use of unprompted emotion-related speech during everyday play (Cervantes & Callanan, 1998; Drummond et al., 2014; Dunn et al., 1987).

1.1 Emotion Development in Neurotypical Children

The mutual exchange and expression of emotions often defines social relationships and regulates social interactions (Begeer et al., 2008). In infancy, the main form of communication between infants and caregivers is behavioral displays of emotional and physical feeling-states (i.e., crying when hungry or tired). Studies on prompted emotion-related speech has found that caregiver input on feeling-states in infancy is correlated with children's emotion and mental-state vocabulary in later infancy and toddlerhood (Beeghly et al., 1986). By 9 months of age, neurotypically developing infants gain the ability to connect emotions to desires and acquire their first feeling-state words around 18-20 months (Chiarella & Poulin-Dubois, 2013; Dunn et al., 1987).

Neurotypical children begin to understand feeling states experienced by others and the consequences of behavior on emotion-states by 28 months of age (Beeghly et al., 1986). By 36 months, children can readily distinguish emotions, connect internal feeling-states to external causes, and express emotional outcomes (Cervantes & Callanan, 1998; Richardson & Wood, 2012). Through emotion discourse during everyday activities, children learn to understand and recognize various emotional states, recognize the contexts that elicit certain emotions, and regulate their emotions and those of others (Dunn et al., 1987).

The use of emotion discourse varies depending on context, caregiver differences, and child's developmental status. Caregivers naturally incorporate emotion discourse in many everyday contexts including conversing about past events, pretend play, meal preparation, book reading, and free play, but the inclusion of emotion discourse is highly context-dependent (Brownell et al., 2013; Dunn et al., 1987; Ensor & Hughes, 2008; Lagattuta & Wellman, 2002). For example, emotion discourse is more frequent and elaborate when caregivers read books and play together with toys rather than without toys (Drummond et al., 2014).

In addition to context effects, caregiver gender impacts the frequency of emotion discourse and children's reciprocal engagement in emotion discussions. A study of 4- and 6-year-old children found that at 4 years, children are more likely to engage in emotion discussions with their mothers than fathers, but this difference is not present at 6 years of age (Aznar & Tenenbaum, 2014). Relatedly, compared to fathers, mothers use more emotion-related speech during everyday play with their children (Aznar & Tenenbaum, 2014). Discourse about negatively charged emotions (i.e., anger, sadness, frustration) is more frequent and detailed than positive emotion-state discussions (i.e., happiness, excitement), because negative emotional states in children often

elicit more salient responses by their caregivers and provide opportunities for teaching emotion regulation skills (Lagattuta & Wellman, 2002).

By commenting on observable manifestations of their child's internal feeling-state and translating their behaviors into discrete language, caregivers provide young children with the language to communicate their feelings. By observing, identifying, and labeling their child's emotions, caregivers model the appropriate identification of emotions and how to express their emotions verbally rather than behaviorally (Ereky-Stevens, 2008; Fonagy et al., 1997). This, in turn, aids children's development of emotion understanding and emotion regulation. Children who have the language to label their emotions display more effective emotion regulation skills, thus improving their social-emotional school readiness and peer relationships in kindergarten years (Eisenberg et al., 2005; Nencheva et al., 2023).

Maternal responsiveness to children's emotions is paramount in the development of social-emotional understanding and emotion regulation skills in both typically developing children and autistic children. Both neurotypical and autistic children have been found to view their mothers as a source of assistance and actively seek out parental support when experiencing intense states of emotion, thus emphasizing the importance of maternal responsiveness to their child's expression of emotions (Gulsrud et al., 2010; Kopp, 1989).

1.2 Autism Spectrum Disorder and Emotion Development

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by social-emotional challenges, differences in communication style, and restricted and repetitive behaviors, affecting 1 in 36 children (American Psychiatric Association, 2013; Maenner et al., 2021).

Although diagnosis of ASD is not reliably available until children reach early preschool years, researchers are able to study the early presentation of ASD through prospective studies of younger siblings of autistic children, who are at an elevated likelihood (EL) of ASD. Through comparisons between EL infants and infants with a typical likelihood for ASD (TL; children with no immediate family history of ASD), researchers can prospectively study the early development of autistic children (Lazenby et al., 2016; Marrus et al., 2018). EL children receive ASD diagnoses at greater frequencies than children with no family history of ASD, with approximately 18.7% of EL infants being diagnosed with ASD (Ozonoff et al., 2011). EL infants also have higher rates of non-ASD related language delays (EL-LD); however, most EL infants receive no diagnoses (EL-ND; Marrus et al., 2018).

Autistic children commonly experience a range of differences and delays in communication and language development. Delays in receptive and expressive language commonly co-occur with ASD, but are no longer included in diagnostic criteria (Lazenby et al., 2016). Further, the current edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) expanded descriptive criteria for atypical language use, such as differences in conversation engagement, repetitive speech patterns, and ritualized verbal behaviors (American Psychiatric Association, 2013; Lazenby et al., 2016). These communication differences common in ASD extend to other domains such as social-emotional understanding.

Many autistic individuals experience and process their emotions and the emotions of others differently than neurotypical individuals (Begeer et al., 2008). Autistic individuals commonly experience alexithymia or marked difficulty in verbalizing and describing emotions (Begeer et al., 2008; Lesser, 1981). In childhood, these social-emotional differences often present as maladaptive behaviors such as irritability, self-injury, anxiety, and impulsivity (Mazefsky et al., 2013). While

literature on autistic adults and their interpretation and expression of emotions is vast, further research is needed to expand our understanding to how autistic children experience emotions.

Research suggests that emotional differences for autistic children can emerge in early infancy, although our understanding remains limited. Infants who later receive an ASD diagnosis show similar expressions of emotions as their neurotypical peers, but are less attentive to faces and their display of affective behavior is less oriented towards others (Richardson & Wood, 2012). This difference in early emotion expression may reflect a social feedback loop, or reciprocal interaction between children and their social environment. As autistic children's display of affective behavior is less oriented towards others (Richardson & Wood, 2012), this gives caregivers fewer opportunities to engage in emotion discourse with their children. This social feedback loop leads to fewer opportunities for caregivers to comment on emotional states and model emotion regulation skills. With fewer opportunities for caregivers to provide input on emotions, children may have fewer opportunities to learn about emotion understanding and to share emotions. Further research is needed to better understand the family environments of autistic children and children's developmental status may influence the content of emotion discourse during play.

1.3 Context Effects on Emotion Speech

As the majority of prior studies on emotion speech involved prompting caregivers to discuss specific emotions in a structured context, there is a significant lack of research on the function of unprompted, spontaneously occurring emotion-related speech during everyday play.

With the current study, we will begin to address these gaps in the literature by investigating the function of spontaneous emotion-related speech during dyadic play between mother and child.

Differences in children's development also influence caregivers' verbal input. Caregivers commonly engage in developmentally sensitive discourse with their children, meaning that they adjust their speech to match their child's developmental level (Beeghly et al., 1986; Drummond et al., 2014). More research is needed to improve our understanding of developmentally sensitive discourse. With the current study, we intend to further our understanding of how developmentally sensitive discourse is used in everyday play settings and if spontaneous emotion discourse follows the trend.

1.4 Current Study

The current study addresses significant gaps in the literature regarding the early social environments of autistic children and the incorporation of emotion discourse during play by observing mothers and their 36-month-old children at typical (TL) and elevated likelihood (EL) for ASD as they engage in semi-structured play tasks in their homes. According to prior studies, at 36 months of age, neurotypically developing children have the ability to understand, discuss, and engage in conversations about emotions experienced by themselves and others (Cervantes & Callanan, 1998; Richardson & Wood, 2012). In our sample of 36-month-old children of varying developmental statuses, we will explore the natural use of emotion-related speech during everyday play. This will be one of the first studies to investigate the unprompted use of emotion-related speech during dyadic play between mother and child.

The current study will address these gaps in the literature by analyzing the use of emotion-related speech during semi-structured play tasks without specific prompts to incorporate emotion discourse, including children of differing developmental groups, and examining potential developmental outcome group differences. This study will investigate the following aims:

1a. What is the frequency of spontaneous maternal emotion-related speech during everyday play, and does it differ between developmental outcome groups? Is maternal emotion-related speech prompted by the child's emotional state?

We hypothesize that the use of unprompted emotion-related speech in everyday play will be relatively infrequent and that mothers will match their input during play to their child's developmental level (Beeghly et al., 1986; Drummond et al., 2014). That is, mothers of neurotypically developing children will use more emotion-related speech in everyday play than mothers of children with ASD or language delay. We hypothesize that spontaneous maternal emotion-related speech during play will rarely be prompted by the child.

1b. What is the frequency of 36-month-old children's spontaneous use of emotion-related speech during everyday play and does it differ between developmental outcome groups?

We hypothesize that children will spontaneously use emotion-related speech during everyday play rarely. We expect the frequency of emotion-related speech to differ depending on the child's developmental status such that neurotypically developing children will use more emotion-related speech than children with ASD or language delay.

2. Do the valence and function of maternal emotion-related speech differ between developmental outcome groups?

Although we do not have a specific hypothesis regarding the valence and function of unprompted emotion-related speech, prior studies of prompted emotion discussions indicated that negatively valanced emotion states are more frequently discussed during play (Lagattuta & Wellman, 2002). Thus, we expect the valence of naturally occurring emotion speech to yield similar distributions of positive, neutral, and negatively valanced emotions. Literature has suggested that autistic children tend to display more negative affect and irritability than their neurotypical peers, leading us to hypothesize that mothers would more frequently discuss negative emotions with their autistic children (Mazefsky et al., 2013). We hypothesize that mothers will mainly label emotion states and pose emotion-related questions.

3. What is the is the relationship between maternal and child use of spontaneous emotion-related speech during everyday play?

We hypothesize that there will be a positive correlation between maternal and child-use of spontaneous emotion-related speech. That is, the more mothers produce emotion-related speech, the more children will use emotion-related speech themselves.

2.0 METHOD

2.1 Participants

Children and their caregivers were visited at home regularly during the first 36 months of life and videorecorded as they engaged in a variety of developmentally appropriate tasks, assessments, and play sessions. The current study includes a subset of 77 mother-child dyads with children at 36 months of age who completed two semi-structured toy play tasks. This subset of 77 dyads was taken from a larger video dataset of caregiver-child dyads (N = 86) for which caregiver and child vocalizations have already been transcribed. The larger dataset included a small subset of non-maternal caregivers (n = 9), but this subset is not large enough to conduct caregiver gender group comparisons. Given this, and the known parental gender differences in the use of emotion words (Aznar & Tenenbaum, 2014; Kuebli & Fivush, 1992), we have excluded the 9 caregiver-child dyads in which the caregiver present in the recorded sessions is *not* the mother, leaving 77 mother-child dyads.

Participants included families with children at a typical (TL) and elevated likelihood (EL) for autism spectrum disorder (ASD). Children with an older sibling diagnosed with ASD are considered to be at an elevated likelihood (EL, n = 62; 27 female) for an ASD diagnosis themselves compared to children with no immediate family history of ASD who are at a typical likelihood (TL, n = 15; 5 female; (Ozonoff et al., 2011). Participants were recruited through a University of Pittsburgh research registry and autism research program, as well as through community agencies and word of mouth. Participants in both likelihood groups were monolingual English-speakers who experienced uncomplicated pregnancies and carried to full-term. The majority of participant

dyads were Caucasian (96.1%; 60/62 EL, 13/15 TL) and did not identify as Hispanic or Latino (90.9%; 55/62 EL, 15/15 TL). There were no likelihood status differences in maternal age or child sex ($p > 0.05$). The majority of mothers earned a bachelor's degree or higher (67.5%; 38/62 EL, 14/15 TL).

2.2 Procedure

To capture the natural use of emotion speech in everyday play, we observed mother-child dyads in their homes. This study will focus on the observation completed when children were 36 months old. Participants were given two standardized toy sets and allotted time to play with each toy set. Dyads were given 3 minutes with a teddy bear toy set (including a teddy bear, cup, spoon, brush, washcloth, and bowl) and 10 minutes with a plastic barn set (including a barn and silo with various rooms and variety of people and farm animals) for a total of 13 minutes of semi-structured play ($M = 12.92$, $SD = 0.55$). There were no group differences in play-task duration ($p > 0.05$). Caregivers were instructed to play as they normally would and were *not* explicitly asked to discuss emotions during play.

Researchers were present to video record the play session, but they did not interact with the dyad during the designated play sessions. All other interactions (between mother, researcher, sibling, etc.) were not included in this study. Researchers sought to minimize other interactions during the designated play period as much as possible. All members of the research team were masked to the participants' likelihood group membership (TL or EL) and outcome groups (TL-ND, EL-ASD, EL-LD, EL-ND).

2.3 Outcome Measures and Classification for EL Children

The Mullen Scales of Early Learning, McArthur-Bates Communicative Development Inventory, and Autism Diagnostic Observation Schedule were utilized to classify EL participants into one of three developmental outcome groups.

At the 18-, 24-, and 36-month visits, trained researchers administered the Mullen Scales of Early Learning (MSEL), a standardized assessment of cognitive functioning and communication abilities (Mullen, 1995). The MSEL is commonly used in EL infant studies (e.g., Jones et al., 2014) and has strong convergent validity with other measures of assessing developmentally appropriate functioning (Bishop et al., 2011).

The MacArthur-Bates Communicative Development Inventory (CDI), a caregiver-report measure of receptive and expressive language, was also completed at 18, 24, and 36 months by a primary caregiver. The CDI is widely used in studies of neurotypical development and in populations with neurodevelopmental disorders such as ASD (e.g., Fenson et al., 1994; Mitchell et al., 2006). The CDI has high levels of validity with standardized measured administered by researchers and test-retest reliability (Fenson et al., 1994).

Scores from the MSEL and CDI were used in conjunction to classify EL children in the language delay (EL-LD) outcome group (see Table 1). These criteria were developed for the purpose of identifying children with a pattern of delayed language development, not to provide a clinical diagnosis. EL children were classified as exhibiting patterns of language delay (EL-LD) if they were not diagnosed with ASD and met one or both of the following criteria:

1. CDI score at or below the 10^{th} percentile between at more than one administration 18 and 36 months of age.

2. CDI score at or below the 10th percentile *and* Receptive and/or Expressive scale of MSEL at 1.5 SDs or more below the mean at 36 months of age.

Finally, at 36 months a clinician masked to study aims and prior study data administered the Autism Diagnostic Observation Schedule (ADOS; Lord & Rutter, 2012). The ADOS is a play-based assessment that utilizes standardized behavior observations and is used to assess and diagnose ASD across developmental levels (Lord & Rutter, 2012). Scores from the ADOS were used to classify EL children with ASD (EL-ASD). EL children who did not meet criteria for an ASD diagnosis or exhibit language delays were classified as EL-ND (no diagnosis).

Out of 62 EL children, 9 were diagnosed with autism spectrum disorder (EL-ASD; 3 female), 20 were classified with patterns of language delay (EL-LD; 9 female), and 33 children did not meet criteria for ASD or show signs of language delay and were identified as EL-ND (no diagnosis; 15 female).

Table 1. Total utterances produced and children's CDI and MSEL scores

	TL-ND	EL-ND	EL-LD	EL-ASD	Difference
Total maternal utterances	208.7 (62.59)	247.5 (69.42)	253.2 (70.0)	248.7 (68.77)	TL-ND < (EL-ND =EL-LD=EL-ASD)
Total child utterances	188.7 (67.67)	170.3 (42.35)	154.6 (61.01)	134.4 (79.34)	EL-ASD < EL-LD < EL-ND < TL-ND
CDI-III Words Produced Percentile	27.85 (25.55) *n*=14	27.41 (26.04) *n*=29	4.0 (3.84) *n*=20	0 (0) *n*=9	(EL-ASD=EL-LD) <(EL-ND=TL-ND)
MSEL Receptive Language T-Score	55.4 (6.66) *n*=15	52.19 (8.71) *n*=32	43.8 (9.10) *n*=20	29.12 (10.96) *n*=8	EL-ASD < EL-LD <(TL-ND=EL-ND)
MSEL Expressive Language T-Score	59.13 (9.85) *n*=15	56.41 (7.43) *n*=32	48.10 (10.69) *n*=20	31.44 (11.94) *n*=9	EL-ASD < EL-LD < (TL-N =EL-ND)

Note: CDI = MacArthur-Bates Communicative Development Inventory; MSEL = Mullen Scales of Early Learning

2.4 Coding Procedures

2.4.1 Transcription

In a previous study (Britsch, 2022), the video recordings of the dyad interactions were independently transcribed using CLAN (Computerized Language Analysis) transcription conventions and CHAT conventions of the Child Language Data Exchange System (MacWhinney, 2000). Transcription coders were trained to a threshold of at least 90% agreement on identification of utterances and 80% agreement on word match. Reliability statistics were conducted on each file, with an average of 95.6% (*SD = 3.48*) exact word match for caregiver speech and 91.80% (*SD = 3.66*) word match for child speech (Britsch, 2022). The total number of mother and child utterances are reported in Table 1.

2.4.2 Emotion Coding

Using the coded transcriptions, an additional coding pass was conducted to identify and classify utterances containing emotion-related speech. The complete coding manual is presented in Appendix A. For the purpose of this study, emotion-related speech was operationalized as words/phrases referring to internal states of emotion (e.g., sad, happy) and emotional behaviors (e.g., cry, laugh) but *not* words/phrases referring to physical states (e.g., hungry, sick, tired). Coders first labeled the type of utterance to indicate if the utterance contained emotion-related speech or not. If the utterance contained emotion-related speech, coders identified the valence of the emotion word used (positive, neutral, or negative) and the function of the utterance (labeling,

questioning, or encouraging an emotional state). A unique code was used to identify utterances that are unintelligible or uncodable for emotion-related speech.

If the utterance contained emotion-related speech, coders indicated the valence of the emotion word used and the function of the emotion utterance. Valence is the affective quality referring to intrinsic "good"-ness or "bad"-ness and is used to characterize and categorize emotions (Lagattuta & Wellman, 2002). Positive emotion words/phrases describe favorable or desirable emotional states (e.g., *happy*), facial expressions (e.g., smile), attitudes, (e.g., love), or emotional evaluations (e.g., fun). Neutral emotion words/phrases describe conditions that are neither positive nor negative, describing an indifferent state of feeling (e.g., okay, fine*)*. Negative emotion words/phrases describe unfavorable or undesirable emotional states (e.g., afraid), facial expressions (e.g., cry), attitudes (e.g., hate), or evaluations (e.g., scary; Lagattuta & Wellman, 2002). An emotion-related utterance may function to *describe/label* an emotional state or behavior (identifying an emotion experienced by self or other and labeling that emotion), *question* (asking questions about one's emotional state), or *encourage emotion-states* (encouraging a specific emotional state). See Table 2 for examples of emotion utterances of each function and valence.

Table 2. Valence and function example phrases

Function	***Valence***		
	Positive	*Neutral*	*Negative*
Labeling/ describing emotions	"That girl is so happy" "I like the bear" "The girl is smiling"	"I'm feeling alright" "I'm okay"	"I'm sad" "I'm so scared" "The bear is crying"
Questioning emotions	"Are you happy?" "Do you like the bear?" "Are you laughing?"	"Are you alright?" "Are you feeling okay?"	"Why are you sad?" "Are you scared?" "Why are you crying"
Encourage emotion states	"Be happy" "Cheer up" "Smile more"		"Don't be sad" "Don't be scared" "Stop crying"

Lastly, we identified whether each maternal emotion utterance was prompted by the child displaying or experiencing an emotional state themselves, as opposed to discussing the feelings related to pretend play/pretend characters, feelings experienced by the mother herself, or feelings of others. An emotion utterance was considered to be prompted by the child's emotional state if the mother was commenting on or questioning an emotional state currently being displayed by the child (e.g., child begins crying and mother asks, "why are you sad?").

2.5 Coding Training and Reliability

Prior to independent coding, coders were trained to a threshold of 90% agreement on utterance classification for three consecutive files. Each participant video was coded by a pair of coders. The primary coder coded the entire file while the reliability coder coded every 5th utterance or 20% of the file. Utterance classification agreement was determined by calculating the percent

agreement and number of disagreements for each file. After independently coding each file, coders met to review the file, resolve disagreements, and consensus code.

3.0 RESULTS

The goal of this study was to explore the spontaneous use of emotion-related speech between mothers and their children with differing developmental outcomes (TL-ND, EL-ND, EL-LD, EL-ASD). We first explored how often mothers and their children spontaneously engaged in emotion discourse during dyadic play, then analyzed the content of maternal emotion-related speech. Lastly, we analyzed the relation between mothers' and children's use of emotion-related speech.

3.1 How do mothers spontaneously use emotion-related speech?

Aim 1a of this study was to examine how mothers spontaneously used emotion-related speech during play. We also explored whether the use of emotion-related speech differed between developmental outcome groups (TL-ND, EL-ND, EL-LD, EL-ASD) and whether emotion-related speech was prompted by the child's current emotional state. To do this, we first calculated the total number of utterances containing emotion-related speech. Generalized linear regression models (GLM) with a Poisson distribution and log link function were fitted to assess group differences. GLM's with Poisson distributions were chosen to due to the zero-inflated nature of our variables. Models were fitted using maximum likelihood (Laplace Approximation). GLM provides embedded pairwise tests to assess group differences. We report z-values which represent the regression coefficient divided by the standard error and are approximately analogous to a t-value from a t-test. Given a two-sided hypothesis and α level of .05, a z-value > 2 is considered

significant. We rotated the reference group to assess all comparisons. To control for differences in talkativeness, we then calculated the proportion of total utterances that contained emotion-related speech and the proportion of emotion-related speech utterances that were prompted by the child's emotional state. We also investigated potential group differences in maternal use of emotion-related speech based on child sex. Primary analyses utilized nonparametric Kruskal-Wallis H tests for proportional data where variables were dependent on one another, and Mann-Whitney U tests were conducted as post-hoc pairwise comparisons.

Table 3. Maternal utterances containing emotion-related speech

	TL-ND	EL-ND	EL-LD	EL-ASD	Difference
Number emotion utterances	4.8 (5.17)	6.94 (7.34)	5.70 (2.90)	4.11 (3.06)	EL-ND > (TL-ND = EL-ASD)
Proportion emotion utterances	0.02 (0-0.07)	0.02 (0-0.11)	0.02 (0.01-0.07)	0.01 (0-0.04)	*n.s.*
Proportion prompted emotion utterances	0 (0-0.67)	0 (0-0.87)	0.17 (0-0.83)	0.25 (0-0.5)	*n.s.*

Note. For number of utterances, means and standard deviations are reported. For proportions, medians and ranges are reported.

On average, mothers produced emotion-related speech 5.86 times (*SD* = 5.61) during 13 minutes of play. That is, approximately 2% of all intelligible maternal utterances contained emotion-related speech (see Table 3). Mothers of EL-ND children used the most utterances containing emotion words (*M* = 6.94, *SD* = 7.34) and used significantly more than mothers of TL-ND (z = -3.08, p = 0.002) and EL-ASD (z = -3.22, p = 0.001) children. Mothers of EL-LD children did not differ from other groups in the number of emotion-related utterances used (ps < 0.05). Despite these significant group differences in the number of emotion-related utterances, group

differences were no longer apparent after controlling for maternal talkativeness by calculating proportions (see Figure 1).

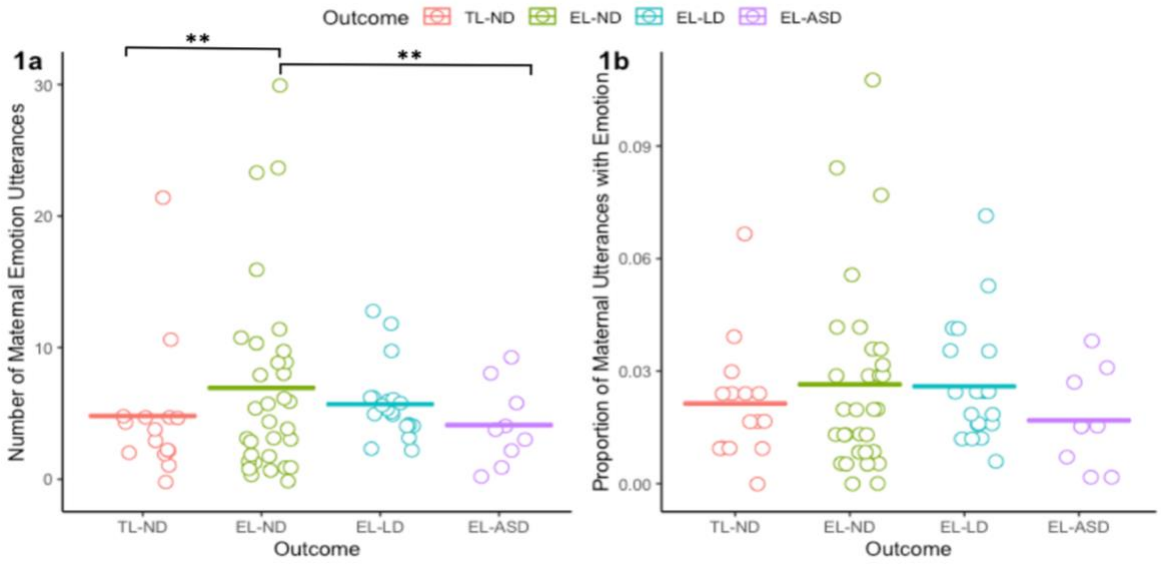

Figure 1. Number and proportion of maternal utterances that contained emotion-related speech
Note. p<.10, *p < .05, **p < .01, ***p < .001

The number of emotion utterances used also differed significantly based on child sex, such that mothers of boys used more emotion-related speech than mothers of girls (z = 3.90, p < 0.001). However, when calculating the proportion of total maternal utterances that contained emotion-related speech, child sex differences were no longer present (ps < 0.05). Qualitatively, there were a few mothers of EL-ND boys who had high overall rates of speech and emotion-related speech, which may have driven both the effect of group and effect of sex. Given that sex differences were no longer apparent when using proportions which control for maternal talkativeness, sex was not included in subsequent analyses.

Finally, we examined the proportion of maternal emotion utterances that were prompted by the child's current emotional state. Mothers' emotion-related speech utterances were rarely prompted by their child expressing an emotion (M = 0.17, SD = 0.23; Mdn = 0.02, $Range$ = 0-

0.87), and the proportion of emotion utterances prompted by the child's emotional state did not differ between developmental outcome groups ($p < 0.05$; see Figure 2).

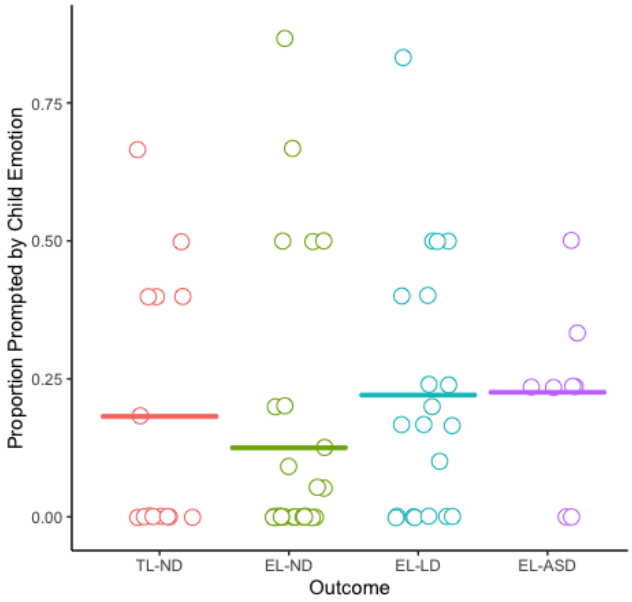

Figure 2. Proportion of maternal emotion utterances prompted by child's emotional state

3.2 How did children spontaneously use emotion-related speech?

Aim 1b of this study was to examine children's spontaneous use of emotion-related speech during play and determine whether it differed between developmental outcome groups (TL-ND, EL-ND, EL-LD, EL-ASD). To do this, we calculated the total number of utterances containing emotion-related speech and the proportion of total utterances that contained emotion-related speech. For count data, as above, we conducted generalized linear regression models (GLM) with a Poisson distribution and log link function were fitted to assess group differences. Kruskal-Wallis H tests were utilized for proportional data where variables were dependent on one another, and Mann-Whitney U tests were conducted as post-hoc pairwise comparisons.

Table 4. Child utterances containing emotion-related speech

	TL-ND	EL-ND	EL-LD	EL-ASD	Difference
Number emotion utterances	1.0 (1.93)	1.47 (2.00)	1.0 (1.69)	1.22 (2.17)	*n.s.*
Proportion emotion utterances	0 (0-0.05)	0.01 (0-0.05)	0 (0-0.07)	0 (0-0.05)	*n.s.*

Note. For number of utterances, means and standard deviations are reported. For proportions, medians and ranges are reported.

Children rarely produced emotion-related speech during the observations. On average, children spontaneously used emotion-related speech 1.22 times (*SD* = 1.90) during 13 minutes of play (see Table 4). As seen in Figure 3, the number of emotion-related speech utterances and the proportion of total utterances that contained emotion-related speech did not differ between outcome groups (*p*s > 0.05). Out of 76 mother-child dyads, 34 children (5 TL-ND, 17 EL-ND, 9 EL-LD, 3 EL-ASD) did not produce any emotion-related speech. A chi-square test of independence was performed and yielded no group differences in whether or not the child used emotion-related speech $X^2 (1, N = 77) = 1.87$, $p > 0.05$. Thus, the content of spontaneous child-produced emotion-related speech was not analyzed further.

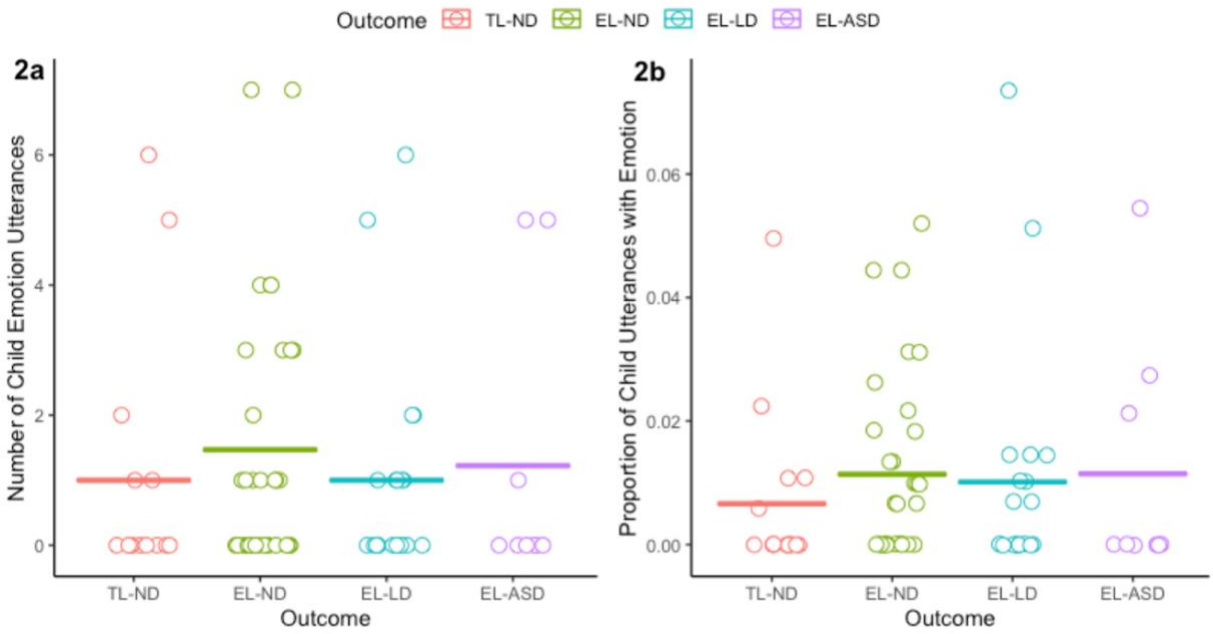

Figure 3. Number and proportion of child utterances that contained emotion-related speech

3.3 What is the content of spontaneous maternal emotion-related speech?

The second aim of this study was to examine the valence and function of emotion-related speech during play and whether this differs between outcome groups. To do this, we calculated the proportion of utterances containing emotion-related speech that used positive, neutral, or negative emotion words. We also calculated the proportion of utterances containing emotion-related speech that functioned to label, question, or encourage emotions. Out of 76 mother-child dyads, 4 mothers (TL-ND = 1, EL-ND = 2, EL-LD = 0, EL-ASD = 1) did not use emotion-related speech and were excluded from these analyses. Primary analyses were conducted using nonparametric Kruskal-Wallis H tests and Mann-Whitney U tests were conducted as post-hoc pairwise comparisons.

With regard to valence, mothers in all groups used a majority of positive emotion words, fewer negative emotion words, and rarely used neutral emotion words (see Table 5, Figure 4). The valence of emotion words used did not differ between developmental outcome groups (*p*s < 0.05).

Table 5. Proportion of valence categories in maternal emotion-related utterances

	TL-ND	EL-ND	EL-LD	EL-ASD	Difference
Proportion Positive	0.73 (0-1)	0.79 (0-1)	0.82 (0.33-1)	0.71 (0-1)	*n.s.*
Proportion Neutral	0 (0-0.4)	0.03 (0-1)	0 (0-0.5)	0 (0-1)	*n.s.*
Proportion Negative	0.12 (0-0.75)	0 (0-0.8)	0.08 (0-0.6)	0.11 (0-0.88)	*n.s.*

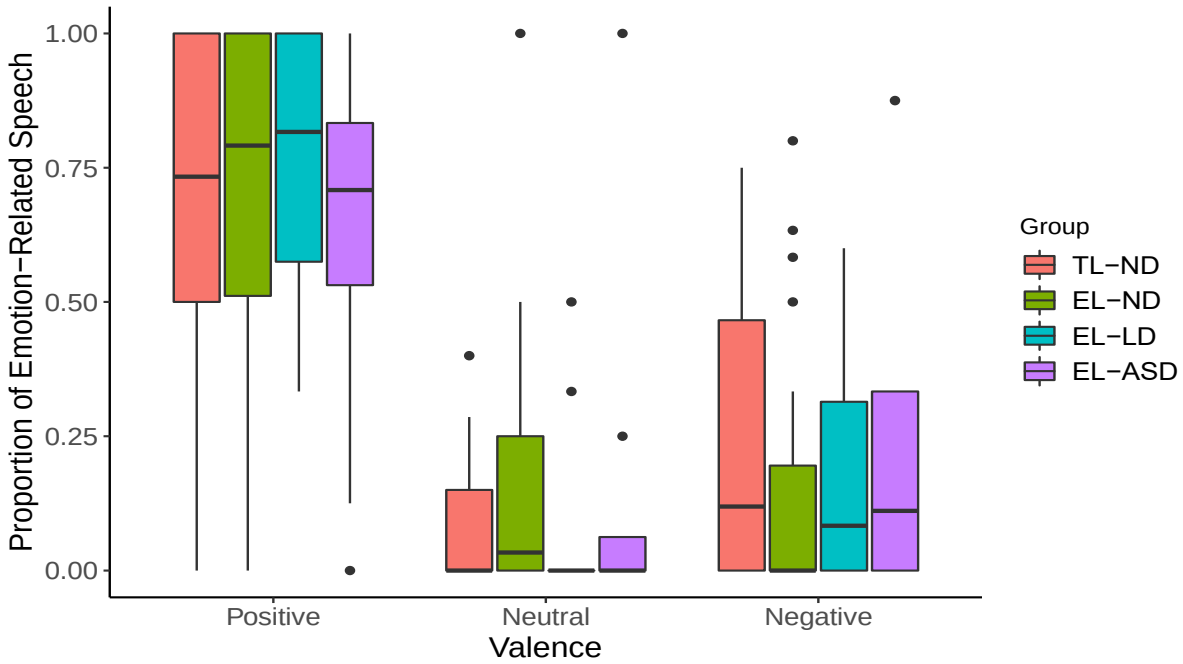

Figure 4. Proportion of emotion utterances that contained positive, neutral, or negative emotion words

When spontaneously discussing emotions during play, mothers' use of emotion-related speech mainly functioned to label/describe emotion states or pose an emotion-related question,

with few utterances encouraging certain states of emotion (see Table 6, Figure 5). This pattern did not differ between developmental outcome groups (*p*'s < 0.05).

Table 6. Proportion of function categories in maternal emotion-related utterances

	TL-ND	EL-ND	EL-LD	EL-ASD	Difference
Proportion Label	0.5 (0-1)	0.67 (0-1)	0.67 (0-1)	0.75 (0.33-1)	*n.s.*
Proportion Questioning	0.45 (0-0.8)	0.30 (0-1)	0.33 (0-1)	0.25 (0-0.67)	*n.s.*
Proportion Encouraging Emotions	0 (0-1)	0 (0-0.33)	0 (0-0.4)	0 (0-0)	*n.s.*

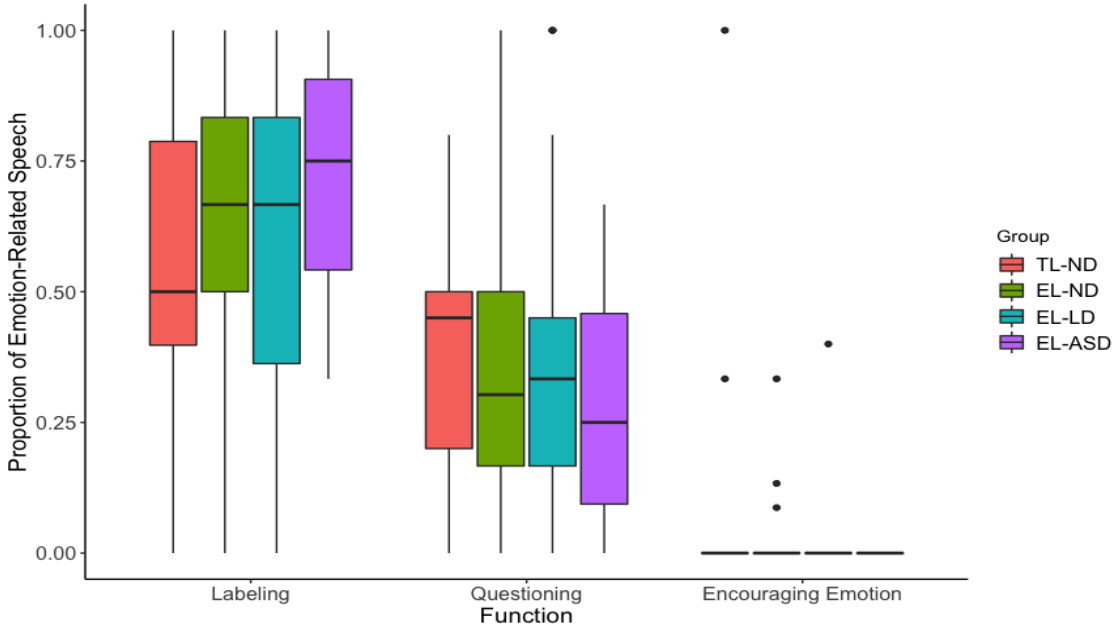

Figure 5. Proportion of maternal emotion utterances that label, question, or encourage emotions

3.4 Does mothers' use of emotion-related speech relate to child's use?

The final aim of this study was to investigate the relationship between mothers' and children's spontaneous use of emotion-related speech during play. To control for variations in dyad talkativeness, we calculated the proportion of utterances that contained emotion-related speech. We ran Spearman correlation analyses to examine relation between the proportion of emotion-related speech uttered by both the mother and child. There was a significant positive correlation between mother and child's use of emotion-related speech ($p < 0.001$, $\rho = 0.426$). That is, the more emotion-related speech mothers used, the more children used emotion-related speech (see Figure 6).

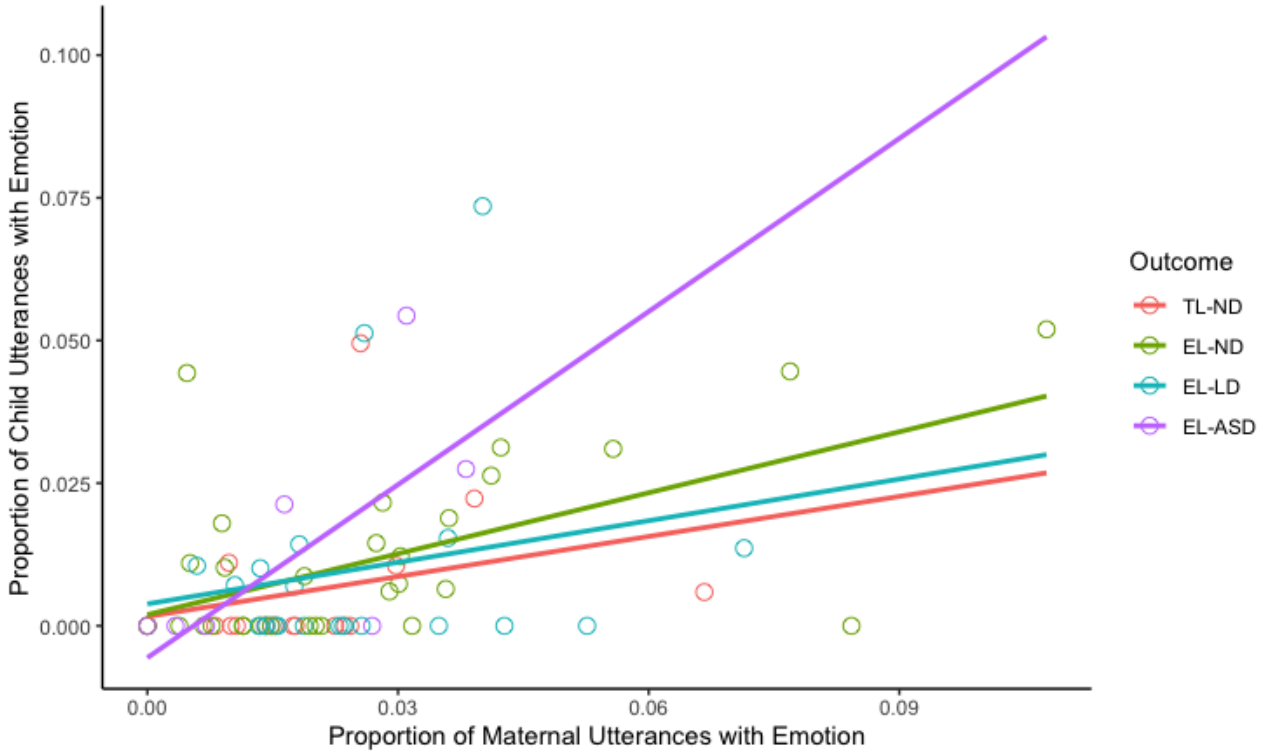

Figure 6. Relationship between maternal and child use of emotion-related speech

4.0 DISCUSSION

This study examined how mothers of children with and without an elevated likelihood (EL) for autism spectrum disorder (ASD) spontaneously discuss emotions during everyday play. We used previously collected videos and coded transcriptions to identify all instances natural emotion discourse during 13 minutes of semi-structured play at home. We then identified whether mothers were responding to an acute emotion displayed by their child, as opposed to emotions of pretend-play characters or others, and further explored the content (valence and function) of mothers' spontaneous emotion-related speech.

Results indicated that mother-child dyads in each of the four developmental outcome groups (TL-ND, EL-ND, EL-LD, EL-ASD) did not differ in the frequency of spontaneous emotion-related speech used during everyday play, after controlling for overall talkativeness. Analyses of mothers' use of emotion-related speech revealed that the valence (positive, neutral, or negative emotion words) and function (labeling, questioning, or encouraging emotions) did not differ between developmental outcome groups. Given that we found no significant group differences, and that this is the first study to measure spontaneous use of emotion-related speech, below, we first discuss overall trends in frequency and content of emotion-related speech during everyday play and the positive association between maternal and child production of emotion-related speech during play. We then consider our finding that groups did not differ in the use of spontaneous emotion-related speech.

4.1 Spontaneous emotion discussions occurred infrequently during play

Spontaneous emotion-related speech between mother-child dyads rarely occurred during everyday play tasks. Mothers tended to use more emotion-related speech than their children, but both mother and child emotion-related speech were relatively infrequent. While there is a plethora of literature on prompted emotion discussions between caregiver-child dyads, this study provides the first insight into the unprompted or spontaneous use of emotion-related speech. Consistent with our hypothesis, our results indicate that while the natural use of emotion-related speech during play occurs infrequently, mothers nevertheless incorporate emotion discussions spontaneously during everyday play with their children.

Overall, maternal emotion-related speech was seldom prompted by the child's current emotional state. On average, maternal emotion-related speech was prompted by their child's emotional state 17% of the time, however there was high variability. There were a number of dyads that had no prompted emotion utterances, and other dyads where over 75% of maternal emotion utterances were prompted by the child's emotion state. Descriptively, we saw that maternal emotion discourse was prompted when the child was displaying extreme emotions. Given the relatively brief observation and undemanding play task, children rarely displayed extreme emotions. However, in the rare instances when children displayed intense emotions during the observational period, mothers often labeled their child's emotion and offered calming or coregulation strategies. Mothers used a few common calming and coregulation strategies in response to their child's intense display of emotions such as validating their child's feelings (e.g., "you're feeling upset") and encouraging a more neutral state of emotion (e.g., "settle down"). However, a majority of emotion-related speech was unprompted and focused on the play context,

with mothers commenting on the play characters' emotions (e.g., "the cow and horse are happy together") or their own (e.g., "I love the barn").

Our findings also support the well-established correlation between caregiver and child speech. Maternal and child use of emotion-related speech were positively related, such that the more emotion-related speech mothers used, the more children also used emotion-related speech. Parent-child speech has been found to be highly interconnected and this trend appears to be replicated for emotion-related speech between mother and child (Dale et al., 2015; Guitar & Marchinkoski, 2001). This was true despite the overall low base rates of emotion-related speech.

4.2 Mothers labeled and asked questions about positive emotions during play

When spontaneously engaging in emotion-related discussions, mothers mainly used positive emotion words, few negative emotion words, and they rarely used neutral emotion words. This finding is inconsistent with our hypothesis and with prior literature suggesting that negatively valanced emotions are discussed more frequently than positive emotions (Lagattuta & Wellman, 2002). We speculate that this difference may be related to prior findings indicating that different dyadic interaction contexts (i.e., playing with toys, book-reading, or pretend play) yield varying rates and content of emotion discussions (Brownell et al., 2013; Drummond et al., 2014; Dunn et al., 1987; Ensor & Hughes, 2008; Lagattuta & Wellman, 2002). The valence of emotion words used during play is also likely impacted by the child's current affect or mood. Presumably, when children express positive emotions (i.e., giggling and smiling), mothers will comment on their child's emotional state by using positive emotions words. On the other hand, if children are expressing negative emotions (i.e., crying and whining), mothers will likely comment on these

negative emotion expressions and attempt to help their children regulate their emotions. Given that the task itself was unstructured, fun, and undemanding, dyads typically maintained positive affect throughout the observation period. Mothers very rarely used neutral emotion words, but this may be more indicative of the vast number of positive and negative emotion words available, while the number of words describing neutral states of emotion is more limited.

Consistent with our hypothesis, mothers mainly identified, labeled, or described emotions and occasionally posed emotion-related questions, but almost never encouraged specific emotion states. Descriptively, mothers most often identified or labeled a state of emotion (e.g., "the girl looks happy"), described emotions (e.g., "I'm sad because the farmer is being mean to me"), questioned an emotional state (e.g., "are you excited?"), or asked emotion-related questions (e.g., "why is the pig upset?"). The lack of speech encouraging specific emotion states relates to our finding that maternal emotion-related speech was rarely prompted by the child's current emotional state. However, when maternal emotion-related speech was prompted by the child's emotional state, mothers often attempted to help their child coregulate their emotions.

4.3 Production of emotion-related speech did not differ between developmental groups

We hypothesized that mothers would engage in developmentally sensitive discourse with their children and that the use of emotion-related speech would vary depending on their child's developmental status (Drummond et al., 2014). However, this hypothesis was not supported by our results. Despite autistic children displaying differences in communication and social-emotional understanding (Begeer et al., 2008; Lazenby et al., 2016), mothers of autistic children did not differ in how they discussed emotions during play. Although infrequent, mothers

spontaneously incorporated emotion-related speech into play regardless of their child's developmental status. Similarly, maternal emotion discourse prompted by the child's current emotional state did not differ between groups. This finding suggests that in an undemanding play task, maternal use of emotion-related speech was not prompted by their child's affect or emotional state. That is, mothers casually discussed emotions similarly regardless of their child's developmental status.

Despite literature suggesting that autistic children exhibit more negative affect (Mazefsky et al., 2013), our study did not yield any group differences in the use of negative emotion words. Likewise, we found no group differences in the use of positive or neutral emotion words. These findings suggest that although differences in autistic children's affect exist, mothers were overall positive when discussing emotions regardless of their child's affect. Similarly, mothers tended to describe or question emotions rather than encouraging specific emotion states. Overall, in the play setting observed here, mothers spontaneously engaged in emotion discussions with their children similarly, regardless of their child's developmental status.

4.4 Strengths, Limitations, and Future Directions

This study provides us with novel insights into the spontaneous use of emotion-related speech in a semi-structured play setting between mother-child dyads. Much of the current literature on emotion discourse between caregiver-child dyads involves researchers prompting caregivers to engage in emotionally charged conversations in a laboratory setting, which likely yielded an overestimate of the use of emotion-related speech (Brownell et al., 2013; Ensor & Hughes, 2008; Lagattuta & Wellman, 2002). Parental language input during structured laboratory tasks and

naturalistic routines yield different patterns of input (Tamis-LeMonda et al., 2017). Using a naturalistic study design forsakes the experimental control of a laboratory setting in exchange for more representative everyday interactions between dyads. However, by using standardized toy sets and a semi-structured play setting, we regained some experimental control. Although few group differences were identified, a strength of our study was the inclusion of a sample of children with diverse developmental trajectories.

However, there are also some study limitations to note. First, across the sample, natural emotion discussions occurred very infrequently during 13 minutes of play, with half of the children producing one or no utterances containing emotion-related speech. Due to the relatively short observation period, we may not have captured the full range of naturally occurring emotion discussions. Additionally, emotion discourse has been found to occur at vastly different rates in different everyday contexts. While emotion discourse is more likely to occur when engaging in play with toys rather than without, compared to activities such as book-reading, the use of emotion discourse during play is relatively infrequent. Lastly, our small sample size and unequal outcome groups likely limited our ability to detect group differences. With a larger sample, we may have been better able to identify group differences between the four developmental outcome groups.

To address these limitations, future studies should consider longer observations in multiple everyday contexts such as mealtime, diaper changes, or book reading. One suggestion for book reading observations is that future studies should utilize books that discuss emotions to encourage mothers and children to elaborate on the themes in the book. To maintain experimental control, future studies should consider providing a standardized set of books with one book that discusses emotions and one book with no reference to emotions. Future studies should also strive for a larger and more diverse sample in terms of caregiver education, socioeconomic status, and race/ethnicity.

4.5 Conclusions and Implications

The present study addressed significant gaps in the literature by exploring the spontaneous use of emotion-related speech between mother-child dyads during everyday play in a sample of developmentally diverse children. The findings from this study suggest that mothers and their children *do* naturally engage in emotion discourse during everyday activities regardless of their child's developmental status. When mothers spontaneously discuss emotions, they frequently label or question positive emotions. The frequency and content of such emotion-related speech varied between individual dyads, but no significant developmental outcome group differences were identified. This suggests that, although communication and social-emotional differences are common among EL children, maternal input on emotions or feeling-states may not. Understanding how children naturally acquire emotion understanding through everyday interactions can provide important insight into how at-home interactions with caregivers help develop and support children's social-emotional development.

Appendix A Coding Manual for Emotion-Related Speech in Mother-Child Dyadic Play

Column: emotion_clean
Arguments: (source, type, valence, function, prompt)

Tag all utterances by mother and child for the following variables:

- < Source > – the *source* argument denotes the source of the utterance as either the maternal caregiver (< p >) or the child (< c >)
- < Type > – the *type* argument will note the type of utterance as either containing emotion-related speech, not containing emotion-related speech, or uncodable
    - Emotion < m >
        - Words/phrases referring to internal states of emotion (e.g., sad, happy) and emotional behaviors (e.g., cry, laugh, smile) are considered emotion-related speech
    - Non-emotion < n >
        - Words/phrases referring to internal conditions (e.g., hungry, tired) will not be included in emotion-related speech and will be considered non-emotion speech
        - All other topics of conversation not pertaining to emotions will be considered non-emotion speech
    - Uncodable < x >
        - Tag utterances as < x > for all instances of vocalizations that are uncodable for emotion speech. This includes the following *pctracript* tags: < u > (uncodable), < v > (vocalization), < xxx > (unintelligible), < soundeffect >)
        - Partially unintelligible utterances
            - If an utterance is partially unintelligible with enough intelligible context, code as usual\
            - If 50% or more of the utterance is unintelligible, tag the entire utterance as uncodable for emotion speech using < x >
- < Valence > – Valence refers to the affective quality referring to the intrinsic attractiveness/"good"-ness or averseness/"bad"-ness of an event, object, or situation and is often used to categorize emotions. The valence argument will denote the valence of the emotion word used in the utterance (if non-emotion utterance, leave the valence argument blank)
    - Positive < p >
        - Positive emotion words/phrases describe favorable or desirable emotional states (i.e., *happy*), facial expressions (i.e., *smile*), attitudes, (i.e., *like*), or emotional evaluations (i.e., *fun*).
    - Neutral < t >

        - Neutral emotion words/phrases describe conditions that are neither positive not negative, describing an indifferent state of feeling (i.e., *okay, surprise*).
    - Negative < g >
        - Negative emotion words/phrases describe unfavorable or undesirable emotional states (i.e., *afraid*), facial expressions (i.e., *cry*), attitudes (i.e., *hate*), or evaluations (i.e., *scary*).
    - A note on utterance valence – Use the valence reference list to determine the valence of the emotion word used in the utterance. If the utterance uses a negating word (e.g., *not* or *don't*), consider the emotion-related word used to determine the valence and note in the comments that a negating word was used. For example, if the utterance is "I don't like this" this would be tagged as a positive < p > utterance for the use of the positive emotion-related word *like*. Note the use of a negating word in the comments.
- < Function > – the *function* argument will denote the function of the emotion-related utterance (if non-emotion utterance, leave the *function* argument blank). Examples below.
    - Describing/Labeling < l >
        - < l > refers to emotion-related utterances that function to describe or label an emotional state or behavioral expression of emotion
    - Questioning < q >
        - < q > refers to emotion-related utterances that function to question an emotional state or behavioral expression of emotion
    - Encouraging positive emotion < e >
        - < e > refers to emotion-related utterances that function to encourage a positive emotional state or behavior
    - Discouraging negative emotion < d >
        - < d > refers to emotion-related utterances that function to discourage a negative emotional state or behavior
- < Prompted > - the *prompted* argument will denote whether or not each maternal emotion-related utterance was prompted by an emotion experienced by the child (as opposed to emotions of pretend-play characters or others).
    - Prompted by child emotion < y >
        - < y > refers to a maternal emotion utterance that is commenting on or in response to their child displaying a current emotional state.
    - Not prompted by child emotion < o >
        - < o > refers to a maternal emotion utterance that is commenting on the emotional state of anyone other than the child (that is, the mother, a pretend play character, an imaginary character, etc.)

Negative <g>	Neutral <t>	Positive <p>
Sad	Okay *	Happy
Mad	Surprise *	Excited
Dislike	All right	Like *
Scared		Nice *
Poor		Love
Mean		Laugh
Cry		Smile
Worried		Silly *
Afraid		Enjoy
Mad		Fun
Upset		Glad
Fuss		Cheery
Annoy		Calm
Cry		Settled
Disappointed		
Embarrass		
Shy		
Lonely		
Naughty		
indicates special conditions, specified below		
Note: All morphological variants of words are included (e.g., scared *includes* scary *and* scare*).*		

Questioning < q >		
negative emotions	**neutral emotions**	**positive emotions**
Why're you so bent out of shape?	Are you all right?	Are you having fun?
What's the matter?	How do you feel?	Why are you laughing?
What's wrong?	Are you okay?	
Am I embarrassing you?	How are you?	
Are you being shy?		
Why are you crying?		

Discouraging negative emotions < d >	**Encouraging positive emotions < e >**
Don't be mean	Cheer up/Lighten up
Don't be sad	Calm down
Stop crying	Feel better
	Settle down
	Smile more

Inclusion/Exclusion Conditions			
Word	**General rule**	**Inclusion examples**	**Exclusion examples** *(+ reason for exclusion)*
Nice	The term ***nice*** is included when it expresses liking or the character attribute of being 'kind'. The term is excluded when it is used in the moral sense of "good" or well-behaved, when used as praise, when used as a mundane response, or when used to describe physical attributes of an object	"This is a nice farmer" "You're a nice baby"	*Well-behaved* "Be nice" - "That's not nice" *Praise* - "Nice job" *Mundane response* - "Oh nice" *Descriptor* - "He looks nice" - "He's nice and clean"
Silly	The term ***silly*** is included when meaning 'something that makes you smile or laugh' but excluded when used to describe the physical attributes of an inanimate object	"You're so silly" "I feel silly"	*Physical attribute* - "That's a silly hat"
Good	The term ***good*** is included when it expresses liking, the character attribute, or refers to *feeling* good. The term is excluded when used as praise, when the phrase could be replaced with '*yummy'* when referring to food, or when used as a mundane response	"I feel good"	*Praise* - "Good job" - "You're good at that" *'Yummy'* - "The food is good" *Mundane response* - "Oh good" - "That's good"

Like	The term ***like*** is included only when it referred to a state of enjoyment or dislike. The term is excluded when used as a comparative, when indicating volition or could be replaced with '*I want'*, and when it could be replaced with '*give me*'	"I like this toy" "Pigs like mud"	*Comparison* - "She's acting like a rabbit" - "We have a toy like this" *Volition* - "I'd like to go swimming" *'Give me'* - "I'd like that toy"
Surprise	The term ***surprise*** is included when referring to a state of shock or unexpectedness, but excluded when referring to a present or gift	"Is that surprising?" *"*Surprise, here I am"	*Gift* - "I have a surprise for you"
Okay	The term ***okay*** is included when describing a state of feeling but is excluded when it is used as a mundane response	"I'm feeling okay" "Are you okay?"	*Mundane response* - "Okay, sure" - "That's okay"
Fun	The term ***fun*** is included when describing a state of feeling enjoyment or excitement but is excluded when used as an adjective to describe inanimate objects	"I'm having fun" "This is so fun"	*Descriptor* - "This is a fun ride" - "This toy is fun"

Bibliography

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders*. DSM Library. https://dsm.psychiatryonline.org/doi/book/10.1176/appi.books.9780890425787

Aznar, A., & Tenenbaum, H. (2014). *Gender and age differences in parent–child emotion talk—Aznar—2015—British Journal of Developmental Psychology—Wiley Online Library*. https://bpspsychub.onlinelibrary.wiley.com/doi/abs/10.1111/bjdp.12069?casa_token=s8JSEzGTSL4AAAAA:U9z4NK5d7tIAE5b7QSNgphv_Zic7GtY2nWxvcjd8K8_HDM6Ey3ryTjy8MWG_pIZFspQdVMo8sNE1KVg

Beeghly, M., Bretherton, I., & Mervis, C. B. (1986). Mothers' internal state language to toddlers*. *British Journal of Developmental Psychology*, *4*(3), 247–261. https://doi.org/10.1111/j.2044-835X.1986.tb01016.x

Begeer, S., Koot, H. M., Rieffe, C., Meerum Terwogt, M., & Stegge, H. (2008). Emotional competence in children with autism: Diagnostic criteria and empirical evidence. *Developmental Review*, *28*(3), 342–369. https://doi.org/10.1016/j.dr.2007.09.001

Bishop, S. L., Guthrie, W., Coffing, M., & Lord, C. (2011). Convergent Validity of the Mullen Scales of Early Learning and the Differential Ability Scales in Children With Autism Spectrum Disorders. *American Journal on Intellectual and Developmental Disabilities*, *116*(5), 331–343. https://doi.org/10.1352/1944-7558-116.5.331

Britsch, E. R. (2022). *Early conversational skills in the younger siblings of children with autism*. 126.

Brownell, C. A., Svetlova, M., Anderson, R., Nichols, S. R., & Drummond, J. (2013). Socialization of Early Prosocial Behavior: Parents' Talk About Emotions is Associated With Sharing and Helping in Toddlers. *Infancy*, *18*(1), 91–119. https://doi.org/10.1111/j.1532-7078.2012.00125.x

Cervantes, C. A., & Callanan, M. A. (1998). Labels and explanations in mother–child emotion talk: Age and gender differentiation. *Developmental Psychology*, *34*, 88–98. https://doi.org/10.1037/0012-1649.34.1.88

Chiarella, S. S., & Poulin-Dubois, D. (2013). Cry babies and pollyannas: Infants can detect unjustified emotional reactions. *Infancy : The Official Journal of the International Society on Infant Studies*, *18*(Suppl 1), E81–E96. https://doi.org/10.1111/infa.12028

Dale, P. S., Tosto, M. G., Hayiou-Thomas, M. E., & Plomin, R. (2015). Why does parental language input style predict child language development? A twin study of gene–environment

correlation. *Journal of Communication Disorders*, *57*, 106–117. https://doi.org/10.1016/j.jcomdis.2015.07.004

Drummond, J., Paul, E. F., Waugh, W. E., Hammond, S. I., & Brownell, C. A. (2014). Here, there and everywhere: Emotion and mental state talk in different social contexts predicts empathic helping in toddlers. *Frontiers in Psychology*, *5*, 361. https://doi.org/10.3389/fpsyg.2014.00361

Dunn, J., Bretherton, I., & Munn, P. (1987). Conversations about feeling states between mothers and their young children. *Developmental Psychology*, *23*, 132–139. https://doi.org/10.1037/0012-1649.23.1.132

Eisenberg, N., Sadovsky, A., & Spinrad, T. L. (2005). Associations of emotion-related regulation with language skills, emotion knowledge, and academic outcomes. *New Directions for Child and Adolescent Development*, *2005*(109), 109–118. https://doi.org/10.1002/cd.143

Ensor, R., & Hughes, C. (2008). Content or Connectedness? Mother–Child Talk and Early Social Understanding. *Child Development*, *79*(1), 201–216. https://doi.org/10.1111/j.1467-8624.2007.01120.x

Ereky-Stevens, K. (2008). Associations between mothers' sensitivity to their infants' internal states and children's later understanding of mind and emotion. *Infant and Child Development*, *17*(5), 527–543. https://doi.org/10.1002/icd.572

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., Pethick, S. J., Tomasello, M., Mervis, C. B., & Stiles, J. (1994). Variability in Early Communicative Development. *Monographs of the Society for Research in Child Development*, *59*(5), i–185. https://doi.org/10.2307/1166093

Fonagy, P., Redfern, S., & Charman, T. (1997). The relationship between belief-desire reasoning and a projective measure of attachment security (SAT). *British Journal of Developmental Psychology*, *15*(1), 51–61. https://doi.org/10.1111/j.2044-835X.1997.tb00724.x

Guitar, B., & Marchinkoski, L. (2001). Influence of Mothers' Slower Speech on Their Children's Speech Rate. *Journal of Speech, Language, and Hearing Research*, *44*(4), 853–861. https://doi.org/10.1044/1092-4388(2001/067)

Gulsrud, A. C., Jahromi, L. B., & Kasari, C. (2010). The Co-Regulation of Emotions Between Mothers and their Children with Autism. *Journal of Autism and Developmental Disorders*, *40*(2), 227–237. https://doi.org/10.1007/s10803-009-0861-x

Jones, E. J. H., Gliga, T., Bedford, R., Charman, T., & Johnson, M. H. (2014). Developmental pathways to autism: A review of prospective studies of infants at risk. *Neuroscience & Biobehavioral Reviews*, *39*, 1–33. https://doi.org/10.1016/j.neubiorev.2013.12.001

Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology*, *25*, 343–354. https://doi.org/10.1037/0012-1649.25.3.343

Kuebli, J., & Fivush, R. (1992). Gender differences in parent-child conversations about past emotions. *Sex Roles*, *27*(11), 683–698. https://doi.org/10.1007/BF02651097

Lagattuta, K. H., & Wellman, H. M. (2002). Differences in early parent-child conversations about negative versus positive emotions: Implications for the development of psychological understanding. *Developmental Psychology*, *38*, 564–580. https://doi.org/10.1037/0012-1649.38.4.564

Lazenby, D. C., Sideridis, G. D., Huntington, N., Prante, M., Dale, P. S., Curtin, S., Henkel, L., Iverson, J. M., Carver, L., Dobkins, K., Akshoomoff, N., Tagavi, D., Nelson, C. A., & Tager-Flusberg, H. (2016). Language Differences at 12 Months in Infants Who Develop Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, *46*(3), 899–909. https://doi.org/10.1007/s10803-015-2632-1

Lesser, I. M. (1981). A review of the alexithymia concept. *Psychosomatic Medicine*, *43*, 531–543. https://doi.org/10.1097/00006842-198112000-00009

Lord, C., & Rutter, M. (2012). *(ADOS®-2) Autism Diagnostic Observation Schedule™, Second Edition*. https://www.wpspublish.com/ados-2-autism-diagnostic-observation-schedule-second-edition

MacWhinney, B. (2000). *The CHILDES Project: The database*. Psychology Press.

Maenner, M. J., Shaw, K. A., Bakian, A. V., Bilder, D. A., Durkin, M. S., Esler, A., Furnier, S. M., Hallas, L., Hall-Lande, J., Hudson, A., Hughes, M. M., Patrick, M., Pierce, K., Poynter, J. N., Salinas, A., Shenouda, J., Vehorn, A., Warren, Z., Constantino, J. N., … Cogswell, M. E. (2021). Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years—Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2018. *Morbidity and Mortality Weekly Report. Surveillance Summaries (Washington, D.C.: 2002)*, *70*(11), 1–16. https://doi.org/10.15585/mmwr.ss7011a1

Marrus, N., Hall, L. P., Paterson, S. J., Elison, J. T., Wolff, J. J., Swanson, M. R., Parish-Morris, J., Eggebrecht, A. T., Pruett, J. R., Hazlett, H. C., Zwaigenbaum, L., Dager, S., Estes, A. M., Schultz, R. T., Botteron, K. N., Piven, J., Constantino, J. N., Piven, J., Hazlett, H. C., … for the IBIS Network. (2018). Language delay aggregates in toddler siblings of children with autism spectrum disorder. *Journal of Neurodevelopmental Disorders*, *10*(1), 29. https://doi.org/10.1186/s11689-018-9247-8

Mazefsky, C. A., Herrington, J., Siegel, M., Scarpa, A., Maddox, B. B., Scahill, L., & White, S. W. (2013). The Role of Emotion Regulation in Autism Spectrum Disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *52*(7), 679–688. https://doi.org/10.1016/j.jaac.2013.05.006

Mitchell, B., Zwaigenbaum, R., Szatmari, S., & Bryson, S. (2006). *Early Language and Communication Development of Infants Late...: Journal of Developmental & Behavioral Pediatrics*.
https://journals.lww.com/jrnldbp/Fulltext/2006/04002/Early_Language_and_Communication_De

velopment_of.4.aspx?casa_token=TdswsC6Nv7IAAAAA:vVB0UotBHW_O46OHnmEMqtZHLbG6AnDeuoT7gVvrd6IBJdO6TjrXkdNu5WC3h_ejdqWqaO4mTgcqG9qe_59h9JFT

Mullen, E. (1995). *Mullen Scales of Early Learning*.

Nencheva, M. L., Tamir, D. I., & Lew-Williams, C. (2023). Caregiver speech predicts the emergence of children's emotion vocabulary. *Child Development*, *n/a*(n/a). https://doi.org/10.1111/cdev.13897

Ozonoff, S., Young, G. S., Carter, A., Messinger, D., Yirmiya, N., Zwaigenbaum, L., Bryson, S., Carver, L. J., Constantino, J. N., Dobkins, K., Hutman, T., Iverson, J. M., Landa, R., Rogers, S. J., Sigman, M., & Stone, W. L. (2011). Recurrence Risk for Autism Spectrum Disorders: A Baby Siblings Research Consortium Study. *Pediatrics*, *128*(3), e488–e495. https://doi.org/10.1542/peds.2010-2825

Richardson, C. E., & Wood, R. A. (Eds.). (2012). *Autism spectrum disorders: New research*. Nova Biomedical, Nova Science Publishers, Inc.

Tamis-LeMonda, C. S., Kuchirko, Y., Luo, R., Escobar, K., & Bornstein, M. H. (2017). Power in methods: Language to infants in structured and naturalistic contexts. *Developmental Science*, *20*(6), e12456. https://doi.org/10.1111/desc.12456